THEME [SPA.2011.1.5-03]
[R&D to enhance future GMES applications in the Marine and Atmosphere areas]

Grant agreement for: Collaborative project*

Annex I - "Description of Work"

Project acronym: NORS

Project full title: " Demonstration Network Of ground-based Remote Sensing Observations in support of the GMES Atmospheric Service "

Grant agreement no: 284421

Version date:

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A1:
Project summary

Project Number [1]	284421	Project Acronym [2]	NORS

One form per project

General information			
Project title [3]	Demonstration Network Of ground-based Remote Sensing Observations in support of the GMES Atmospheric Service		
Starting date [4]	01/11/2011		
Duration in months [5]	33		
Call (part) identifier [6]	FP7-SPACE-2011-1		
Activity code(s) most relevant to your topic [7]	SPA.2011.1.5-03: R&D to enhance future GMES applications in the Marine and Atmosphere areas		

Abstract [9]

The principal objective of the NORS project is to improve the quality and validation of the products delivered by the GMES Atmospheric Service (GAS), using independent groundbased remote sensing data from the international Network for the Detection of Atmospheric Composition Change (NDACC). NDACC is a cross-border research network with a strong European contribution, providing high-quality reference observational data for understanding the physical / chemical state of the stratosphere and troposphere, and for assessing the impact of atmospheric composition changes on climate. NORS focuses on a selection of NDACC data that have high priority in the different domains of GAS, namely 'ozone and UV', 'air quality' and 'climate'. The research planned in NORS aims at tailoring these NDACC products to the needs of GAS. It includes a full characterisation of the products and an evaluation of the consistency between the ground-based data and the satellite data assimilated in the GAS production chain. As ground-based remote sensing data form the ideal link between in situ surface concentration and satellite column data, NORS will investigate how integrated tropospheric products and integrated ozone products can be developed.

The project will demonstrate operational rapid delivery of NDACC data to GAS, including a comprehensive set of metadata and a user guide. It will also develop and implement a web-based server for providing consistent validation reports of the GAS products using the NORS data products, on an operational basis. In support of the re-analyses planned in GAS, NORS will deliver time-series of ground-based data back to 2003.

The achievements of NORS will be made available to NDACC as a whole and especially to candidate NDACC stations filling gaps outside Western Europe. The project will be performed in close collaboration with relevant projects in the context of GAS, and it will liaise with NDACC, the European Environmental Agency, and major GMES/GEOSS actors.

A2:
List of Beneficiaries

Project Number [1]	284421	Project Acronym [2]	NORS

List of Beneficiaries

No	Name	Short name	Country	Project entry month[10]	Project exit month
1	INSTITUT D'AERONOMIE SPATIALE DE BELGIQUE.	BIRA-IASB	Belgium	1	33
2	EIDGENOESSISCHE MATERIALPRUEFUNGS- UND FORSCHUNGSANSTALT	EMPA	Switzerland	1	33
3	INSTITUTO NACIONAL DE TECNICA AEROESPACIAL	INTA	Spain	1	33
4	UNIVERSITAET BERN	UBern	Switzerland	1	33
5	Karlsruher Institut fuer Technologie	KIT	Germany	1	33
6	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE	CNRS	France	1	33
7	UNIVERSITAET BREMEN	UBremen	Germany	1	33
8	UNIVERSITE DE LIEGE	ULg	Belgium	1	33
9	MAX PLANCK GESELLSCHAFT ZUR FOERDERUNG DER WISSENSCHAFTEN E.V.	MPIC	Germany	1	33
10	RUPRECHT-KARLS-UNIVERSITAET HEIDELBERG	UH	Germany	1	33
11	SCIENCE AND TECHNOLOGY B.V.	S&T	Netherlands	1	33

A3:
Budget Breakdown

Project Number [1]	284421	Project Acronym [2]	NORS

One Form per Project

Participant number in this project [11]	Participant short name	Fund. % [12]	Ind. costs [13]	Estimated eligible costs (whole duration of the project)					Total receipts	Requested EU contribution
				RTD / Innovation (A)	Demonstration (B)	Management (C)	Other (D)	Total A+B+C+D		
1	BIRA-IASB	75.0	T	460,440.00	0.00	11,856.00	114,840.00	587,136.00	0.00	384,000.00
2	EMPA	75.0	T	135,680.00	0.00	0.00	12,240.00	147,920.00	0.00	114,000.00
3	INTA	75.0	S	200,885.00	0.00	0.00	32,929.00	233,814.00	0.00	155,000.00
4	UBern	75.0	T	139,332.80	0.00	0.00	12,667.20	152,000.00	0.00	114,000.00
5	KIT	75.0	A	212,710.00	0.00	0.00	33,750.00	246,460.00	0.00	185,000.00
6	CNRS	75.0	T	461,785.07	0.00	0.00	34,058.33	495,843.40	0.00	372,000.00
7	UBremen	75.0	T	489,072.00	0.00	0.00	71,200.00	560,272.00	0.00	372,000.00
8	ULg	75.0	T	135,856.00	0.00	0.00	19,744.00	155,600.00	0.00	114,000.00
9	MPIC	75.0	S	45,500.00	0.00	0.00	21,167.00	66,667.00	0.00	50,000.00
10	UH	75.0	A	61,600.00	0.00	0.00	3,800.00	65,400.00	0.00	49,999.50
11	S&T	75.0	T	122,400.00	0.00	0.00	0.00	122,400.00	0.00	90,000.00
Total				2,465,260.87	0.00	11,856.00	356,395.53	2,833,512.40	0.00	1,999,999.50

Note that the budget mentioned in this table is the total budget requested by the Beneficiary and associated Third Parties.

*** The following funding schemes are distinguished**

Collaborative Project (if a distinction is made in the call please state which type of Collaborative project is referred to: (i) Small of medium-scale focused research project, (ii) Large-scale integrating project, (iii) Project targeted to special groups such as SMEs and other smaller actors), Network of Excellence, Coordination Action, Support Action.

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project, and it cannot be changed. The project number **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

2. Project acronym

Use the project acronym as indicated in the submitted proposal. It cannot be changed, unless agreed during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry info force of the Grant Agreement (NB : entry into force = signature by the Commission). Please note that if a fixed starting date is used, you will be required to provide a detailed justification on a separate note.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Activity code

Select the activity code from the drop-down menu.

8. Free keywords

Use the free keywords from your original proposal; changes and additions are possible.

9. Abstract

10. The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

11. The number allocated by the Consortium to the participant for this project.

12. Include the funding % for RTD/Innovation – either 50% or 75%

13. Indirect cost model

A: Actual Costs
S: Actual Costs Simplified Method
T: Transitional Flat rate
F :Flat Rate

Workplan Tables

Project number

284421

Project title

NORS—Demonstration Network Of ground-based Remote Sensing Observations in support of the GMES Atmospheric Service

Call (part) identifier

FP7-SPACE-2011-1

Funding scheme

Collaborative project

WT1
List of work packages

Project Number [1]	284421	Project Acronym [2]	NORS

LIST OF WORK PACKAGES (WP)

WP Number [53]	WP Title	Type of activity [54]	Lead beneficiary number [55]	Person-months [56]	Start month [57]	End month [58]
WP 1	Project coordination	RTD	1	8.50	1	33
WP 2	Project outreach	OTHER	1	1.50	2	33
WP 3	Rapid data delivery at 4 NDACC stations	RTD	4	53.50	1	33
WP 4	Advanced characterisation of NORS data products	RTD	7	67.50	1	30
WP 5	Integration of tropospheric products	RTD	2	17.00	1	33
WP 6	Integration of ozone products	RTD	6	22.50	1	33
WP 7	Reanalysis of ground-based time series back to 2003	RTD	5	33.00	18	27
WP 8	Web-based server for validation of GAS products using NORS data products	RTD	11	29.00	1	21
WP 9	Validation of GAS products for O3, NO2, CO, CH4, H2CO, aerosol	RTD	8	17.50	18	33
WP 10	Capacity building and sustainability	OTHER	1	23.50	1	33
WP 11	Project management	MGT	1	1.00	1	33
			Total	274.50		

WT2:
List of Deliverables

Project Number [1]	284421	Project Acronym [2]	NORS

List of Deliverables - to be submitted for review to EC

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	meeting minutes	1	1	1.25	R	RE	1
D2.1	NORS Web pages	2	1	0.75	O	PU	3
D2.2	NORS flyer	2	1	0.25	O	PU	4
D2.3	Publications / Communications	2	1	0.25	O	PU	33
D2.4	Final NORS Workshop & report	2	1	0.25	R	PU	33
D3.1	Operational data delivery	3	4	45.50	O	PU	21
D3.2	Preliminary documentation of data delivery system	3	4	5.00	R	PU	22
D3.3	Final documentation of data delivery system	3	4	3.00	R	PU	33
D4.1	data format definitions	4	8	8.00	R	PU	6
D4.2	Data user guide	4	1	5.00	R	PU	18
D4.3	Error budgets	4	5	11.00	R	PU	18
D4.4	Data representativeness	4	7	12.00	R	PU	21
D4.5	NORS data consistency	4	7	12.00	R	PU	24
D4.6	Carbon monoxide mid- and near infra-red data assessment	4	7	7.00	R	PU	24
D4.7	Consistency with satellite data	4	3	12.50	R	PU	30
D5.1	Description of methodology for data integration	5	2	4.00	R	RE	24
D5.2	Derived tropospheric column data	5	2	8.00	O	PU	24

WT2:
List of Deliverables

Delive-rable Number [61]	Deliverable Title	WP number [53]	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.3	Cross comparisons report	5	2	5.00	R	PU	33
D6.1	S/W for Ozone data integration	6	6	10.50	O	PP	24
D6.2	Integrated Ozone profile data	6	6	6.00	O	PU	30
D6.3	Integrated Ozone tropo- and stratospheric column data	6	6	6.00	O	PU	30
D7.1	Re-analysed time series	7	5	33.00	O	PU	27
D8.1	Validation server User Requirements Document (URD)	8	1	5.50	R	PU	6
D8.2	Validation server design document (DD)	8	11	4.50	R	PU	8
D8.3	Validation server in test-phase	8	11	8.50	O	RE	18
D8.4	Ready-to-use Validation Server	8	11	10.50	O	RE	21
D9.1	Feedback report regarding validation server	9	8	4.00	R	CO	20
D9.2	Assessment of GAS products	9	8	13.50	R	PU	33
D10.1	NDACC Capacity report	10	1	15.00	R	PU	33
D10.2	NDACC status report	10	1	2.00	R	PU	33
D10.3	NORS capacity and sustainability	10	1	2.50	R	PU	33
D10.4	NORS as an in-situ GAS component	10	1	4.00	R	PU	33
			Total	266.25			

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP1	Type of activity [54]	RTD
Work package title	Project coordination		
Start month	1		
End month	33		
Lead beneficiary number [55]	1		

Objectives

- ensure timely execution of the project
- ensure appropriate collaboration between partners
- ensure coordination with REA and the EU
- ensure project reporting
- chair the Project Management Team (PMT)
- ensure follow-up of the project by the Steering Committee (SC)

Description of work and role of partners

• All partners are involved to some extent in the management of the project, because they are WP, sub-WP and/or task leader, and as such have responsibility as to the timely and correct execution of this WP and/or task, respectively. The WP leaders (BIRA-IASB, EMPA, UBern, KIT, CNRS and UBremen) must contribute to the bi-monthly WP reporting at the Project Management Team's teleconferences and must attend the Steering Committee meetings.
• The project coordinator has the following tasks:
- Task 1.1: organize bi-monthly teleconferences with the PMT and half-yearly teleconferences with the SC
The teleconferences will be scheduled well in advance, an agenda will be distributed in advance of the teleconference, and minutes will be written and distributed to the consortium and the SC
- Task 1.2: coordinate the annual and final project reporting
The necessary templates and guidelines as received from the EU will be distributed in the consortium. The individual partner reports and WP reports will be collected and compiled accoding to EU guidelines.
- Task 1.3: organise project meetings and SC meetings
Annual and final project meetings will be organised at a date and time agreed with the PMT. At the same occasion a SC meeting will be organised; the minutes will be distributed to the consortium. The final meeting will be an open, international workshop.
- Task 1.4: interface with the consortium, and with REA and/or the EU for all contract-related issues.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	2.50
2	EMPA	1.00
3	INTA	0.50
4	UBern	0.50
5	KIT	0.50
6	CNRS	0.50

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
7	UBremen	1.00
8	ULg	0.50
9	MPIC	0.50
10	UH	0.50
11	S&T	0.50
	Total	8.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D1.1	meeting minutes	1	1.25	R	RE	1
		Total	1.25			

Description of deliverables

D1.1) meeting minutes: minutes of PMT (every 2 months) and SC teleconferences or meetings (every 6 months). Particularly important minutes will be the minutes of the project second progress meeting and review, when there is no official reporting to the EU. [month 1]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS1	Kick Off	1	1	Minutes of KO meeting will be distributed
MS9	First Progress Meeting and SC meeting	1	12	Minutes of meeting. Updated planning for year 2
MS17	Second progress meeting and SC meeting	1	24	Minutes of meeting. Updated planning until project end
MS19	Final project workshop and SC meeting	1	32	Final meeting minutes

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP2	Type of activity [54]	OTHER
Work package title	Project outreach		
Start month	2		
End month	33		
Lead beneficiary number [55]	1		

Objectives

- ensure proper dissemination of project results

Description of work and role of partners

- T2.1: development and maintenance of Web pages to advertise NORS.
The NORS Webpages will have a public and a private section. The private section will be used to exchange information between partners, to exchange project meeting minutes, intermediate results and documents, etc.
The public section will be used to advertise NORS and to highlight NORS achievements.
The NORS Webapges will also make links to the NORS data products and validation server.

- T2.2: dissemination of overall project results in scientific meetings, workshops, open literature,...
It is planned that NORS results are presented at the yearly EGU meetings, at the MACC Assemblies and possibly at MACC validation meetings.
At least once during the lifetime of NORS, we plan a presentation about NORS at AGU: this is important to advertise NORS to the US partners of NDACC and to the NASA satellite teams.
NORS will also be presented in NDACC-related workshops, like the "O3 Theme meetings", and possibly at a SPARC Workshop.
We intend to publish NORS achievements, especially research achievements, in peer-reviewed journals.

- T2.3 Final NORS workshop.
The aim of the workshop is to show NORS achievements to a wider audience, including NDACC members who are not belonging to the NORS consortium, including MACC partners, satellite teams, other GAS or GMES actors (to be identified), some European policy makers, and the local press. We aim at an attendance of around 50 to 75 people. The workshop will be held in Brussels - logistics will be defined during the last year of the project.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	1.50
2	EMPA	0.00
3	INTA	0.00
4	UBern	0.00
5	KIT	0.00
6	CNRS	0.00
7	UBremen	0.00
8	ULg	0.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
9	MPIC	0.00
10	UH	0.00
11	S&T	0.00
	Total	1.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D2.1	NORS Web pages	1	0.75	O	PU	3
D2.2	NORS flyer	1	0.25	O	PU	4
D2.3	Publications / Communications	1	0.25	O	PU	33
D2.4	Final NORS Workshop & report	1	0.25	R	PU	33
		Total	1.50			

Description of deliverables

D2.1) NORS Web pages: Dedicated NORS Webpages, including public and internal (restricted to partners) sections [month 3]

D2.2) NORS flyer: A colourful leaflet for advertising NORS [month 4]

D2.3) Publications / Communications: At the end of the project, a list of all publications and communications (e.g., posters) concerning NORS will be available in the final project report and on the NORS Webpages. Links will be made to the publications/communications whenever possible. [month 33]

D2.4) Final NORS Workshop & report: A final NORS Workshop will be organized in Brussels. A report with the conclusions drawn during the final project workshop will be available as a final project brochure. [month 33]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP3	Type of activity [54]	RTD
Work package title	Rapid data delivery at 4 NDACC stations		
Start month	1		
End month	33		
Lead beneficiary number [55]	4		

Objectives

The overall objective of this WP is to deliver multi-station targeted NDACC data (the NORS data products) on an operational basis with a delay of maximum 1 month after acquisition to the NORS data server, in a common HDF format and according to the GEOMS guidelines, using the formatting templates defined in WP4. This will be achieved at 4 pilot stations of the NDACC.

Description of work and role of partners

Each partner involved in this WP is PI of (an) NDACC-certified instrument(s) at one of the pilot stations involved in this WP, and is responsible for the continuous operation of this (these) instrument(s).
The NORS pilot stations are Ile de La Réunion (21°S, 55°E), Ny-Ålesund (79°N, 12°E), in the Alps (Bern (47°N; 7°E), Jungfraujoch (47°N, 8°E), Observatoire de Haute-Provence or OHP (44°N, 6°E)), and Izana (28°N, 16°W).
The ground-based remote sensing techniques are Differential Optical Absorption Spectroscopy (DOAS and MAXDOAS instruments), Fourier Transform Infrared Spectroscopy (FTIR), Differential Absorption O3 LIDAR (DIAL), and microwave radiometry (MW). In this project we focus on the Lidars and Microwave radiometers for ozone (O3).
The following Table identifies the types of instruments at the 4 pilot stations, as well as the partner's responsibilities:

----------DOAS-------- ----MAXDOAS---- FTIR---------O3 DIAL----------O3 MW

BIRA-IASB---Alps----------Alps----------Reunion----------
INTA----------Izana----------
UBern----------Alps--------
KIT----------Izana----------
CNRS----------Alps, Reunion----------Alps, Reunion----------
UBremen----------Ny-Ålesund--Ny-Ålesund----------Ny-Ålesund
ULg----------Alps----------

The NORS data products for the various techniques involved are as follows:
For DOAS: Stratospheric O3 columns; stratospheric NO2 columns and profiles; tropospheric NO2 columns;
For MAXDOAS: Stratospheric O3 columns; stratospheric NO2 columns, lower tropospheric profiles of NO2, H2CO and aerosol extinction;
For FTIR: tropospheric and stratospheric columns of CO, CH4, and O3;
For the O3 DIAL: O3 vertical profiles in the stratosphere between 10 and 50 km;
For the O3 MW: O3 vertical profiles in the stratosphere between 20 and 70 km;
They are called the NORS target data products throughout this DoW.

The NORS data server has to be defined. The aim is to have a data server set up at the NDACC Data Handling Facility (DHF). If this takes too much time at start, we will temporarily use the GEOmon ftp server for Rapid Data delivery that will be maintained by the Norwegian Institute for Air Research (NILU) and that is already operational, and move to the NDACC DHF at a later stage.
The work package is therefore dedicated to (1) the implementation of the GEOMS data format, (2) the development of an operational data processing and delivery system to the NORS data server, and (3) the optimisation and documentation of the data delivery system, at all stations.

Therefore, the tasks are:
Task 3.1: The participants develop software routines to save their atmospheric observation data according to the data formatting standards defined in WP4, T4.1. These standards will be compliant with the recently developed Generic Earth Observation Metadata Standard (GEOMS).
Task 3.2: The participants implement automatic data processing systems generating the data products, including a QA/QC validation step.
Task 3.3: The participants install data delivery systems providing the data products within 1 month to the NORS data center.
Task 3.4: Test runs and demonstration of operational data delivery system;
Task 3.5: Optimisation of data delivery system
Task 3.6: Routine operation of data delivery to the NORS data center
All research partners involved in the WP participate to all the above tasks: they are responsible for the implementation of the operational data delivery system for their instruments at their sites. S&T will provide IT consultancy regarding the operational systems to be developed.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	9.00
3	INTA	1.00
4	UBern	13.50
5	KIT	6.00
6	CNRS	10.50
7	UBremen	9.00
8	ULg	4.00
11	S&T	0.50
	Total	53.50

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
D3.1	Operational data delivery	4	45.50	O	PU	21
D3.2	Preliminary documentation of data delivery system	4	5.00	R	PU	22
D3.3	Final documentation of data delivery system	4	3.00	R	PU	33
		Total	53.50			

Description of deliverables

D3.1) Operational data delivery: Start of operational NORS data delivery to GAS [month 21]

D3.2) Preliminary documentation of data delivery system: Initial documentation of data delivery system [month 22]

D3.3) Final documentation of data delivery system: Final report of WP3: documentation of data delivery system, summary of experiences gained with GEOMS and the rapid data delivery system [month 33]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS3	Rapid data delivery system	4	6	Rapid data delivery system is set up
MS14	Operational data delivery	4	21	Linked to D3.1: Start of NORS data delivery to GAS on an operational basis

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP4	Type of activity [54]	RTD
Work package title	Advanced characterisation of NORS data products		
Start month	1		
End month	30		
Lead beneficiary number [55]	7		

Objectives

The overall objective of this WP is to ensure that the products provided by NORS are tailored so that the data can be used directly as validation data in the GMES atmospheric service.
To this end, several steps will be undertaken:
• Data products will be harmonised with respect to their file formats and file contents, e.g. quantities saved, units used and uncertainty information provided. This builds on work started within NDSC/NDACC, TCCON and in previous EU projects, in particular COSE and GEOmon. This will be done in close collaboration with the validation activities of the GAS which may have specific needs. The objective is to facilitate a smooth inclusion of the data in the GMES services.
• The information content of the data sets will be fully characterised with respect to vertical and horizontal resolution, measurement volume and retrieval sensitivity. For some remote sensing techniques (FTIR and DOAS) the geographical location of the air-parcels sampled depends on the astronomical position of the sun and the trace gas sampled. This variability will be considered as part of the fully characterised data set. This information will be documented and provided to the data users in the form of appropriate metadata and user guides. The objective is to ensure that data users have the full information needed to interpret the data properly.
• Measurement uncertainties will be evaluated and added to the data product or documented in separate files. This includes theoretical estimates, measurement errors, and uncertainties resulting from the retrieval process. In addition, results from comparisons to independent measurements and inter-comparison between different NORS measurements will be documented as part of the project deliverables. The objective is to provide a full description of uncertainties.
• The data will be compared to satellite data used for assimilation into the GMES Atmospheric Service. This relies in part on previous work using NDACC and TCCON measurements for validation of satellite products, and also on validation work already achieved under the responsibility of ESA and the EUMETSAT, but will be extended to new data versions and to those species where comparisons do not yet exist, or for new releases of satellite products. The objective is to establish an acceptable level of agreement between the assimilated data and the validation data which is relevant for the interpretation of validation results.

Description of work and role of partners

Task 4.1: Data Formats (ULg, UBremen, BIRA-IASB, INTA, UBern, KIT, CNRS, MPIC, UH, S&T)
• Collection of data formats and contents currently used (NDACC, TCCON, GEOmon, ...)
• Iteration of needs on data format and content with GMES atmospheric service and data suppliers
• Harmonisation of product data files from all NORS measurement systems following the recently developed Generic Earth Observation Metadata Standard (GEOMS)
• Definition of new format and templates/contents by all data providers for WP3 and WP7. According to needs, open source software tools will be developed to convert existing files into the common format to facilitate data provision and possible extension to other NDACC stations.

Task 4.2: Information Content and harmonization of networks/techniques (U. Bremen, BIRA-IASB, INTA, UBern, KIT, CNRS, ULg, MPIC, UH)
• Characterisation of vertical sensitivity and resolution using consistent parameters for all measurement systems.
• Analysis of horizontal averaging and displacement of measurement volume for the different measurement techniques and observations modes (zenith-sky, off-axis, direct sun) using different radiative transfer models; evaluation of effect on retrieved quantities

• Study of the consistency between the CO data retrieved from NDACC and TCCON measurements at the 3 NDACC stations involved in NORS that are also TCCON stations, i.e., all the stations except the Alpine station.
• Standardisation of retrieval settings and parameters within measurement techniques where not already achieved in previous projects (e.g.: for MAX-DOAS, O3 retrievals have been standardised within NDACC, but not yet NO2 and HCHO; e.g., for FTIR: NO2 retrieval strategies have not been harmonized yet in NDACC and will be investigated in this activity).
• Systematic comparison of periods of parallel measurements of the same quantities at selected stations
=> NO2 and HCHO (FTIR and DOAS in Ny-Ålesund, Bremen, Jungfraujoch and Paramaribo, FTIR and DOAS in Izana and Réunion (NO2 only)) (U. Bremen, UH, INTA, BIRA-IASB, KIT, CNRS, ULg)
=> O3 (FTIR and MW in Ny-Ålesund, DOAS and FTIR in La Reunion, DOAS and FTIR and Brewer in Izana). (U. Bremen, BIRA-IASB, INTA, CNRS, KIT)
=> aerosol optical depth and surface extinction in Hohenpeißenberg (MAX-DOAS and ceilometer, sun-photometer and in-situ) and Mainz (MAXDOAS and ceilometer, sun-photometer) (MPIC, UH)
This task will link to WPs 5 and 6.
• Consistent documentation of measurement procedures, retrieval strategies, and results in metadata and report / user guide.

Task 4.3: Uncertainties (KIT, U Bremen, BIRA-IASB, INTA, UBern, CNRS, ULg, MPIC, UH)
• Collection of existing error assessments for each instrument and product
• Execution of additional sensitivity studies and theoretical uncertainty evaluations where needed
• Consistent documentation of results in the data and a report.
• Formulation of recommendations for harmonised uncertainty reporting for the different measurement techniques

Task 4.4: Comparison to satellite observations (INTA, UBremen, BIRA-IASB, INTA, UBern, KIT, CNRS, ULg, MPIC, UH)
• Evaluation of existing studies comparing satellite products used for assimilation in the GMES Atmospheric Service and NORS data products.
• Definition of a validation approach and protocol (coincidence criteria, handing of smoothing error, ...)
• Execution of additional comparisons where possible and not already available.
• Production of a report on consistency of satellite observations used for assimilation and NORS validation data.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	12.00
3	INTA	3.50
4	UBern	1.00
5	KIT	4.00
6	CNRS	15.00
7	UBremen	13.00
8	ULg	4.00
9	MPIC	8.50
10	UH	6.00
11	S&T	0.50
	Total	67.50

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D4.1	data format definitions	8	8.00	R	PU	6
D4.2	Data user guide	1	5.00	R	PU	18
D4.3	Error budgets	5	11.00	R	PU	18
D4.4	Data representativeness	7	12.00	R	PU	21
D4.5	NORS data consistency	7	12.00	R	PU	24
D4.6	Carbon monoxide mid- and near infra-red data assessment	7	7.00	R	PU	24
D4.7	Consistency with satellite data	3	12.50	R	PU	30
		Total	67.50			

Description of deliverables

D4.1) data format definitions: Description of the adopted GEOMS format and templates to be used in NORS for the various techniques [month 6]

D4.2) Data user guide: User guide to the application and interpretation of NORS data [month 18]

D4.3) Error budgets: Report on uncertainties in NORS data products [month 18]

D4.4) Data representativeness: Report about sensitivity and specific displacements of sounded air volumes for each NORS trace gas and instrument [month 21]

D4.5) NORS data consistency: Report on consistency of selected NORS data products [month 24]

D4.6) Carbon monoxide mid- and near infra-red data assessment: Assessment of consistency between carbon monoxide from NDACC and TCCON measurements [month 24]

D4.7) Consistency with satellite data: Report on consistency of satellite observations and NORS data [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS2	Formats agreement	8	6	Data formatting templates agreed for all g-b instruments in NORS; required also in WP3
MS8	Start of NDACC-TCCON Xcalibration	7	12	Establishment of a protocol for retrieval in overlapping NDACC-TCCON region
MS10	Uncertainties in NORS data products	5	18	The uncertainties will be included in the NORS

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
				data products. Link to D4.3
MS11	Start verification of consistency of NORS data products	7	18	Collection of parallel measurements and 1st comparisons of results; identification of areas of discrepancies
MS13	Multi-D characterisation of NORS data products	7	21	Linked to D4.4

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP5	Type of activity [54]	RTD
Work package title	Integration of tropospheric products		
Start month	1		
End month	33		
Lead beneficiary number [55]	2		

Objectives

Validation and integration of tropospheric composition measurements (in-situ and remote-sensing measurements) :

The main objective of WP5 is to further validate the NORS products at two demonstration sites by linking them to surface in-situ measurements that can be traced back to international gravimetric concentration standards. Since the different instruments sample different air masses this task requires the characterisation of representativeness of the involved products. Further information on the vertical concentration structure is needed and will be taken from available chemistry transport models.

Description of work and role of partners

The integration/validation effort in WP5 will be carried out for two out of three candidate sites and parameters listed in the table below. The length of the comparison period will be at least 2 years and will be selected depending on data availability. Further selection criteria will be based on representativeness considerations. Due to its location in more polluted central Europe representativeness issues arise for Jungfraujoch due to strong horizontal gradients in surface concentrations but also due to its elevated position that is not well represented in models. The latter is also true for Izana. In addition, long range transport events from either North America or Europe influence the Jungfraujoch site and will be considered in the representativeness analysis. Preliminary data screening and model simulations will be used to reach a final decision on site and period selection. The final sites will be selected according to availability of inter-comparison data and variability and differences observed in these data. The sites with larger differences will be analysed in more detail.

In the following table of tropospheric data stations/products/responsible institutes at demonstration sites, we list the sources of the data to be integrated, in the following order:
DOAS / MAXDOAS / FTIR /In situ surface /Satellite /Model* (with X standing for non-available):
Jungfraujoch
NO2 => BIRA-IASB / BIRA-IASB / ULg / EMPA / EMPA § / MOZART-4
O3 => X / BIRA-IASB / ULg / EMPA /WP4 / MOZART-4
CO => X / X / ULg / EMPA / WP4 / MOZART-4
CH4 => X /X / ULg / EMPA / WP4 / TM5
Izana
NO2 => INTA / INTA / KIT / EMPA + / WP4 / MOZART-4
O3 => X / INTA / KIT / EMPA + / WP4 / MOZART-4
CO => X / X / KIT / EMPA + / WP4 / MOZART-4
CH4 => X / X / KIT / EMPA + / WP4 / TM5
Ny Ålesund
NO2 => UBremen / UBremen / UBremen / EMPA + / WP4 / MOZART-4
O3 => X / UBremen / UBremen / EMPA + / WP4 / MOZART-4
CO => X/ X/ UBremen / EMPA + / WP4 / MOZART-4
CH4 => X/ X/ UBremen / EMPA + / WP4 / TM5
*: The column 'Model' gives the name of the suggested global chemistry transport model whose output will be used to create profile and column data from surface in-situ measurements (MOZART-4:

http://www.acd.ucar.edu/gctm/mozart/, TM5: http://www.phys.uu.nl/~tm5/). As an alternative the global reanalysis products as created in MACC and GEMS (http://www.gmes-atmosphere.eu/data/) will be considered.
+: In-situ data from Izana and Ny Ålesund will be obtained through the Global Atmosphere Watch data centre for greenhouse gases (WDCGG)
§: New OMI NO2 retrieval with improved quality above complex terrain for central Europe (see http://temis.empa.ch/index.php)

Task 5.1: Data collection (EMPA, BIRA-IASB, INTA, KIT, UBremen, ULg)
• Collection of ground-based remote sensing tropospheric columns of O3, NO2, CO, CH4 and metadata concerning the measurement volume for the different techniques (see Task 4.2) (BIRA-IASB, INTA, KIT, UBremen, ULg).
• Collection of satellite tropospheric column data at the demonstration sites. The NO2 columns will be retrieved at EMPA, columns for other species will be delivered by Task 4.4 in WP4. (EMPA, INTA)
• Collection of ground-based in-situ observations of O3, NO2, CO and meteorology from the demonstration sites (EMPA)
• Collection of model profile data of O3, NO2, CO, CH4 from MOZART and TM5 model extracted at the location of the demonstration sites (EMPA)
• Evaluation of data availability of the different products (observations and simulations) at the different sites. Agreement on comparison period and two out of three demonstration sites.

Task 5.2: Emission sensitivities (EMPA)
• Calculate quantitative source-receptor relationships for the different data products (sampled volumes) at the two selected demonstration sites to characterise differences in representativeness taking high resolution regional scale emission data of CO, NO2, CH4, NMVOC into account.
• Estimate representativeness and representativeness uncertainty of surface in-situ data in comparison to model and remote sensing data using obtained source-receptor relationships.
• Integrate browser for source sensitivity maps in web server.

Task 5.3: Extrapolation of surface in-situ data (EMPA)
• Surface in-situ data will be used to scale modelled vertical profiles. Uncertainties due to representativeness as derived in Task T5.2 will be taken into account.
• Consistent documentation of extrapolation procedures and results in report (D5.1).

Task 5.4: Validation (EMPA)
• Cross comparison between different tropospheric column data as collected in T5.1 and constructed in T5.3 taking observation uncertainties as derived from T4.3 and uncertainties due to representativeness (T5.2) into account.
• Production of a report on consistency of NORS validation data and in-situ measurements and the influence of uncertainties due to representativeness (D5.3).

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	3.00
2	EMPA	10.00
3	INTA	1.50
5	KIT	0.00
7	UBremen	2.50
8	ULg	0.00
	Total	17.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D5.1	Description of methodology for data integration	2	4.00	R	RE	24
D5.2	Derived tropospheric column data	2	8.00	O	PU	24
D5.3	Cross comparisons report	2	5.00	R	PU	33
		Total	17.00			

Description of deliverables

D5.1) Description of methodology for data integration: Document describing combination of surface in-situ data, representativeness information and model profiles to derive tropospheric column data [month 24]

D5.2) Derived tropospheric column data: Data set of deduced tropospheric column data at demonstration sites available for use in WP9 [month 24]

D5.3) Cross comparisons report: Document describing cross comparison of different tropospheric column products [month 33]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS5	Agreement on comparison sites and periods	2	6	Evaluation of data availability at different sites
MS16	Source sensitivities	2	24	Source sensitivity maps on a web browser

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP6	Type of activity [54]	RTD
Work package title	Integration of ozone products		
Start month	1		
End month	33		
Lead beneficiary number [55]	6		

Objectives

Develop a methodology for integrating ground-based data sources to provide consistent ozone vertical distribution time series as well as tropospheric and stratospheric ozone columns at NDACC stations.

Description of work and role of partners

• T6.1: evaluate the validity domain of ozone profile measurements available at 4 NDACC stations from O3 DIAL, FTIR and MW (depending on the station), using error assessment and vertical resolution results of WP4, and from ozone sounding data also available at these stations. (CNRS, UBern, INTA, UBremen, BIRA-IASB, ULg, KIT)

• T6.2: Develop a method to statistically combine the ozone data sets in order to provide an ozone vertical profile consistent with total ozone measurements, as well as integrated tropospheric and stratospheric ozone columns. Ancillary data to determine the state of the atmosphere will be used e.g. tropopause height for stratospheric and tropospheric ozone columns and potential vorticity for not collocated data as in the Alpine station. (CNRS, UBern)

• T6.3: Provide combined ozone vertical distribution time series, tropospheric and stratospheric columns at 4 NDACC stations from 2003.(CNRS)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	2.00
4	UBern	2.00
5	KIT	2.00
6	CNRS	14.00
7	UBremen	2.50
8	ULg	0.00
	Total	22.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.1	S/W for Ozone data integration	6	10.50	O	PP	24

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D6.2	Integrated Ozone profile data	6	6.00	O	PU	30
D6.3	Integrated Ozone tropo- and stratospheric column data	6	6.00	O	PU	30
		Total	22.50			

Description of deliverables

D6.1) S/W for Ozone data integration: Software creating NORS combined ozone vertical distribution time series from NDACC data [month 24]

D6.2) Integrated Ozone profile data: NORS combined ozone vertical distribution time series at the 4 NDACC pilot stations from 2003 submitted to the NORS data center. [month 30]

D6.3) Integrated Ozone tropo- and stratospheric column data: NORS integrated tropospheric and stratospheric ozone column time series with specified uncertainties and spatial resolution at the 4 NDACC pilot stations from 2003 submitted to the NORS data center [month 30]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS4	Selection of O3 data sets	6	6	Internal report identifying the selection of ozone data and ancillary data to be used for the combined time series at the selected NORS stations
MS7	Selection of statistical method for integrating O3 data products	6	12	Internal report identifying the statistical method to be used for integrating O3 data products, and its justification

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP7	Type of activity [54]	RTD
Work package title	Reanalysis of ground-based time series back to 2003		
Start month	18		
End month	27		
Lead beneficiary number [55]	5		

Objectives

The objective is to provide a consistent and well characterized data set dating back to 2003 or to start of measurements if later than 2003. This data set will include time series of O3, NO2, CO, CH4, H2CO and aerosol, which will be made available for distribution to GAS. In particular, the objectives are
- to provide long-term consistent time series (ie after possible harmonization in WP4) at the 4 NDACC pilot stations, corresponding to the Table in WP3
- to submit the re-analysed time series to the NORS data server and the NDACC database in GEOMS-compliant HDF format
- to include the characterisation of the time series along the lines developed in WP4

Description of work and role of partners

Task 7.1: Re-analyse remote sensing data back to 2003 or to start of measurements if later than 2003, considering the results of the harmonization effort made in WP4/T4.1 (all partners):
This task consists of :
- Re-analysis of time series of stratospheric O3 columns and stratospheric NO2 columns and profiles from DOAS measurements (BIRA, INTA, CNRS)
- Re-analysis of time series of lower tropospheric profiles of NO2, H2CO and aerosol extinction obtained with MAXDOAS technique (BIRA, INTA, UBremen)
- Re-analysis of time series of tropospheric and stratospheric columns of O3, CO and CH4 with FTIR observations (BIRA, KIT, UBremen, ULg)
- Re-analysis of time series of O3 DIAL: O3 vertical profiles in the stratosphere between 10 and 50 km from DIAL measurements (CNRS)
- Re-analysis of time series of O3 vertical profiles in the stratosphere between 20 and 70 km from millimetre wave radiometers (UBern, UBremen)

Task 7.2: Archive harmonized and consolidated data set (all partners). This data set includes time series of atmospheric species as well as auxiliary data to characterize these data with respect to errors and vertical resolution.
This task consists of :
- Archiving of time series of stratospheric O3 columns and stratospheric NO2 columns and profiles from DOAS and MAXDOAS measurements (BIRA, INTA, CNRS)
- Archiving of time series of lower tropospheric profiles of NO2, H2CO and aerosol extinction obtained with MAXDOAS technique (BIRA, INTA, UBremen)
- Archiving of time series of tropospheric and stratospheric columns of O3, CO and CH4 with FTIR observations (BIRA, KIT, UBremen, ULg)
- Archiving of time series of O3 DIAL: O3 vertical profiles in the stratosphere between 10 and 50 km from DIAL measurements (CNRS)
- Archiving of time series of O3 vertical profiles in the stratosphere between 20 and 70 km from millimetre wave radiometers (UBern, UBremen)

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	8.00
3	INTA	1.50
4	UBern	3.00
5	KIT	3.00
6	CNRS	5.50
7	UBremen	9.00
8	ULg	3.00
	Total	33.00

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D7.1	Re-analysed time series	5	33.00	O	PU	27
		Total	33.00			

Description of deliverables

D7.1) Re-analysed time series: Re-analysed time series of NORS target products at the 4 NDACC pilot stations archived at NDACC and on the NORS data server (each partner is responsible for his data sets) [month 27]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS12	Guidelines for re-analysis of timeseries	5	18	Based on WP4 outputs, guidelines will be formulated as to re-analysis strategies
MS18	Readiness for validation of the GAS reanalyses	5	27	Data delivered in D7.1 are available for uptake in the validation server

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP8	Type of activity [54]	RTD
Work package title	Web-based server for validation of GAS products using NORS data products		
Start month	1		
End month	21		
Lead beneficiary number [55]	11		

Objectives

The objective is to build a system that generates in an operational and consistent way validation reports of GAS products based on independent NORS data products

Description of work and role of partners

Task 8.1: Definition of the validation server system (all partners involved in the WP)
To define the system, a survey will be made of the GAS requirements and existing systems, e.g., the GECA system. The definition of the system will account for the user requirements and the technical aspects of the implementation and possible integration with an existing system. The SC will be consulted in the definition of the system. In particular, it will be necessary to decide where the server will be hosted in order to be optimally integrated in existing systems.

Task 8.2: development of the validation server system (S&T)
S&T will develop the S/W to build the validation system. To enable the PMT to closely follow the system development, S&T will submit monthly progress reports.

Task 8.3: validation server system tests (all partners involved in the WP)
Partners will report test results to S&T and BIRA-IASB; S&T will upgrade the system to correct / improve for reported problems, until satisfaction of the partners.

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	4.00
3	INTA	1.00
4	UBern	1.00
5	KIT	1.00
6	CNRS	0.00
7	UBremen	4.00
8	ULg	1.00
11	S&T	17.00
	Total	29.00

WT3:
Work package description

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D8.1	Validation server User Requirements Document (URD)	1	5.50	R	PU	6
D8.2	Validation server design document (DD)	11	4.50	R	PU	8
D8.3	Validation server in test-phase	11	8.50	O	RE	18
D8.4	Ready-to-use Validation Server	11	10.50	O	RE	21
		Total	29.00			

Description of deliverables

D8.1) Validation server User Requirements Document (URD): Document describing the user requirements of the validation server [month 6]

D8.2) Validation server design document (DD): Document describing the technical characteristics of the validation server [month 8]

D8.3) Validation server in test-phase: Validation server operational and available for testing [month 18]

D8.4) Ready-to-use Validation Server: Validation server accepted by the Project Management Team [month 21]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments
MS6	Definition of validation server	1	6	LInked to D8.1= User requirements document
MS15	NORS validation server operational	11	21	Linked to D8.4:validation server accepted by Project Management Team. Production of GAS validation reports starts

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP9	Type of activity [54]	RTD
Work package title	Validation of GAS products for O3, NO2, CO, CH4, H2CO, aerosol		
Start month	18		
End month	33		
Lead beneficiary number [55]	8		

Objectives

- to generate in an operational and consistent way validation reports of GAS products based on independent NORS data products using the system developed in WP8
- identify possible problems, bias… in the GAS products by putting into perspective differences observed between GAS and NORS correlative comparisons with the performance and characteristics of the NORS products, as assessed by the WP4 tasks

Description of work and role of partners

Task 9.1:
• After completion of the technical tests planned in WP8, use first preliminary validation server reports and verify –in collaboration with GAS representatives– the usefulness, completeness and appropriateness of all the information these reports convey, for a subset of NORS targets (O3, CH4, NO2 and aerosols); evaluate if the template and display of these reports are optimum at this stage, or can still be improved (ULg, BIRA-IASB, INTA, UBern, KIT, CNRS, UBremen)
• Provide feedback to WP8 and suggest changes aiming at improving the tools and its outputs to match at best the end users' needs (ULg, BIRA-IASB)

Task 9.2: Using the updated validation server and the latest available results, evaluate for all NORS products the quality and representativeness of the GAS products, for the various latitudes and atmospheric conditions encompassed in the NORS database (ULg and all partners involved in the WP)

Task 9.3: For successful evaluations/comparisons and corresponding products, draw general conclusions as to the quality of the GAS products; if relevant, identify the GAS products which are of insufficient quality and if this is verified at the global level, but also for more specific locations or conditions (e.g. high latitude, tropical regions) (ULg and all partners involved in the WP)

Task 9.4: conclude on the appropriateness of NORS-like data to characterize GAS products, identify additional NDACC products that could provide solid basis for additional comparisons and assessment of GAS products (ULg and all partners involved in the WP)

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	5.00
3	INTA	1.00
4	UBern	1.00
5	KIT	2.00
6	CNRS	1.50
7	UBremen	4.00

WT3:
Work package description

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
8	ULg	3.00
	Total	17.50

List of deliverables

Delive-rable Number [61]	Deliverable Title	Lead benefi-ciary number	Estimated indicative person-months	Nature [62]	Dissemi-nation level [63]	Delivery date [64]
D9.1	Feedback report regarding validation server	8	4.00	R	CO	20
D9.2	Assessment of GAS products	8	13.50	R	PU	33
		Total	17.50			

Description of deliverables

D9.1) Feedback report regarding validation server: Internal report identifying changes to be implemented to the NORS validation server, for optimum operation [month 20]

D9.2) Assessment of GAS products: Document assessing the overall quality of the GAS products, their possible weaknesses at the global scale, or for specific locations and/or conditions. Identification of additional NDACC species candidates allowing to extend the validation of GAS products [month 33]

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead benefi-ciary number	Delivery date from Annex I [60]	Comments

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP10	Type of activity [54]	OTHER
Work package title	Capacity building and sustainability		
Start month	1		
End month	33		
Lead beneficiary number [55]	1		

Objectives

- To export expertise acquired in NORS to new potential NDACC stations at which the partners are active or which they have collaborations with (tropical stations, stations in Eastern Europe, Asia, China, Latin America, Africa).
- To liaise with NDACC
- To liaise with operational satellite data providers of GAS in particular (via EUMETSAT O3M-SAF and ESA Quality Working Group) and with the wider satellite community (via CEOS WGCV)
- To liaise with EEA
- To establish a data policy in agreement with GAS and NDACC policies, and in agreement with the approach developed at EEA for the insitu data

Description of work and role of partners

Task 10.1: export NORS expertise to candidate NDACC stations outside western Europe.
Various partners are involved in the implementation of NDACC infrastructure and observation and data analysis procedures at observatories outside of western Europe, often in collaboration with local partners, as shown below. The structure per line is as follows:
Observatory -- Country -- Instrument -- NORS partner involved -- Local partner;
* Xianghe Integrated Observatory -- China -- MAXDOAS -- BIRA-IASB -- Institute for Atmospheric Physics / Chinese Academy of Sciences;
* Beijing -- China -- Mini MAXDOAS -- MPIC -- Chinese Academy of Meteorological Sciences;
* Kourovka -- Russia -- FTIR -- UBremen -- Univ. of Yekaterinburg;
* Tomsk -- Russia -- FTIR -- KIT -- Zuev Institute of Atmospheric Optics;
* Paramaribo -- Suriname -- FTIR -- UBremen -- Anton de Kom University;
* Paramaribo -- Suriname -- MAXDOAS -- UH -- Meteorological Service of Suriname;
* Mexico City -- Mexico -- FTIR -- KIT -- UNAM;
* Rio Gallegos -- Argentina -- O3 Lidar --CNRS -- CEILAP-CONICET;
* Bujumbura -- Burundi -- MAXDOAS -- BIRA-IASB -- Univ. of Bujumbura;
* Addis Ababa -- Ethiopia -- FTIR -- KIT -- Addis Ababa University;
* Belgrano -- Antarctica -- MAXDOAS -- INTA --Instituto Antártico Argentino (IAA);
* Seoul -- South Korea -- O3 MW -- IAP/UBern -- Sookmyung Women's University Division/Department Chemistry.

The partners involved will initiate the exportation of expertise acquired in NORS to these observatories, and will report about the state of progress, and the additional workload required to upgrade these stations to the level of NORS. We cannot guarantee that all these stations will be NDACC-qualified by the end of NORS, nor that they deliver data operationally to the NORS server.

Task 10.2: Promote the achievements of NORS in NDACC and CEOS WGCV
The achievements of NORS will be reported and promoted at the NDACC Steering Committee meetings and in the NDACC UVVIS, Infrared, lidar and microwave Working Group meetings, and in CEOS WGCV meetings. In particular, it will be discussed how the NORS data server can be embedded in the NDACC Data Handling Facility (BIRA-IASB and partners involved in the WP).

Task 10.3: Meetings with EEA to ensure integration of NORS in the EEA structure of the in-situ component of GAS, and to ensure compliance of NORS with GAS data policies and metadata standards (BIRA-IASB and partners involved in the WP).

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	5.00
2	EMPA	0.50
3	INTA	2.00
4	UBern	2.00
5	KIT	3.00
6	CNRS	1.50
7	UBremen	5.00
8	ULg	1.00
9	MPIC	3.00
10	UH	0.50
	Total	23.50

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
D10.1	NDACC Capacity report	1	15.00	R	PU	33
D10.2	NDACC status report	1	2.00	R	PU	33
D10.3	NORS capacity and sustainability	1	2.50	R	PU	33
D10.4	NORS as an in-situ GAS component	1	4.00	R	PU	33
		Total	23.50			

Description of deliverables

D10.1) NDACC Capacity report: status report concerning additional NDACC stations outside western Europe [month 33]

D10.2) NDACC status report: report on the progress of NDACC towards a network in support of GAS [month 33]

D10.3) NORS capacity and sustainability: report on NORS achievements and experience at CEOS WGCV plenary meeting [month 33]

D10.4) NORS as an in-situ GAS component: report on the integration of NORS in the in-situ component of GAS and on the compliance with GAS requirements as to data policies and metadata standards [month 33]

WT3:
Work package description

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS20	NORS Perspectives	1	33	Conclusions as to success of NORS for validation of GAS products and as to future capacities and integration in GMES in situ component

WT3:
Work package description

Project Number [1]	284421	Project Acronym [2]	NORS

One form per Work Package

Work package number [53]	WP11	Type of activity [54]	MGT
Work package title	Project management		
Start month	1		
End month	33		
Lead beneficiary number [55]	1		

Objectives

Administrative, legal and financial management of the project

Description of work and role of partners

- take care of all administrative, legal and financial obligations of the project coordinator
- support partners with their administrative, legal and financial obligations in the frame of the NORS project
- verify whether all partners comply with their administrative, legal and financial obligations in the frame of the NORS project
- communicate with the EU concerning administrative, legal and financial aspects of the NORS project

Person-Months per Participant

Participant number [10]	Participant short name [11]	Person-months per participant
1	BIRA-IASB	1.00
	Total	1.00

List of deliverables

Deliverable Number [61]	Deliverable Title	Lead beneficiary number	Estimated indicative person-months	Nature [62]	Dissemination level [63]	Delivery date [64]
		Total	0.00			

Description of deliverables

Schedule of relevant Milestones

Milestone number [59]	Milestone name	Lead beneficiary number	Delivery date from Annex I [60]	Comments

WT4:
List of Milestones

Project Number [1]	284421	Project Acronym [2]	NORS

List and Schedule of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS1	Kick Off	WP1	1	1	Minutes of KO meeting will be distributed
MS2	Formats agreement	WP4	8	6	Data formatting templates agreed for all g-b instruments in NORS; required also in WP3
MS3	Rapid data delivery system	WP3	4	6	Rapid data delivery system is set up
MS4	Selection of O3 data sets	WP6	6	6	Internal report identifying the selection of ozone data and ancillary data to be used for the combined time series at the selected NORS stations
MS5	Agreement on comparison sites and periods	WP5	2	6	Evaluation of data availability at different sites
MS6	Definition of validation server	WP8	1	6	LInked to D8.1= User requirements document
MS7	Selection of statistical method for integrating O3 data products	WP6	6	12	Internal report identifying the statistical method to be used for integrating O3 data products, and its justification
MS8	Start of NDACC-TCCON Xcalibration	WP4	7	12	Establishment of a protocol for retrieval in overlapping NDACC-TCCON region
MS9	First Progress Meeting and SC meeting	WP1	1	12	Minutes of meeting. Updated planning for year 2
MS10	Uncertainties in NORS data products	WP4	5	18	The uncertainties will be included in the NORS data products. Link to D4.3
MS11	Start verification of consistency of NORS data products	WP4	7	18	Collection of parallel measurements and 1st comparisons of results; identification of areas of discrepancies
MS12	Guidelines for re-analysis of timeseries	WP7	5	18	Based on WP4 outputs, guidelines will be formulated as to re-analysis strategies

WT4:
List of Milestones

Milestone number [59]	Milestone name	WP number [53]	Lead beneficiary number	Delivery date from Annex I [60]	Comments
MS13	Multi-D characterisation of NORS data products	WP4	7	21	Linked to D4.4
MS14	Operational data delivery	WP3	4	21	Linked to D3.1: Start of NORS data delivery to GAS on an operational basis
MS15	NORS validation server operational	WP8	11	21	Linked to D8.4:validation server accepted by Project Management Team. Production of GAS validation reports starts
MS16	Source sensitivities	WP5	2	24	Source sensitivity maps on a web browser
MS17	Second progress meeting and SC meeting	WP1	1	24	Minutes of meeting. Updated planning until project end
MS18	Readiness for validation of the GAS reanalyses	WP7	5	27	Data delivered in D7.1 are available for uptake in the validation server
MS19	Final project workshop and SC meeting	WP1	1	32	Final meeting minutes
MS20	NORS Perspectives	WP10	1	33	Conclusions as to success of NORS for validation of GAS products and as to future capacities and integration in GMES in situ component

WT5:
Tentative schedule of Project Reviews

Project Number [1]	284421	Project Acronym [2]	NORS

Tentative schedule of Project Reviews

Review number [65]	Tentative timing	Planned venue of review	Comments, if any
RV 1	12	BIRA-IASB	project review takes place during or immediately after first progress meeting, and is aligned with first project report
RV 2	24	BIRA-IASB	project review takes place during or immediately after second progress meeting; minutes of the meeting will be produced
RV 3	33	BIRA-IASB	Final project review

WT6:
Project Effort by Beneficiary and Work Package

Project Number [1]	284421	Project Acronym [2]	NORS

Indicative efforts (man-months) per Beneficiary per Work Package

Beneficiary number and short-name	WP 1	WP 2	WP 3	WP 4	WP 5	WP 6	WP 7	WP 8	WP 9	WP 10	WP 11	Total per Beneficiary
1 - BIRA-IASB	2.50	1.50	9.00	12.00	3.00	2.00	8.00	4.00	5.00	5.00	1.00	53.00
2 - EMPA	1.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.50	0.00	11.50
3 - INTA	0.50	0.00	1.00	3.50	1.50	0.00	1.50	1.00	1.00	2.00	0.00	12.00
4 - UBern	0.50	0.00	13.50	1.00	0.00	2.00	3.00	1.00	1.00	2.00	0.00	24.00
5 - KIT	0.50	0.00	6.00	4.00	0.00	2.00	3.00	1.00	2.00	3.00	0.00	21.50
6 - CNRS	0.50	0.00	10.50	15.00	0.00	14.00	5.50	0.00	1.50	1.50	0.00	48.50
7 - UBremen	1.00	0.00	9.00	13.00	2.50	2.50	9.00	4.00	4.00	5.00	0.00	50.00
8 - ULg	0.50	0.00	4.00	4.00	0.00	0.00	3.00	1.00	3.00	1.00	0.00	16.50
9 - MPIC	0.50	0.00	0.00	8.50	0.00	0.00	0.00	0.00	0.00	3.00	0.00	12.00
10 - UH	0.50	0.00	0.00	6.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	7.00
11 - S&T	0.50	0.00	0.50	0.50	0.00	0.00	0.00	17.00	0.00	0.00	0.00	18.50
Total	8.50	1.50	53.50	67.50	17.00	22.50	33.00	29.00	17.50	23.50	1.00	274.50

WT7:
Project Effort by Activity type per Beneficiary

Project Number [1]	284421	Project Acronym [2]	NORS

Indicative efforts per Activity Type per Beneficiary

Activity type	Part. 1 BIRA-IA	Part. 2 EMPA	Part. 3 INTA	Part. 4 UBern	Part. 5 KIT	Part. 6 CNRS	Part. 7 UBremen	Part. 8 ULg	Part. 9 MPIC	Part. 10 UH	Part. 11 S&T	Total
1. RTD/Innovation activities												
WP 1	2.50	1.00	0.50	0.50	0.50	0.50	1.00	0.50	0.50	0.50	0.50	8.50
WP 3	9.00	0.00	1.00	13.50	6.00	10.50	9.00	4.00	0.00	0.00	0.50	53.50
WP 4	12.00	0.00	3.50	1.00	4.00	15.00	13.00	4.00	8.50	6.00	0.50	67.50
WP 5	3.00	10.00	1.50	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.00	17.00
WP 6	2.00	0.00	0.00	2.00	2.00	14.00	2.50	0.00	0.00	0.00	0.00	22.50
WP 7	8.00	0.00	1.50	3.00	3.00	5.50	9.00	3.00	0.00	0.00	0.00	33.00
WP 8	4.00	0.00	1.00	1.00	1.00	0.00	4.00	1.00	0.00	0.00	17.00	29.00
WP 9	5.00	0.00	1.00	1.00	2.00	1.50	4.00	3.00	0.00	0.00	0.00	17.50
Total Research	45.50	11.00	10.00	22.00	18.50	47.00	45.00	15.50	9.00	6.50	18.50	248.50
2. Demonstration activities												
Total Demo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3. Consortium Management activities												
WP 11	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
Total Management	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
4. Other activities												
WP 2	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50
WP 10	5.00	0.50	2.00	2.00	3.00	1.50	5.00	1.00	3.00	0.50	0.00	23.50
Total other	6.50	0.50	2.00	2.00	3.00	1.50	5.00	1.00	3.00	0.50	0.00	25.00

WT7:
Project Effort by Activity type per Beneficiary

Total	53.00	11.50	12.00	24.00	21.50	48.50	50.00	16.50	12.00	7.00	18.50	274.50

WT8:
Project Effort and costs

Project Number [1]	284421	Project Acronym [2]	NORS

Project efforts and costs

Benefi-ciary number	Beneficiary short name	Estimated eligible costs (whole duration of the project)						Total receipts (€)	Requested EU contribution (€)
		Effort (PM)	Personnel costs (€)	Subcontracting (€)	Other Direct costs (€)	Indirect costs OR lump sum, flat-rate or scale-of-unit (€)	Total costs		
1	BIRA-IASB	53.00	350,310.00	0.00	16,650.00	220,176.00	587,136.00	0.00	384,000.00
2	EMPA	11.50	83,125.00	0.00	9,325.00	55,470.00	147,920.00	0.00	114,000.00
3	INTA	12.00	86,537.00	0.00	29,660.00	117,617.00	233,814.00	0.00	155,000.00
4	UBern	24.00	95,000.00	0.00	0.00	57,000.00	152,000.00	0.00	114,000.00
5	KIT	21.50	144,050.00	0.00	4,585.00	97,825.00	246,460.00	0.00	185,000.00
6	CNRS	48.50	229,527.13	15,000.00	71,000.00	180,316.27	495,843.40	0.00	372,000.00
7	UBremen	50.00	319,000.00	18,000.00	19,920.00	203,352.00	560,272.00	0.00	372,000.00
8	ULg	16.50	87,500.00	0.00	9,750.00	58,350.00	155,600.00	0.00	114,000.00
9	MPIC	12.00	23,611.00	0.00	10,000.00	33,056.00	66,667.00	0.00	50,000.00
10	UH	7.00	31,434.00	0.00	9,494.00	24,472.00	65,400.00	0.00	49,999.50
11	S&T	18.50	72,500.00	0.00	4,000.00	45,900.00	122,400.00	0.00	90,000.00
Total		274.50	1,522,594.13	33,000.00	184,384.00	1,093,534.27	2,833,512.40	0.00	1,999,999.50

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It cannot be changed unless agreed so during the negotiations. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

53. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

54. Type of activity

For all FP7 projects each work package must relate to one (and only one) of the following possible types of activity (only if applicable for the chosen funding scheme – must correspond to the GPF Form Ax.v):

• **RTD/INNO =** Research and technological development including scientific coordination - applicable for Collaborative Projects and Networks of Excellence

• **DEM =** Demonstration - applicable for collaborative projects and Research for the Benefit of Specific Groups

• **MGT =** Management of the consortium - applicable for all funding schemes

• **OTHER =** Other specific activities, applicable for all funding schemes

• **COORD =** Coordination activities – applicable only for CAs

• **SUPP =** Support activities – applicable only for SAs

55. Lead beneficiary number

Number of the beneficiary leading the work in this work package.

56. Person-months per work package

The total number of person-months allocated to each work package.

57. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

58. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

59. Milestone number

Milestone number:MS1, MS2, …, MSn

60. Delivery date for Milestone

Month in which the milestone will be achieved. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

61. Deliverable number

Deliverable numbers in order of delivery dates: D1 – Dn

62. Nature

Please indicate the nature of the deliverable using one of the following codes

R = Report, **P** = Prototype, **D** = Demonstrator, **O** = Other

63. Dissemination level

Please indicate the dissemination level using one of the following codes:

• **PU =** Public

• **PP =** Restricted to other programme participants (including the Commission Services)

• **RE =** Restricted to a group specified by the consortium (including the Commission Services)

• **CO =** Confidential, only for members of the consortium (including the Commission Services)

• **Restreint UE =** Classified with the classification level "Restreint UE" according to Commission Decision 2001/844 and amendments

• **Confidentiel UE =** Classified with the mention of the classification level "Confidentiel UE" according to Commission Decision 2001/844 and amendments

• **Secret UE =** Classified with the mention of the classification level "Secret UE" according to Commission Decision 2001/844 and amendments

64. Delivery date for Deliverable

Month in which the deliverables will be available. Month 1 marking the start date of the project, and all delivery dates being relative to this start date

65. Review number

Review number: RV1, RV2, ..., RVn

66. Tentative timing of reviews

Month after which the review will take place. Month 1 marking the start date of the project, and all delivery dates being relative to this start date.

67. Person-months per Deliverable

The total number of person-month allocated to each deliverable.

Project full title:

Demonstration Network Of ground-based Remote Sensing observations in support of the GMES Atmospheric Service

Project acronym:

NORS

Type of funding scheme:
Collaborative Project ;
Small or medium-scale focused research project

Work programme topics addressed:
SPA.2011.1.5- 03: R&D to enhance future GMES applications in the Atmosphere area
in Area 9.1.5 'Continuity of GMES services in the areas of Marine and Atmosphere' of the FP7-SPACE-2011-1 call

Name of the coordinating person:
Dr. Martine De Mazière
Belgian Institute for Space Aeronomy

List of participants

Participant no. *	**Participant organisation name / Short name in the project**	**Country**
1 (Coordinator)	Institut d'Aéronomie Spatiale de Belgique/ BIRA-IASB	BE
2	Eidgenoessische Materialpruefungs- und Forschungsanstalt / EMPA	CH
3	Instituto Nacional de Tecnica Aeroespacial / INTA	ES
4	Universitaet Bern / UBern	CH
5	Karlsruher Institut fuer Technologie / KIT	DE
6	Centre National de La Recherche Scientifique / CNRS	FR
7	Universitaet Bremen / UBremen	DE
8	Université de Liège / ULg	BE
9	Max Planck Gesellschaft zur Foerderung der Wissenschaften / MPIC	DE
10	Ruprecht-Karls-Universitaet Heidelberg / UH	DE
11	Science and Technology B.V. / S&T	NL

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Acronyms list

AVDC	Aura Validation Data Center
BIRA-IASB	Belgian Institute for Space Aeronomy
Cal/val	Calibration Validation
CEOS	Committee on Earth Observation Satellites
CNRS	Centre National de la Recherche Scientifique
COSE	Compilation of atmospheric Observations in Support of satellite measurements over Europe
CTM	Chemistry Transport Model
DHF	Data Handling Facility
DIAL	Differential Absorption LIDAR
DOAS	Differential Optical Absorption Spectrometry
ECMWF	European Centre for Medium-Range Weather Forecasts
EEA	European Environment Agency
EMPA	Eidgenoessische Materialpruefungs- und Forschungsanstalt
ENVISAT	Environmental Satellite
ESA	European Space Agency
EU	European Union
EVDC	Envisat Validation Data Center
FTIR	Fourier Transform Infrared Spectroscopy
GAS	GMES Atmospheric Service
GAW	Global Atmospheric Watch
GECA	Generic Environment for Calibration/Validation Analysis
GEMS	Global and regional Earth-system (Atmosphere) Monitoring using Satellite and in-situ data
GEO	Global Earth Observation
GEOmon	Global Earth Observation Monitoring
GEOMS	Generic Earth Observation Metadata Standard
GEOSS	Global Earth Observation System of Systems
GIRPAS	InfraRed Group of Atmospheric and Solar Physics
GMES	Global Monitoring for Environment and Security
GOME-2	Global Ozone Monitoring Experiment 2
GSE	GMES Service Element
HDF	Hierarchical Data Format
IAP	Institute of Applied Physics
IASI	Infrared Atmospheric Sounding Interferometer
IFS	Integrated Forecast System
INTA	Spanish acronym for National Institute for Aerospace Technology
INSPIRE	INfrastructure for SPatial InfoRmation in Europe
IO_3C	International Ozone Commission
IRWG	Infrared Working Group
IUP	Institute of Environmental Physics
LPDM	Lagrangian Particle Dispersion Models
KIT	Karlsruhe Institute of Technology
KO	Kick Off
LACy	Laboratory of Atmosphere and Cyclones
LATMOS	Laboratoire Atmosphères, Milieux, Observations Spatiales
LIDAR	LIght Detection And Ranging of Laser Imaging Detection And Ranging
LPDM	Lagrangian Particle Dispersion Model
MACC	Monitoring Atmospheric Composition and Climate
MAXDOAS	Multi-Axis DOAS
MIPAS	Michelson Interferometer for Passive Atmospheric Sounding
MOZART	Model of Ozone And Related Tracers
MPIC	Max Planck Gesellschaft zur Foerderung der Wissenschaften

MW	Microwave spectroscopy
NASA	National Aeronautics and Space Administration
NDACC	Network for the Detection of Atmospheric Composition Change
Net-CDF	network Common Data Form
NILU	Norwegian Institute for Air Research
NMVOC	Non-Methane Volatile Organic Compounds
NORS	Demonstration Network Of ground-based Remote Sensing observations in support of the GMES Atmospheric Service
NRT	Near Real Time
O3M-SAF	EUMETSAT satellite application facility on ozone and atmospheric chemistry monitoring
PASODOBLE	Promote Air Quality Services integrating Observations – Development Of Basic Localized information for Europe
PI	Principal Investigator
PMT	Project Management Team
PROMOTE	PROtocol MOniToring for the GMES Service Element: Atmosphere
QA4EO	Quality Assurance Framework for Earth Observation
QA/SAC	Quality Assurance/Scientific Activity Centres
QWG	Quality Working Group
REA	Research Executive Agency
SAOZ	Système d' Analyse par Observation Zénitale
SC	Steering Committee
SME	Small and Medium Enterprises
S&T	Science & Technology BV
TCCON	Total Carbon Column Observing Network
TM	Transport Model
UH	Ruprecht-Karls-Universitaet Heidelberg
UNEP	United Nations Environment Programme
UVSQ	Université de Versailles Saint-Quentin-en-Yvelynes
UVVIS	Ultraviolet visible spectroscopy
WCC	World Calibration Centre
WGCV	Working Group on Calibration and Validation
WP	Work Package

Demonstration Network Of ground-based Remote Sensing observations in support of the GMES Atmospheric Service

Acronym: NORS

B1. Concept and objectives, progress beyond state-of-the-art, S/T methodology and workplan

B1.1. Concept and project objectives

The GMES Atmospheric Service (GAS) is to deliver policy-relevant services on atmospheric composition and climate. Quality assessment and quality control of the GAS data products and services are of key importance for ensuring the suitability of the GAS products for the atmospheric and climate change research communities, and for the adequacy of policy decisions. The satisfaction of the users and the competitiveness of the Service will depend strongly on the quality of the delivered data products. Therefore, this project aims at assessing and improving the quality of the GAS operational data products through the development and provision of customized high quality ground-based remote sensing data from the Network for the Detection of Atmospheric Composition Change (NDACC; http://www.ndacc.org). This will be beneficial for all GAS applications beyond 2015.

In NORS, the required research and developments will be made to optimize the NDACC data and data products for the purpose of supporting the quality assessments of the future GAS.

The major objectives are

- to implement procedures for operational data delivery of NDACC data to GAS actors with a delay of maximum 1 month;
- to provide an extensive characterisation of targeted NDACC data and user documentation. The NDACC data will also be evaluated in comparison with satellite data that are assimilated in the GAS products, and against other network data like Global Atmosphere Watch (GAW) surface data and the Total Carbon Column Observing Network (TCCON) data, in a comprehensive and coordinated way;
- to investigate the integration of ground-based data products from various sources (ground-based in-situ surface and remote-sensing data, and satellite data), and to provide the integrated data products to GAS. Hereto, new scientific methodologies will be developed.
- to provide ground-based measurement time series back to 2003 in support of the re-analysis products of GAS. NORS will provide and archive quality-controlled long-term reference data sets for open access by GAS and GMES users, a need expressed in the GAS Implementation Group Final Report.
- to develop and implement a new GAS-compliant web-based application for operational validation of GAS products using the NORS data products. In this validation service, better methodologies for validation will be included, based on the improved characterisation of the ground-based data. This service will be user-oriented.
- to support the extension of NDACC to stations outside Western Europe, namely in the tropics, in China, Latin America, Africa and Eastern Europe.

NDACC is a cross-border international research network of remote sounding stations. It is a major contributor to the World Meteorological Organisation (WMO) GAW programme and it works under the auspices of United Nations Environment Programme (UNEP) and the International Ozone Commission (IO_3C). Relying on a strong involvement of European partners and efficient collaboration with partners worldwide, the network started operations officially in 1991, but a few

data records extend back to the 1970s and even to the 1950s. At present time it includes more than 70 high-quality, remote-sensing research stations/sites distributed worldwide for (i) observing and understanding the physical / chemical state of the stratosphere and troposphere, and (ii) assessing the impact of stratospheric changes on the underlying troposphere and on global climate.
Several NDACC priorities are directly relevant to the GAS:

- Detecting trends in overall atmospheric composition and understanding their impacts on the stratosphere and troposphere,
- Studying atmospheric composition variability at interannual and longer timescales,
- Establishing links and feedbacks between climate change and atmospheric composition,
- Calibrating and validating space-based measurements of the atmosphere,
- Supporting process-focused scientific field campaigns, and
- Testing and improving theoretical models of the atmosphere.

In NORS, we will focus on key species for the stratospheric ozone, air quality, and climate areas of GAS at 4 NDACC sites managed by European partners, as a demonstrator, with the objective of exporting the achievements of NORS to many stations of the global NDACC network and to additional species in the near-future.
The species actually focused on in NORS are

- tropospheric and stratospheric ozone columns and vertical profiles up to 70 km altitude;
- tropospheric and stratospheric NO_2 columns and profiles;
- lower tropospheric profiles of NO_2, H_2CO, aerosol extinction;
- tropospheric and stratospheric columns of CO
- tropospheric and stratospheric columns of CH_4

They are listed in the GAS Implementation Group Final Report as priority species for the above mentioned areas, and they are products of the current MACC (Monitoring Atmospheric Composition and Climate Interim Implementation) services.
Within NORS they will be monitored using standard NDACC remote-sensing techniques, based on Fourier Transform InfraRed (FTIR) and MicroWave (MW) spectroscopy, UV-Visible Differential Optical Absorption Spectroscopy (DOAS) and multi-axis DOAS or MAXDOAS, Microwave spectroscopy and differential absorption lidar technique. This selection of instruments represents all NDACC type of instruments that are suited to monitor the above species, with the exception of Dobson/Brewer instruments and ozone sondes of which the data are already included in the validation activities for GAS. The sites included in NORS for operational data delivery to GAS are NyÅlesund in the Arctic (79°N, 12°E), the Alpine station including the International Scientific Station of the Jungfraujoch (47°N, 8°E), Bern (47°N, 7°E) and the Observatoire de Haute Provence (44°N, 6°E), Izana (28°N, 16°W) in Tenerife at low northern latitudes, and Ile de La Réunion (21°S, 55°E) in the southern hemisphere tropics.

Hereinafter, the above products will be called the target NORS data products and the sites will be referred to as the 4 NDACC pilot stations.

Regarding the web-based validation services, it will be investigated how the NORS validation service can be integrated in existing systems or systems under development in support of the GAS. Developed in response to the GEO Tasks DA-06-02/DA-09-01 that address a GEOSS data quality strategy for Earth Observation data and higher level data products, the ESA Generic Environment for Calibration/Validation Analysis (GECA) is a natural candidate. This system will already provide a server for consistent validation of European satellite sensors using ground-based data and it is our intention in NORS to extend its capabilities to include a validation service for GAS. Therefore, the NORS Steering Committee will include an ESA representative for GECA. The collaboration with the GMES Atmospheric Core Service project and the use of the GECA system will ensure access to the satellite data needed in the NORS project.

The project will be carried out in close collaboration with other actors in GMES: leading members of relevant GMES Atmospheric Service projects will be invited to be member of the NORS Steering Committee. The Project Management Team will liaise with the European Environmental Agency (EEA) who is responsible for the coordination of the in-situ data for GMES; an EEA representative will be member of the NORS Steering Committee. It will also promote the NORS activities in the NDACC community: the NDACC co-chairman will be a member of the NORS Steering Committee and several members of the NORS consortium have steering roles in NDACC as co-chairmen of working groups and as members of the NDACC Steering Committee. The idea behind this is to gradually achieve an enlarged and sustained involvement of NDACC partners in the GAS products chain. The project will also liaise with upstream satellite partners of GAS, namely, the community of operational satellite data providers, represented in the NORS Steering Committee by a member of the Committee on Earth Observation Satellites (CEOS) Working Group on Calibration and Validation (WGCV).

NORS will be addressing several points that, according to the GAS Implementation Group Final Report, should be in the focus of EU funding for GAS: (i) the European contribution, in particular through European capacities, to international observation networks and data management systems, (ii) technical coordination activities like cal/val and data management facilities, and (iii) gap filling in observation infrastructure in eastern Europe and outside Europe.

B1.2. Progress beyond the state-of-the-art

This project will build upon results achieved in former EU projects like COSE (Compilation of atmospheric observations in support of satellite measurements over Europe', ENV4-CT98-0750, 1998-2000; http://www.nilu.no/projects/nadir/cose/cose.html) and the EU FP6 Integrated Project GEOmon (Global Earth Observation and Monitoring, 2007-2011; http://www.geomon.eu), and it will exploit the existing NDACC observational infrastructure in Europe and beyond.

Data delivery

NDACC Principal Investigators are committed to submit their data to the NDACC Data Handling Facility (DHF) twice a year, with a delay not larger than 2 years after the measurement. In the GEOmon Activity 'Stratospheric Ozone and Climate', we set a first step towards more rapid data delivery from NDACC stations. However, accepted delays for data submission were still of the order of 3 months after the measurements, and every partner was allowed to submit the data in a totally free format, without any metadata. The submitted data could be retrieved from an ftp server accessible via the GEOmon data portal hosted by the Norwegian Institute for Air Research (NILU).
In NORS, we will move to a data submission scheme with a delay not larger than one month after the measurement, and we will enforce a common format including metadata, in order to provide a high-quality and useful service to GAS. NORS will adopt a format that is compliant with GEOMS (Generic Earth Observation Metadata Standard, published on AVDC Web pages (http://avdc.gsfc.nasa.gov/index.php?site=1178067684, 2011) established lately in GECA, in agreement with ESA, the NASA Aura Validation Data Center (AVDC), the Envisat Validation Data Center (EVDC) hosted at NILU and the NDACC DHF, and approved by the Committee on Earth Observation Satellites (CEOS) Working Group on Calibration and Validation (WGCV). These metadata guidelines are actually implemented using the Hierarchical Data Format (HDF4 and HDF5 file formats), but are not limited to these formats; the network Common Data Form (netCDF-4) is of interest as this shares the same data model with HDF5. HDF has become the de-facto satellite data exchange format for the ESA and the NASA Earth observation missions, while netCDF is a standard in the climate research community. In NORS, we will verify whether the GEOMS-compliant HDF format satisfies our requirements. If not, we will suggest amendments to the GEOMS managers in order to optimize the implementation of the guidelines for the needs of NORS and GAS.

NORS will also deliver re-analysed time series of atmospheric measurements back to 2003 or to the start time of the observations if this is later than 2003, in support of the re-analysis performed in GAS.

Data characterization

The second important activity in NORS is the advanced characterization of the NORS data products. Work in this direction has been going on in the various NDACC Working Groups[1] but a coordinated approach is required to tailor and document the products in agreement with the special needs of the GAS users. In particular, more studies are needed to assess the uncertainties associated with the NORS products, their vertical sensitivity and resolution, and their agreement with satellite data products. These characteristics must be taken seriously when comparing data from different sources, e.g., ground-based remote sensing data with satellite data or with model analyses. Therefore, in this project it is aimed at providing all information needed on vertical and horizontal averaging, location of the remotely-sensed air volume, and resolution of the data, in the form of metadata and user guides in a consistent format for all instruments. This integrated approach constitutes a significant progress beyond the state of art.

[1] The NDACC organisation is composed of several working groups, according to instrument type or research theme; see http://www.ndacc.org.

Remote-sensing data products (satellite as well as ground-based) have a multi-dimensional character, which varies with the measurement geometry, the spectral range, the species etc. In GEOmon, pioneering research was done to better characterize this multi-dimensional character and the resulting issues to be addressed when comparing two data sets with a very different perception of the atmosphere. E.g., for the first time, two-dimensional averaging kernels were derived for MIPAS profile retrievals, enabling the characterization of the MIPAS horizontal resolution and consequently a better understanding of both horizontal and vertical smoothing and sampling issues (von Clarmann et al., 2009). The latter issues have direct impact on the interpretation of the MIPAS data, on their ground-based validation and on their ingestion by data assimilation systems like the one coupled to the IFS at ECMWF. This innovative research will be extended in NORS to all the data types involved. As a result, the exact location and extent of the probed air volume, as a function of the date/time of the measurement, will be determined and included with the data products or the accompanying metadata. This will enable reducing collocation and smoothing errors in data comparisons and better understanding the representativeness of the data with respect to a model or analysis field.

Comparisons between datasets from different sources

NORS will also make progress in the evaluation of data products coming from various sources. For example, tropospheric columns from different instruments (MAXDOAS, DOAS, FTIR) were compared for the first time in GEOMon and the results showed a promising potential for satellite validation. As instrumental techniques become more advanced and retrieval algorithms more sophisticated, new data products are generated and it is important to know how they compare to older versions of the same product, or to a similar product delivered by another type of instrument or coming from another network. An example is the cross-validation between the NDACC and the more recent TCCON methane products. In the data characterization studies, we will include some NDACC products that are not mature yet for operational data delivery but that have a significant potential for the future and that are also highlighted as priority parameters in the GAS Implementation Group Final Report, like the NO_2 column and formaldehyde in the mid troposphere from FTIR measurements or tropospheric ozone from MAXDOAS instruments.

Much progress was already achieved in GEOmon concerning the evaluation of the agreement between NDACC and satellite products, at various time and space scales. This work and work going on in parallel to NORS, will not be repeated but complemented with similar studies for additional data products, and for more recent versions of the satellite and/or ground-based products. Based on the various inputs regarding satellite validation, we will make a clear and complete compilation of the results in order to give the providers of GAS products a better insight into the consistency between the various datasets that are used in the generation and validation of their products. Such a compilation is not readily available at this moment.

Data integration

Having data products for the same atmospheric species but with different characteristics coming from different sources, it is possible to combine them to an integrated product carrying the best of the information from all sources. This is a very acute issue for ozone where multiple sources exist for column and profile information and where a combined product covering the O_3 profile from the surface to the upper atmosphere would be very welcome. This was never achieved before and will be investigated in NORS.

Ground-based remote-sensing data are the ideal intermediate between the in situ surface concentration data and the satellite integrated column data. Research will be carried out to investigate this link, using information on data representativeness and including knowledge derived from chemistry-transport models.

Analyses of site representativeness have been carried out since several years applying Lagrangian Particle Dispersion Models (LPDM) in backward mode to establish source-receptor relationships.

Such studies were used to describe the area influencing measurements at Jungfraujoch (Folini et al., 2008) but also to inter-compare sites in the European domain (Folini et al., 2009). Different surface station categories based on parameters describing representativeness were developed within the FP6 project GEOmon (Henne et al., 2010).

Building on this experience we propose a more advanced approach within NORS comparing tropospheric column data as retrieved from ground-based and satellite remote sensing with surface in-situ measurements. The latter ones offer a solid ground for validation, since they are taken at numerous stations of extensive national networks and can be traced back to international gravimetric concentration standards. When comparing surface in-situ data with tropospheric column data, additional information on the tropospheric profile shape is necessary to link the surface concentrations to the column. The profile information is typically taken from an atmospheric chemistry-transport model with rather coarse horizontal resolution. Here we will use two independent model products. On the one hand, output from the global state-of-the-art chemistry transport model (CTM) MOZART-4 (http://www.acd.ucar.edu/gctm/mozart/) for ozone, nitrogen dioxide, and carbon monoxide, and data from the global CTM TM5 (http://www.phys.uu.nl/~tm5/), which is specialized for methane, will be used. Methane is not treated explicitly in the MOZART-4 run. On the other hand, the re-analysis products produced by GEMS and MACC (http://www.gmes-atmosphere.eu/data/) will be considered.
An additional uncertainty is introduced in the comparison if the in-situ observations are not representative in terms of model surface concentrations and satellite columns. Representativeness here is understood as a tolerable difference between the point measurement of the in-situ site and the volume average as it is represented in the model or satellite product. This mismatch is mostly driven by recent surface influences on the concentration field. By applying higher resolution backward LPDM calculations for the different sampled or simulated air masses, the mismatch between point measurement and model grid box can be quantified and either be used to filter out situations with large mismatch or to assign additional uncertainties in a quantitative comparison (e.g. weighted regression analysis). Additional representativeness issues arise for sites in complex terrain. Here the model surface height often underestimates the altitude of the actual sampling site (classically placed on mountain tops or saddles). Under such circumstances it is not a-priori certain which model grid box should be used for comparison with surface in-situ data. Assessing the surface influence through LPDM calculations for different grid boxes above the surface and comparing these to the estimated influences of the point measurement, will allow selecting the model output altitude with the best match. Detailed comparison studies including analyses of representativeness are proposed for the site Jungfraujoch that is situated in the central Swiss Alps but frequently subject to pollution episodes originating from the densely populated areas towards the South (Po Valley) and North (Swiss Plateau). For sites that are less affected by recent surface fluxes (usually island sites or sites in sparsely populated regions) a direct comparison between model-extended surface in-situ data, remotely-sensed surface concentration data and tropospheric column data might be feasible without further analysis of representativeness. This question will be evaluated for at least one more European site.

Therefore, based on existing long-term time series (ground-based remote sensing and in-situ) of established networks (e.g. NDACC or GAW) combined with model information, long-term products with better defined uncertainties (as explained above) can provide long-term information to assess satellite data on a regular basis during the whole life time of the satellite.

Operational validation of GAS products using NORS data sets

Current projects engineering the future GAS give proper importance to aspects of data quality and service quality. However, they tend to rely only on existing operational networks with fast delivery capabilities. A consequence is that they lack validation sources for several chemical species of high priority, not covered by these fast delivery networks. Several of the missing validation sources can be provided by the complementary types of instrumentation operated within NDACC. Moreover, the different types of NDACC instrumentation offer complementary perceptions of atmospheric composition, a more comprehensive view than can be offered by a network exploiting

a single measurement technique. Furthermore, NDACC strives at the excellence needed to detect subtle changes in atmospheric composition and its link with climate, through a coherent series of instrument and data protocols. This makes NDACC a natural source of validation data and validation expertise.
To our knowledge, NDACC data have not been used yet for the validation of GAS products. Only a few validation tests have been carried out in the framework of the former FP6 GEMS and ESA GMES Service Element PROMOTE projects. NORS will be the first coordinated effort to provide NDACC data specifically tailored for GAS validation purposes, and to develop and implement a dedicated web-server for validating GAS products using these NORS data products on an operational basis and in a consistent way. This represents a big step forward compared to the actual state-of-the-art. The validation procedures used in NORS will be compliant with the GAS Validation Protocols being developed within MACC and PASODOBLE, which are themselves compliant with the higher level Quality Assurance Framework for Earth Observation (QA4EO) established for the GEOSS. In particular, the web-based archive we propose as part of this server, replies directly to the requirement of traceability of the quality information and its long-term sustainability. To ensure mutual consistency, avoid duplication of work, and enhance dissemination of results with upstream and downstream GAS partners, interactions will be sought with the GAS projects teams performing validation tasks and with satellite data providers in charge of validation activities (e.g. the O3M-SAF which is responsible for the production and validation of EUMETSAT atmospheric composition measurements by GOME-2 and IASI).

References

Folini, D., S. Ubl, and P. Kaufmann, Lagrangian particle dispersion modeling for the high Alpine site Jungfraujoch. J. Geophys. Res., 113, D18111, doi: 10.1029/2007JD009558, 2008.

Folini, D., P. Kaufmann, S. Ubl, and S. Henne,: Region of influence of 13 remote European measurement sites based on modeled CO mixing ratios. J. Geophys. Res., D08307, doi: 10.1029/2008JD011125, 2009.

Henne, S., D. Brunner, D. Folini, S. Solberg, J. Klausen, and B. Buchmann, Assessment of parameters describing representativeness of air quality in-situ measurement sites. Atmos. Chem. Phys., 10, 3561-3581, 2010.

von Clarmann, T., C. De Clercq, M. Ridolfi, M. Höpfner, and J.-C. Lambert, The horizontal resolution of MIPAS, Atmos. Meas. Tech., 2, 47–54, 2009.

B1.3. S/T methodology and associated work plan

B1.3.1 Overall strategy and general description

The planned activities have been divided into workpackages according to the type of work. Many will run in parallel, some are quite independent of the others, some have strong interactions among them (see charts below).

WP1 ensures the overall scientific project management.

WP2 ensures proper dissemination of project results (outreach)

WP3 cares for the development and implementation of automatic processing and formatting (archiving) of the NORS data at the partners sites and the development and implementation of a rapid delivery system of the processed and formatted data to GAS. The data formats will be defined in WP4.

Table 1.3.1.1: Identification of the types of instruments at the 4 NORS stations, and of the partner's responsibilities

	DOAS	**MAXDOAS**	**FTIR**	**O_3 LIDAR**	**O_3 MW**
BIRA-IASB	Alps	Alps	Reunion		
INTA		Izana			
UBern					Alps
KIT			Izana		
CNRS	Alps, Reunion			Alps, Reunion	
UBremen		Ny-Ålesund	Ny-Ålesund		Ny-Ålesund
ULg			Alps		

WP4, in addition, includes scientific work aimed at better characterizing the data, among others by comparing data for the same atmospheric parameter from different sources. The metadata associated with the data will be defined and a user guide will be delivered. WP4 also includes an evaluation of the consistency between the ground-based data and the satellite data used in the GAS assimilation chain.

WP5 and WP6 develop new scientific methodologies for integrating data from different sources, in particular in WP5 for tropospheric products (in-situ surface concentration measurements, ground-based remote sensing data and satellite data, with the help of model information) and in WP6 for ozone products.

Table 1.3.1.2: Tropospheric data stations/products/responsible institutes at candidate demonstration sites

	DOAS	**MAXDOAS**	**FTIR**	**In situ surface**	**Sat.**	**Model***
Jungfraujoch						
NO_2	BIRA-IASB	BIRA-IASB	ULg	EMPA	EMPA[§]	MOZART-4
O_3		BIRA-IASB	ULg	EMPA	WP3000	MOZART-4
CO			ULg	EMPA	WP3000	MOZART-4
CH_4			ULg	EMPA	WP3000	TM5
Izana						
NO_2	INTA	INTA	KIT	EMPA[+]	WP3000	MOZART-4

	DOAS	MAXDOAS	FTIR	In situ surface	Sat.	Model*
O_3		INTA	KIT	EMPA+	WP3000	MOZART-4
CO			KIT	EMPA+	WP3000	MOZART-4
CH_4			KIT	EMPA+	WP3000	TM5
Ny Ålesund						
NO_2	UBremen	UBremen	UBremen	EMPA+	WP3000	MOZART-4
O_3		UBremen	UBremen	EMPA+	WP3000	MOZART-4
CO			UBremen	EMPA+	WP3000	MOZART-4
CH_4			UBremen	EMPA+	WP3000	TM5

*: Column gives the name of the suggested global chemistry transport model whose output will be used to create profile and column data from surface in-situ measurements (MOZART-4: http://www.acd.ucar.edu/gctm/mozart/, TM5: http://www.phys.uu.nl/~tm5/). As an alternative the global reanalysis products as created in MACC and GEMS (http://www.gmes-atmosphere.eu/data/) will be considered.
+: In-situ data from Izana and Ny Ålesund will be obtained through the Global Atmosphere Watch data centre for greenhouse gases (WDCGG)
§: New OMI NO_2 retrieval with improved quality above complex terrain for central Europe (see http://temis.empa.ch/index.php)

WP7 cares for the delivery of re-analysed time-series of ground-based measurements at the 4 NDACC pilot stations back to 2003 or to the start of the measurements.

WP8 develops and implements a web-based server for consistent and operational validation of the GAS products using the NORS data products. The server will become operational in the course of the project (month 21).

WP9 will generate validation reports of the GAS products, using the server developed in WP8. Based hereupon, a global assessment of the quality of the GAS products will be delivered.

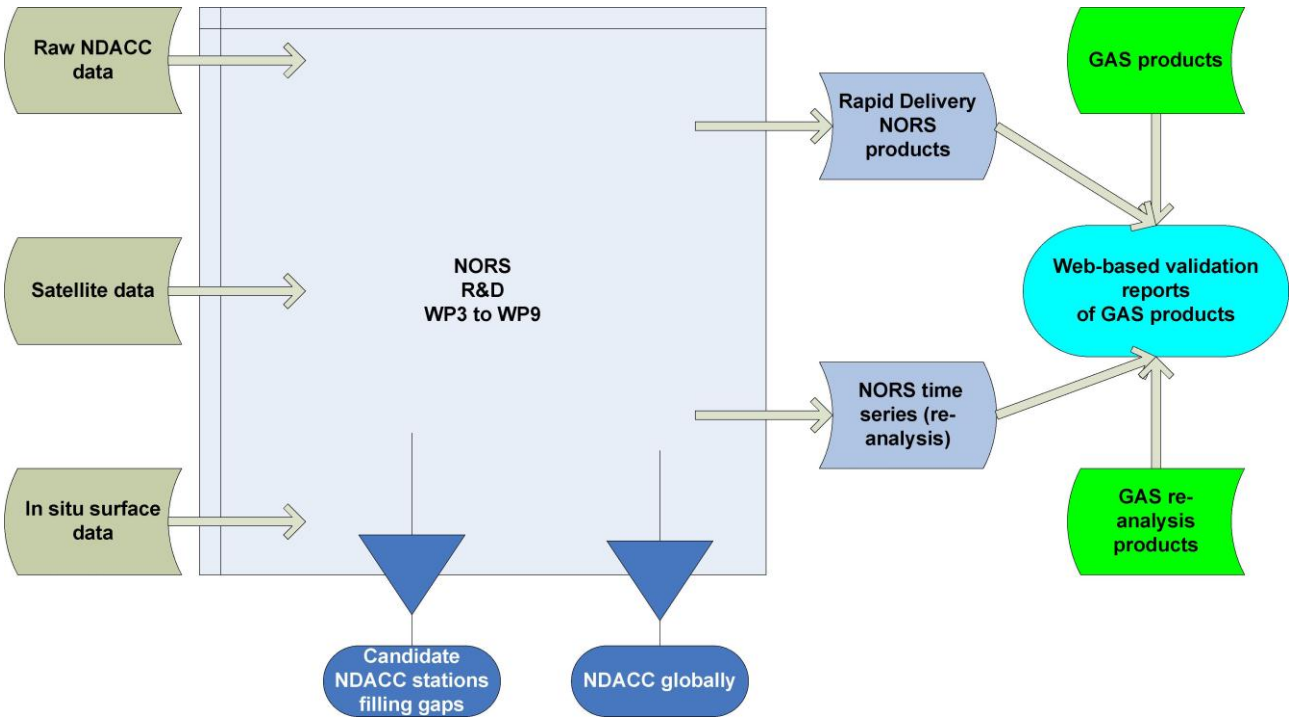
WP10 prepares for implementing the NORS approach in NDACC as a whole, and it starts the exportation of the NORS expertise to observatories outside of Western-Europe, in collaboration with external teams. This activity will take the necessary steps to ensure a larger NDACC-based validation capacity of GAS in the future.

Table 1.3.1.3: Involvement of various NORS partners in the implementation of NDACC infrastructure and observation and data analysis procedures at observatories outside of western Europe, often in collaboration with local partners.

Observatory	Country	Instrument	NORS partner involved	Local partner
Xianghe Integrated Observatory	China	MAXDOAS	BIRA-IASB	Institute for Atmospheric Physics / Chinese Academy of Sciences
Beijing	China	Mini-MAXDOAS	MPIC	Chinese Academy of Meteorological Sciences
Kourovka	Russia	FTIR	UBremen	Univ. of Yekaterinburg
Tomsk	Russia	FTIR	KIT	Zuev Institute of Atmospheric Optics
Paramaribo	Suriname	FTIR	UBremen	Anton de Kom University
Paramaribo	Suriname	MAXDOAS	UH	Meteorological Service of Suriname

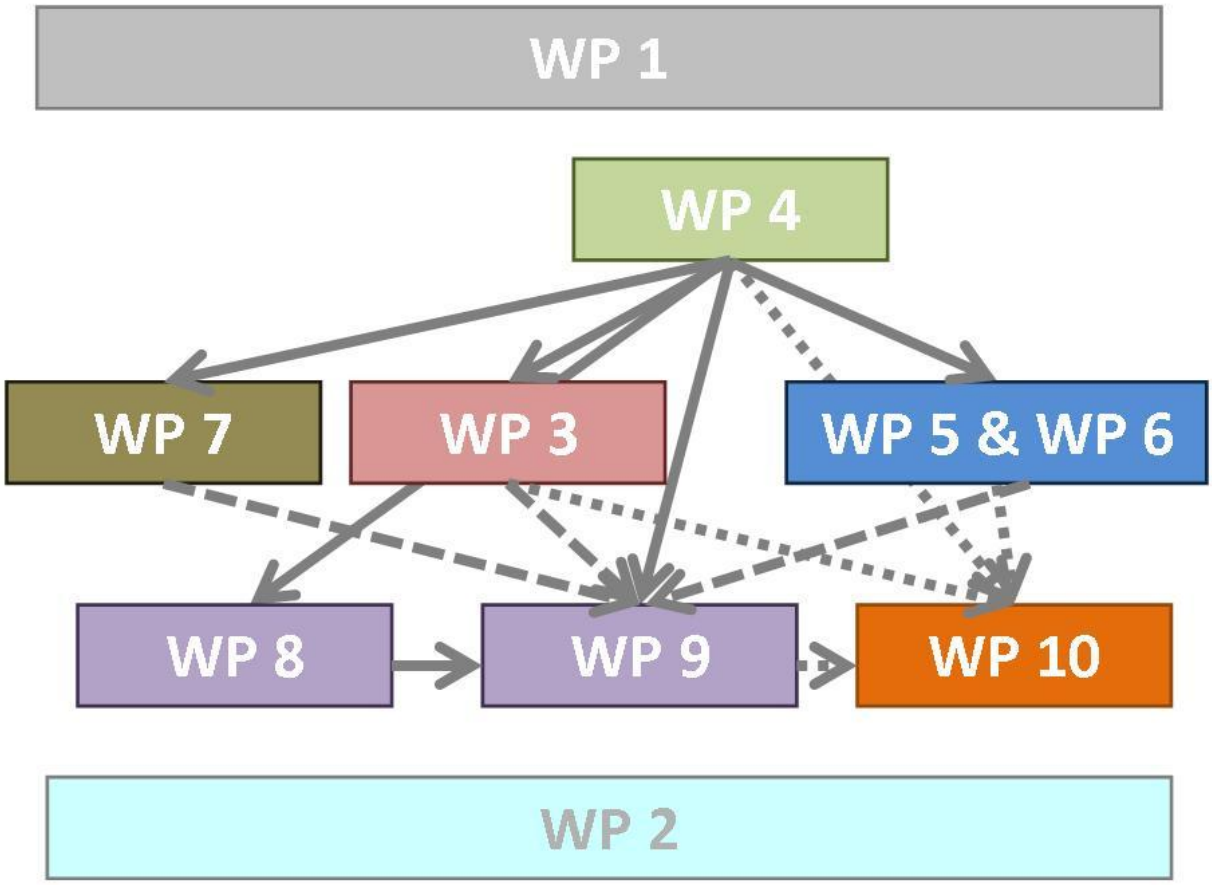
Observatory	Country	Instrument	NORS partner involved	Local partner
Mexico City	Mexico	FTIR	KIT	UNAM
Rio Gallegos	Argentina	O_3 Lidar	CNRS	CEILAP-CONICET
Bujumbura	Burundi	MAXDOAS	BIRA-IASB	Univ. of Bujumbura
Addis Ababa	Ethiopia	FTIR	KIT	Addis Ababa University
Belgrano	Antarctica	MAXDOAS	INTA	Instituto Antártico Argentino (IAA)
Seoul	South Korea	O_3 MW	IAP/UBern	Sookmyung Women's University Division/Department Chemistry

The workflow in NORS is as follows:



B1.3.2 Interdependencies of the workpackages

Dashed arrows indicate data flow; full arrows indicate knowledge flow; dotted arrows indicate export of knowledge.



B1.3.3 Risks and associated contingency plans

This is a project with few risks.

The NORS data products are derived from observations with NDACC instruments at different sites managed by the partners involved in the consortium. These sites have been operational for many years and have a strong commitment to NDACC: up to now, these stations have succeeded in maintaining the necessary infrastructure and personnel for continuing the observations. Instrument failures can always happen, but the plan is of course to ensure timely repair, using resources external to this project. There is a risk that the resources, external to this project, that are required to maintain continuity of the data acquisition and exploitation decrease significantly or – in the worst case – become insufficient. But as shown in Table 2.4.1 in Section B2.4, this risk appears to be small, and the continuity of the data acquisition seems to be guaranteed for the duration of NORS.

The in-situ surface concentration data are monitored by operational networks. The data are publically available from the GAW World Data Center for Greenhouse Gases (WDCGG). Moreover the data at Jungfraujoch belong to one of the partners (EMPA).

The GAS products and the satellite data that are involved in the GAS production chains will be obtained via our contacts with the GMES Atmospheric Service teams who will be represented in the Steering Committee, and via partners' involvements in the O3M-SAF and in ESA satellite validation projects like MULTI-TASTE. In addition, ESA satellite data will be accessible through GECA.

All partners, including the SME, have a strong heritage regarding the tasks to which they committed themselves in the project, as shown in Section B2.3, so there is no reason why they could not assume these tasks correctly. The basic data analysis tools, including radiative transfer models, and the chemistry-transport model results to be used in WP5 are available already with the partners. Also the risk of significant communication failures is extremely small as all partners have collaborated in the past and are involved in ongoing projects.

If a problem occurs, the impact will be evaluated in terms of the potential delay or potential non-delivery of one or more deliverables of the project. If the impact is minor and if it has no direct impact on another activity or on the main final project results, then the concerned deliverable will be shifted or eliminated, the workplan will be adapted accordingly, and the change will be reported in the next project report. If the delay or non-delivery has a significant impact on another activity, it will be verified whether this other activity can be re-scheduled without affecting significantly the final results of the project. If this is not the case, or if the problem (delay or non-delivery) has a serious impact on the project as a whole, the Project Management Team will consider how the impact on the final project results can be minimized and implement the necessary changes in the project workplan; the REA or the EU will be informed.

If a partner does not comply with his/her commitments in the project, the Project Management Team will draw the partner's attention to his/her responsibilities in the project and the impact of his negligence on the project's risks of failure. If that doesn't help improving the situation, the hierarchical chief of the partner will be contacted and asked to exert pressure on his employee. If necessary, the directors of the coordinator's institute and the partner's institute will both be called upon on the purpose of finding a solution. If the situation cannot be cleared, then the EU officer will be contacted by the coordinator to terminate the partner's contract. The implications for the project will be discussed with the REA or EU and a revised project workplan will be submitted and negotiated.

The project coordinator will verify the timeliness of the achievement of project milestones throughout the project. She will send a short Email to the Project Officer concurring with every milestone to confirm completeness or to inform about any delay (reason of delay and expected time of completeness). She will be in touch with the lead beneficiary partner in any case. In case of problems, she will discuss the problem with the lead beneficiary partner and – if necessary – discuss with the partner(s) causing the delay.

B1.3.4 Timing of the workpackages and their components

Table B1.3.4.1
T=Trimester; ♦ indicates punctual activity; grey shading means continuous activity; the arrows indicate that the start of a task or subtask depends critically on the outcome and finalisation of another task.

		Year 1				Year 2				Year 3		
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
WP1	T1.1	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
	T1.2				♦	♦			♦	♦		♦
	T1.3				♦	♦			♦	♦		♦
	T1.4											
WP2	T2.1											
	T2.2											
WP3	T3.1											
	T3.2											
	T3.3											
	T3.4											
	T3.5											
	T3.6											
WP4	T4.1											
	T4.2											
	T4.3											
	T4.4											
WP5	T5.1											
	T5.2											
	T5.3											
	T5.4											
WP6	T6.1											
	T6.2											
	T6.3											
WP7	T7.1											
	T7.2											
WP8	T8.1											
	T8.2											
	T8.3											
WP9	T9.1											
	T9.2											
	T9.3											
	T9.4											
WP10	T10.1											
	T10.2											
	T10.3											

Table B1.3.4.2: Timing of project meetings and outreach meetings (nominal plan).

		Year 1				Year 2				Year 3		
		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11
WP1	Project meetings	KO			X				X			X
WP2	Outreach meetings		1		3		1		3	2	1	4

1: Annual EGU meeting, which takes place in April every year

2: AGU Fall meeting, taking place in December in San Francisco

3: Attendance of MACC-II General Assemblies or dedicated validation subproject meetings

4: Final NORS workshop, coincident with final project meeting

B2. Implementation

B2.1. Management structure and procedures

The project is small-sized: it will consist of only 11 partners, who have worked together in the past in the context of the NDACC working groups and more specifically in the context of former EU projects like COSE, and recently GEOmon. The coordinator has also collaborated in the past with the SME involved in this project, in the context of the ESA Generic Calibration/Validation Analysis (GECA) project. The complexity of the project is therefore rather limited and does not justify a complex management structure.
We believe however that it is very important that this project is embedded in the overall GMES landscape, and therefore, we plan the establishment of a Steering Committee including members external to this project.

The Project Management Team (PMT) will consist of the coordinator and the WP leaders. They are part of the Steering Committee (SC) which includes additional members who are not involved in the project, but who have strong links to the project because of their role in GMES or in NDACC.
The planned composition of the Steering Committee is as follows:

- the Project Management Team (coordinator and WP leaders);
- representatives of the GMES Atmospheric Service projects, including representatives for the in-situ component, the validation activities and the data quality management (probably one or two representatives of MACC-II)[*];
- a representative of ESA for the GECA environment (T. Fehr or another person designated by ESA);
- a representative of EEA for the coordination of the in-situ component in the GMES Atmosphere area (probably Henrik Steen Andersen);
- G. Braathen (WMO), co-chairman of NDACC;
- O. Taranova, responsible at WMO for matters related to Greenhouse gases, Reactive gases, GAW stations and QA/QC;
- J.C. Lambert, member of the CEOS WGCV

The persons listed above, as well as leading members of the ongoing MACC project, have all agreed to be member of the NORS SC.

We plan bi-monthly teleconferences of the Management Team to discuss the progress of the project, interactions between the WP activities, possible problems,…, in order to avoid delays of deliverables and optimise the overall coordination between the various project activities. It is expected that, in preparation of the teleconferences, the WP leaders will have collected the information about the tasks in their WP and represent the task leaders at the teleconference. Every third teleconference, i.e., every half year, we will invite the other members of the Steering Committee to take part in the teleconference, in order to discuss the interaction with other relevant projects in Area 9.1.5, with ESA , NDACC and GAW.

[*] The names of the representatives of the GMES Atmospheric Service projects in the Steering Committee will be decided once the relevant projects that are granted in Area 9.1.5 of the Space Call 2011, 'Continuity of GMES services in the areas of Marine and Atmosphere' are known

The minutes of the teleconferences will be distributed to the whole consortium and the Steering Committee members.
In addition to the teleconferences to follow closely the project execution, we will have annual plenary progress meetings, starting with a Kick Off meeting and ending with a final meeting.

The Steering Committee will be invited at the Kick Off meeting and at the annual project meetings. At these occasions, we will have a Steering Committee Board meeting to review the progress of the project and to get advice on the optimal interaction with the other projects and activities in the frame of the GMES Atmosphere Service

At Kick Off, we will also define very explicitly the tasks, the role of each partner in each task, and the responsibilities in the deliverables. The timing will be verified accordingly. The Kick Off meeting will also serve the collection of a maximum of advices and information from the Steering Committee members.
At the plenary annual meetings, the research and development progress will be reviewed, and plans for the next period will be updated if necessary.
The plan is that the final meeting is open to additional GAS actors outside of the NORS consortium.
We will probably need some specific workpackage meetings in the course of the project, to discuss more technical details of the WP research work. It will be the responsibility of the WP leaders to organize and chair these meetings.
All meetings will be organised at the partners' home institutes. Only for the final meeting where we expect a larger audience, we may need to find a more suitable meeting facility, but it will anyway be close to a partner's location.

Decisions concerning important actions affecting the project and/or the consortium will be taken by the Project Management Team, after discussion with the consortium. They will be communicated to the consortium, and to the Steering Committee if relevant for them.

The interaction with the EU or REA will be insured by the coordinator. The PMT and the consortium will be informed at all times about any important messages resulting from those interactions. The coordinator will also insure that messages from the consortium to the EU or REA are transmitted to the relevant bodies or persons.

B2.2. Beneficiaries

Partner 1 : Institut d'Aéronomie Spatiale de Belgique / BIRA-IASB

The Belgian Institute for Space Aeronomy (BIRA-IASB) is a Belgian Federal Scientific Research Institute created in 1964. Its main tasks consist in developing research and public service activities in the field of space aeronomy, which in a broad sense encompasses the physics and chemistry of the Earth atmosphere, as well as the study of other planets of the solar system and the outer space. BIRA-IASB scientists rely on observations from ground-based, balloon-, air- or space-borne instruments, as well as on theoretical and numerical modeling studies. Among the topics of interest, stratospheric ozone depletion is being investigated which includes the study of volcanic aerosols, polar stratospheric clouds and halogenated compounds. Long-term changes are evaluated and forecasting capabilities are being developed in support of the Montreal Protocol on the protection of the ozone layer. BIRA-IASB also studies the tropospheric chemistry, with a focus on natural and manmade emissions, tropospheric ozone precursors, the relationship to air quality and the evolution of greenhouse gases in support of the Kyoto Protocol. Forecasting of chemical weather is being developed. Within NORS, BIRA-IASB will be responsible for the overall coordination of the project and for FTIR and UV-Vis MAXDOAS related studies at Reunion Island, Jungfraujoch and OHP.

Dr. M. De Mazière, Head of Department at BIRA-IASB, which she joined in 1988. Her main expertise concerns remote sensing of the atmospheric composition using optical spectrometric techniques in the infrared, from space and ground: instruments and data acquisition, inversion algorithms, data analysis, and geophysical interpretation of the data. She has been very active in satellite validation using NDACC data. She is PI of the FTIR experiment at Ile de La Réunion. She is scientific coordinator in the ESA GECA project and she is member of the GEOMS development team, and is therefore well prepared to interface with GECA in NORS WP8 and WP9 and to consult on the data formatting issues in NORS WP3 and WP4. She was coordinator of the former EU COSE project, and leader of the Activity 'Stratospheric Ozone and Climate' in GEOmon and member of the GEOmon Executive Board. She is an NDACC Steering Committee member, being co-chair of its Infrared Working Group (IRWG).
Dr. M. Van Roozendael is senior scientist at BIRA-IASB and leader of the 'UV-Visible Atmospheric observations and related laboratory experiments' group. His main activities are (1) to develop ground-based MAXDOAS instruments and associated retrieval schemes, (2) to perform long-term monitoring at NDACC stations, and (3) to design scientific trace gas retrieval algorithms for UV-Vis sensors like GOME, SCIAMACHY and GOME-2. M. Van Roozendael is co-chair of the UV-Visible working group of the NDACC, and member of the science advisory groups of the GOME, SCIAMACHY, OMI and Sentinel 5 Precursor. Within NORS, he will be responsible for DOAS and MAXDOAS observations by BIRA, including data characterisation and exploitation tasks.
Dr. J.C. Lambert leads the Synergistic Data Exploitation group at BIRA-IASB, where he has developed specific expertise in satellite validation, model evaluation and integrated use of network data. He is involved in FP7 MACC and PASODOBLE quality management activities, in the establishment of the GEO Quality Assurance framework for Earth Observation (QA4EO), in the validation of ESA and EUMETSAT satellites, and in INSPIRE developments. He is a member of the International Ozone Commission, Vice-chair of CEOS WGCV Atmospheric Composition SG, Co-chair of the NDACC Satellite WG, member of the SCIAMACHY Science Advisory Group and Co-chair of its validation subgroup SCIAVALIG, and member of other satellite validation teams.

Additional personnel to be hired:
- A PhD in Physics or Chemistry or in Applied Sciences (civil engineer) to support the FTIR team. This PhD will pursue some of the work started by Dr. G. Vanhaelewyn in GEOmon that needs to be further developed in NORS). Dr. G. Vanhaelewyn left the team in May 2011.
- A PhD in Physics or Chemistry or in Applied Sciences (civil engineer) to support the DOAS team.

Partner 2: Eidgenoessische Materialpruefungs- und Forschungsanstalt / EMPA

Eidgenoessische Materialpruefungs- und Forschungsanstalt (EMPA) is a research institute with about 900 employees in the domain of the Swiss Federal Institute of Technology Zurich (ETHZ).

The Laboratory for Air Polution & Environmental Technology at Empa has continuously demonstrated its leading position in ground-based in-situ measurements of air pollutants within Europe but also achieved comprehensive expertise in atmospheric modelling (being a core member of the Centre for Climate System Modelling C2SM at ETHZ) and satellite retrieval methodologies (contributions to TEMIS, PROMOTE, Accent Troposat with a particular focus on NO_2). Comparisons between satellite retrieved tropospheric columns of NO2 and ground-based in-situ observations were carried out at Empa as part of ESA DUP POLPO (Schaub et al. 2006) and comparisons for CO2 and CH4 are now executed within the ESA CCI-GHG project.

The expertise in long-term atmospheric measurements and quality assurance draws on the operation of the Swiss Air Quality Monitoring Network NABEL and the outstanding role of Empa within the Global Atmosphere Watch (GAW) programme of WMO. Empa hosts one of GAW's four Quality Assurance/Scientific Activity Centres (QA/SAC) and operates the GAW World Calibration Centre (WCC) for ozone, carbon monoxide, methane and carbon dioxide. Empa is thus responsible for quality assurance of the continuous in-situ ozone, carbon monoxide, methane measurements and carbon dioxide performed at "global" GAW sites. Within the NABEL network Empa monitors amongst others ozone, nitrogen oxides, carbon monoxide, and methane concentrations throughout Switzerland and at the high-altitude site Jungfraujoch.

Analyses of site representativeness have been carried out at Empa since several years applying Lagrangian Particle Dispersion Models (LPDM) in backward mode to establish source-receptor relationships. Such studies were used to describe the area influencing measurements at Jungfraujoch (Folini et al. 2008) but also to inter-compare sites in the European domain (Folini et al. 2009). Different surface station categories based on parameters describing representativeness were developed within the FP6 project GEOmon (Henne et al., 2010).

The work within NORS will be carried out by the following members of the team; no additional personnel will be hired.

Dr. Brigitte Buchmann is head of the Laboratory Air Pollution/Environmental Technology at EMPA. Her research is focussing on air pollution, emission estimation and climate change. She has long term experience in measurements of air pollutants, established the world calibration centre (WCC-Empa) for ozone, carbon monoxide, methane and carbon dioxide of GAW/WMOs and is member of the Science Advisory Group (SAG/WMO) for reactive gases. She is Swiss ESA delegate in the Data, Operations, Scientific and Technical Advisory Group (DOSTAG) of the EO-Programme. She has been involved in several EC and ESA and is author and co-author of more than 50 peer-reviewed papers.

Dr. Stephan Henne: Dr. Stephan Henne is a senior scientist in the laboratory Air Pollution/Environmental Technology at EMPA. His research is mainly focused on atmospheric transport modelling and gas phase chemistry simulations with the aim to improve understanding of atmospheric processing and deduce anthropogenic emissions. Within that scope he is responsible for the development and application of Lagrangian particle dispersion models. Applying such models Stephan Henne developed a new approach for the characterisation of surface observations of atmospheric composition and the analysis of site representativeness within the framework of the FP6 project GEOmon. He is an author and co-author of over 20 peer-reviewed publications and was awarded the "Silbermedaille" of the ETH Zürich for his out-standing PhD thesis on atmospheric transport in complex terrain.

Dr. Martin Steinbacher studied meteorology and holds a PhD from the Swiss Federal Institute of Technology (ETH) in Zurich. He is in charge of the continuous in-situ trace gas measurements at Jungfraujoch within the Swiss National Air Pollution Monitoring Network. In addition, he is member

of the WMO/GAW Quality Assurance / Science Activity Center (QA/SAC) Switzerland. He led the work package ‘Calibration and quality control’ of the EU FP6 project ‘EUROHYDROS’ and is author and co-author of more than 30 peer-reviewed publications.

Partner 3: Instituto Nacional de Tecnica Aeroespacial / INTA

INTA (Spanish acronym for National Institute for Aerospace Technology) is a public institution, specialized in aeronautic and aerospace research and development. The institute develops R+D (through National and EC programmes) and commercial activities such as testing, experimentation, certifying and technical assessment to Administration Authorities and to those of National Industry in the Aerospace field. INTA has a total staff of about 1400, more than 1000 dedicated to R&D activities, testing and certification.

Under the Earth Observation, Remote Sensing and Atmosphere Department, the duties of the Atmospheric branch (AIIA) is devoted to the physic-chemistry experimental research and monitoring activities carried-out at INTA in the field of the terrestrial atmosphere. Both commercial and home made hi-tech multi-platform instrumentation is used for this purpose (including satellite, balloon-borne, aircraft and ground-based). Stratospheric ozone, Aerosols monitoring, Air quality and UV radiation, and its impact on nature are main fields of interest.

AIIA/INTA started DOAS activities in 1988 by measuring NO_2 and O_3 in Antarctica during the "ozone hole" season. In 1993 settled the first long-term monitoring station at Izaña Observatory (AEMET) for zenith sky DOAS measurements which is still in operation. Additional routine monitoring stations are running in Argentina and Antarctica (Marambio 64ºS, and Belgrano, 78ºS). Since 2009 the instrumentation has been improved towards MAXDOAS spectroscopy, attending to NDACC intercomparison for tropospheric NO_2 at Cabauw (CINDI campaign). At the beginning of 2011 measurements of stratospheric NO_2, O_3, OClO (Antarctica) and BrO and tropospheric NO_2, O_3 IO, BrO, CHOCHO and HCHO will be performed in Belgrano (Antarctica 78ºS) in addition to Izaña (28ºN)

INTA Personnel

Manuel Gil-Ojeda, PhD in Atmospheric Physics, has over 30 years of experience in applied research in Atmospheric Physics and since 1993 he is heading the Atmospheric Research Branch at INTA (Instituto Nacional de Técnica Aeroespacial). During this time M. Gil-Ojeda has participated in National and European funded projects and contributed in more than 70 peer reviewed papers in his field of research. Main activity has been related to stratospheric composition and processes and ozone-related chemistry based on differential optical absorption spectroscopy (DOAS). He is the PI of the NDACC DOAS instrumentation at Izaña station and will contribute to WP3000 (all tasks) and WP5000 (T5010-5022).

Margarita Yela-González, PhD in Atmospheric Physics, was research scientist for 1992-2008 and tenured research scientist since 2008 at the Atmospheric Research Branch at INTA. She's 17 years of experience in atmospheric physics. Her expertise covers the study of stratospheric composition and processes related to ozone chemistry using DOAS spectrometry (technical development, operation, data retrieval and analysis) and ozone balloon borne sondes. Since 1995 she coordinates the INTA stratospheric monitoring program in Antarctica. Since 1992, she has been involved in many national and international projects and has contributed to more than 30 publications in the peer reviewed literature. She will contribute to the WP5000 (stratospheric NO2 trends and reevaluation, if required) WP7000 implementing NORS procedures in Belgrano (Antarctica) DOAS.

Olga Puentedura-Rodriguez. PhD in Atmospheric Chemistry, has more than fifteen years of experience in UV-visible absorption spectroscopy. Since 1992 is involved in the field work of ground-based DOAS instrumentation and in the development and operation of new DOAS and MAXDOAS instrumentation. During her PhD thesis she took part in the

development of a visible spectrometer for the observation of stratospheric BrO, currently settled in Izaña station. Since 2001 she's responsible for the collection and evaluation data of this instrument for BrO, IO and HCHO. She will contribute to WP3000 (HCHO) and WP5000

Mónica Navarro-Comas. Master in Atmospheric Physics has more than ten years of research in UV-visible atmospheric remote sensing from ground-based instruments. Experience in developing analysis software for the processing of ground based DOAS measurements. She's also involved in the analysis, interpretation, formatting and archiving of data in geophysical databases. In NORS she will be in charge of format and file management issues (WP2000 and WP6000) and will contribute to the satellite ground-based comparison (WP3400)

Laura Gómez-Martín. PhD in Molecular spectroscopy. She has about 8 years of experience in experimental and theoretical spectroscopy of molecules of astrophysical and atmospheric interest, working in several laboratories in France and Spain (CISC, UTINAM, PALMS, LISA, LADIR). This work has led to 17 papers and 23 contributions to national and international conferences. Her current work at INTA is vertical profiling of atmospheric gases from MAXDOAS measurements. She will contribute to T7.1 and T7.2.

It is planned to hire a person with background in Atmospheric Sciences during the 2nd and 3rd years of NORS to assist the team in part of the work to be carried out, in particular regarding the WP4 (Advanced characterization of NORS data products) in the following tasks:

+ Write code for format conversion whenever required.
+ Compilation of published works on NDACC – satellite instrument comparisons.
+ Contribution to the production of a report on consistency of satellite observations used for assimilation and NORS validation data.

Partner 4: Universitaet Bern / UBern

Structure of IAP-Bern:
The Institute of Applied Physics (IAP, http://www.iap.unibe.ch) is a member of the Faculty of Natural Sciences at the University of Bern, Switzerland. It participates in the teaching activities of the Faculty and conducts research in the field of electromagnetic radiation from microwave to X-rays and the investigation of interaction mechanisms of radiation with matter. The methodologies range from the generation of intensive monochromatic light to very sensitive methods for the detection of submillimeter waves and to photon counting. Scientists working in this field of research are supported by technical and administrative staff leading to a total of approx. 70 persons working at the IAP. The research projects are manifold and range from environmental studies to applications of laser light in medicine or information technology. Research is mostly carried out in cooperation with other national and international institutes as well as with partners from industry.

Remote Sensing of the Environment:
Since many years the department of microwave physics at the Institute of Applied Physics, University of Bern, has been active in the field of remote sensing of the environment. Radiometers at microwave frequencies and up to the sub-mm region have been developed and successfully operated from the ground, from aircraft and from space in order to determine the altitude distribution of constituents like water vapour, ozone, chlorine monoxide and others. Research in the field of water vapour and ozone in the middle atmosphere has become a key research topic at the IAP in recent years. During the last years we were successful in designing, optimizing and operating instruments for the measurement of water vapour. The IAP is a member of the Oeschger Centre for Climate Change Research.

Active Participation in Observation Networks and Data Centers:
The radiometers of IAP are primary instruments of the Network for the Detection of Atmospheric Composition Change (NDACC). We are also part of the COST activity Water Vapour in the Climate System (N. Kämpfer is leader of working group 1), Global Earth Observation and Monitoring (GEOMON) of EU, and Global Atmosphere Watch (GAW) of WMO. Recently a water vapour observatory was constructed by IAP in Zimmerwald (south to Bern).

Scientists:

Prof. Dr. Niklaus Kämpfer is Head of the Microwave Department of the Institute of Applied Physics at the University of Bern. His research interests are microwave remote sensing of the atmosphere and optics in the millimeter and submillimeter range. He is co-chair of the NDACC Microwave Working Group.

Dr. Klemens Hocke is assistant at the Institute of Applied Physics of the University of Bern. His research interests are remote sensing, data analysis and study of atmospheric coupling processes.

Partner 5 : Karlsruher Institut fuer Technologie / KIT

Karlsruhe Institute of Technology (KIT) is a higher education and research organisation with about 8000 employees and 18,500 students. KIT was established on 01/10/2009 as merger of University Karlsruhe and the Forschungszentrum Karlsruhe, a member of the Helmholtz Association. The Institute for Meteorology and Climate Research, Atmospheric Trace Gases and Remote Sensing (IMK-ASF) has its focus on the free troposphere and middle atmosphere. Primarily remote sensing instruments (ground-based, airborne, balloon-borne, and satellite-based) are deployed to study the budgets of various atmospheric trace gases. The ground-based remote sensing group at IMK-ASF operates four spectrometers within the framework of the NDACC (Network for Detection of Atmospheric Composition Change) and TCCON (Total Carbon Column Observing Network): Kiruna (Sweden, since 1996), Izanha Observatory, Tenerife Island (Spain, since 1999), Addis Ababa (Ethiopia) and Karlsruhe (Germany; both since 2009). The retrieval software PROFFIT (PROFile FIT) to derive profiles from ground-based spectra has been developed at the IMK-ASF. The accurate knowledge of the instrumental line shape (ILS) is essential for good profile retrieval. Therefore, the ILS is determined routinely by low pressure gas cell measurements analyzed with the LINEFIT software. The LINEFIT software has been developed at the IMK-ASF, and the NDACC-FTIR and TCCON community has been provided with this software.

The work in NORS will be provided by the Large-scale Research Sector of KIT which is an integral part of Karlsruher Institut fuer Technologie and which has an analytical accounting system allowing it to identify its actual indirect costs. Therefore, and notwithstanding the provisions of article II.15.3, Large-scale Research Sector may declare indirect costs in FP7 grant agreements based on its actual indirect costs, despite the fact that the Karlsruher Institut fuer Technologie has opted for a flat rate. Therefore KIT is a Special Clause 30 partner in the NORS consortium.

Short biography of senior scientists who will be working on NORS:

Dr. Frank Hase is an expert in technical aspects of FTS, in the characterization of the instrumental line shape of FTIR spectrometers and in the retrieval of atmospheric information from FTIR spectra. He developed and maintains the LINEFIT software, which is in wide use by both atmospheric and lab spectroscopists to achieve a proper characterization of their spectrometers. He developed and maintains the PROFFIT retrieval software and has participated in several international projects like UFTIR, SCOUT-O3, HYMN und GEOmon.

Dr. Thomas Blumenstock is leader of the group 'Ground-based FTIR measurements' at IMK-ASF Karlsruhe since 1999. He has more than 20 years of experience in ground-based FTIR spectroscopy, in operating high-resolution FTIR instruments as well as in retrieving atmospheric parameters and their interpretation. He is PI of the FTIR sites Kiruna and Izana. His special interests are trends and variability of atmospheric trace gases. He has participated in several international campaigns and projects like CHEOPS-III, EASOE, ESMOS, SESAME, THESEO, VINTERSOL, ILAS, UFTIR, SCOUT-O3, HYMN, GEOmon and ENVISAT validation experiments.

It is not known yet whether additional personnel will be hired. In any case, additional personnel will have the required competences to perform the work planned in NORS.

Partner 6 : Centre National de La Recherche Scientifique / CNRS

The National Center for Scientific Research (CNRS) is the main multi-disciplinary Institution for fundamental research in France. CNRS contribution to NORS involves two laboratories:

The Laboratoire Atmosphère, Milieux, Observations Spatiales (LATMOS) is a joint research laboratory of CNRS, Université of Versailles Saint-Quentin-en-Yvelines (UVSQ) and Université Pierre et Marie Curie (UPMC). It was founded in 2009 by merging two laboratories including the former Service d'Aéronomie, which had a long recognized experience in atmospheric observations, modelisation as well as in data assimilation. LATMOS is one amongst the leading institutions worldwide in the field of lidar and UV-Visible spectrometer observations. It is a co-investigator of the ENVISAT GOMOS instrument and of the CALIPSO satellite. LATMOS is strongly involved within NDACC in which it contributes with the Haute-Provence Observatory (OHP) and Dumont d'Urville (Antarctica) stations as well as with the DOAS (SAOZ) network of UV-Visible spectrometers, comprising 11 stations located from 70°N to 75°S.

For the NORS project, CNRS will use personnel and infrastructure of Laboratory of Atmosphere and Cyclones (LACy). LACy runs the Reunion station in the Southern Indian ocean and is a joint research laboratory of Reunion Island University, CNRS and MétéoFrance, with research themes on stratospheric and tropospheric chemical and dynamical processes including the study of the influence of biomass burning emission on aerosol and trace gases levels over the Indian Ocean. Atmospheric measurements at La Réunion Island are performed within the newly founded Observatory of Physics of the Atmosphere of Reunion (OPAR), which will perform long term atmospheric observations.

Dr. Sophie Godin-Beekmann (LATMOS) is a CNRS personnel. She has been working in Atmospheric Chemistry at CNRS since 1989. Her expertise covers the use of ground-based and airborne lidar systems for the study of stratospheric ozone and aerosols and the use of chemistry transport models for the the study of polar ozone loss. She has contributed to more than 80 publications in the peer-reviewed literature, has coordinated one and has been PI of 15 EU-funded projects (most recent GEOmon where she was leader of the outreach activity and member of the executive board). She contributed as lead-author and co-author to various international assessments, including the most recent WO/UNEP assessment on stratospheric ozone to appear in 2011. She is also a member of the NDSC/NDACC steering committee as co-chair of the lidar working group, the Scientific Advisory Group on ozone for WMO and she is currently secretary of the International Ozone Commission.
For the NORS project, she will be responsible of the CNRS contribution and she will be the leader of WP6.
Dr. Andrea Pazmiño is a UVSQ personnel. She has 9 years experience in atmospheric chemistry. Since September 2009, she is responsible for the DOAS (UV-Visible spectrometer) French Network (SAOZ), part of NDACC. The research activities of A. Pazmiño concern the evolution of the stratosphere as a result of human activities and its link to climate change. Her expertise includes the measurement of ozone by lidar instrument and by passive instruments as the DOAS spectrometer and UV biometers. She has also experience in intercomparisons of ozone profiles (sondes and lidars) and total ozone (DOAS (SAOZ) and Dobson) with satellite measurements. She has contributed to 16 publications in the peer-reviewed literature.
For the NORS project, she will be responsible for the provision and assessment of the DOAS UV-Visible measurements.

A PostDoctoral fellow will be hired for the NORS project. The fellow will be in charge of the contribution of CNRS to NORS mainly related to WP4 (characterization of UV-Visible and lidar products) and WP6 (integration of ozone data products for the provision of vertical ozone profile time series).

Partner 7: Universitaet Bremen / UBremen

The Institute of Environmental Physics (IUP) at the University of Bremen (UB) is amongst the leading European research institutions in the field of ground- and space-borne remote sensing of the atmosphere. The IUP has leading expertise in the Global Ozone Monitoring Experiment GOME (since 1995 on ERS-2) and SCIAMACHY (since 2002 on Envisat) satellite project and is one of the drivers behind the GeoSCIA/GeoTROPE initiative. Parallel to the satellite studies, an important number of ground-based and air-borne remote-sensing experiments are carried out by IUP scientists, using microwave, infrared and UV-visible spectroscopic techniques. The IUP team is strongly involved in the analysis of GOME, SCIAMACHY, and GOME-2 data. For example, within the EU THESEO/GODIVA/QUILT projects the IUP team provided an ozone profile product and trace gas column product service in near-real time. Major focus of IUP research has been the development of various scientific algorithms for the retrieval of tropospheric and stratospheric data products from the spectral measurements provided by GOME and SCIAMACHY (Burrows et al., 1999; Bovensmann et al., 1999). The IUP team has been involved in a many EU projects SESAME, SCUVS, PRICE, PRIME, BROMINE, GODIVA, QUILT, EVERGREEN, ACCENT, GEOMON, CITYZEN, GEMS, MACC) as well as in ESA studies. As a result of numerous successful international collaborations the IUP team is well experienced in working within large international research projects.

Dr. Andreas Richter graduated in 1991 in Physics from the Ludwig-Maximilians Universität München. He then moved to the University of Bremen where he completed his doctoral thesis on absorption spectroscopy of stratospheric trace gases in 1997. Since then he is the leader of the DOAS group at the Institute of Environmental Physics, University of Bremen. Andreas Richter has been working on remote sensing of atmospheric composition using UV/visible radiation from the ground and from space for more than 15 years. He was involved in many EU projects including SCUVS, THALOZ, RETRO, FORMAT, COSE, QUILT, GEOMON, GEMS, and MACC, and has more than 100 peer reviewed publications on atmospheric physics and chemistry.

Prof. Dr. Justus Notholt started to work on atmospheric science as a postdoctoral fellow at the Joint Research Centre of the EC, Environment Institute, Ispra (Italy). In 1990 he moved to the Alfred-Wegener-Institute for Polar and Marine Research, where he began atmospheric trace gas measurements using the FTIR-spectrometry. Since 2002 he is professor at the University of Bremen, where he works on atmospheric remote sensing. He participated in several national and international projects, like the EC projects EASOE, COSE, UFTIR, HYMN, GEOMON, IMECC or the national projects of the DFG, the HGF or the BMBF.

Dr. Thorsten Warneke graduated in physics from the University of Heidelberg in 1998 and received his PhD degree in terrestrial environmental physics at the Southampton Oceanography Centre (UK) in 2002. In August 2002 he joined the Institute of Environmental Physics at the University of Bremen and is the leader of the FTIR-group since 2005. His main interests are remote sensing and in situ measurements of greenhouse gases using FTIR spectrometry. He has participated in diverse national and international research projects involving FTIR spectroscopy (e.g. HYMN, GEMON, IMECC).

For the NORS project, two PhD students will be hired; one working on the FTIR related parts of the work, the other one on the UV/visible instruments and data. For both positions, candidates with a strong background in Physics and or Mathematics will be needed.
All persons listed here above are working for the University of Bremen

An optical engineer will be employed by the subcontractor AWI to provide the measurements and rapid data delivery at the Atmospheric observatory of the French-German Arctic research base AWIPEV in Ny-Alesund. The tasks of the engineer will be the execution of the long-time measurements with spectrometers, multi wavelengths lidar, and microwave radiometers. In

addition he will ensure the rapid on site data preprocessing and delivery. The engineer will have experience with optical and electronic scientific instrumentations, as well as data preprocessing.

Partner 8: Université de Liège / ULg

The GIRPAS group of the University of Liège (ULg) has been involved in atmospheric research activities since the mid-1970s, using state-of-the-art instrumentation to monitor the Earth atmosphere from the ground and from stratospheric balloon- and space-based platforms. In particular and within this framework, the group has built, installed and operated on a regular basis high-resolution infrared instruments at the Jungfraujoch station (46.5ºN, 3580m asl). This has resulted in gaining instrumentation expertise and in the gathering of a unique observational database now spanning 35 years.
In 1989, the GIRPAS became affiliated to the Network for the Detection of Stratospheric Change (NDSC), now renamed Network for the Detection of Atmospheric Composition Change (NDACC). Since then, two FTIRs have been operated intensively at the Jungfraujoch to record solar absorption spectra under clear sky conditions, with on average 120 days of observations per year over 1996-2009. Consistent and optimized spectrometric analysis of these observations with NDACC-recommended algorithms has allowed to generate multi-decadal time series for about two-dozen atmospheric species (among which the NORS products CO, CH_4, O_3, NO_2 and HCHO), vital for long-term trend studies and for the validation of space-based sensors.
The group has supported atmosphere-dedicated European campaigns (EASOE, SESAME, and THESEO); it has also contributed to the data validation of several space missions (e.g. ATMOS, HALOE, MAPS, MOPITT), and is currently involved in the ENVISAT, ACE and IASI validation efforts. These various and complementary activities have essentially been carried out within the frame of national and EU projects (the GIRPAS has been active partner of four EU projects over the last five years).
This experience is very relevant to the tasks to which ULg will contribute within NORS. ULg will perform rapid delivery of FTIR high-level products to the NORS server (WP3), contribute to a careful and thorough characterization of the NORS data and compare them to satellite products (WP4), contribute to the delivery of consistent data for past observations (from 2003 onwards, WP7) and participate to the development and the exploitation of the NORS validation service (WP8, lead of WP9).

Two members of the team will directly contribute to NORS:

Dr. Emmanuel Mahieu has been with GIRPAS since 1991. His expertise is in IR remote sensing data analysis of space- and ground-based high-resolution observations. He is further involved in data interpretation, intercomparison and validation as well as in the archiving of the geophysical databases derived from the Jungfraujoch FTIR observations. He is member of the ACE (Atmospheric Chemistry Experiment, onboard the Canadian Scisat-1 platform) science team and has coordinated the validation of several version 1 and version 2.2 products. He is also *ex officio* member of the NDACC steering committee. He has taken part to numerous EU and national research projects since 1992. Together with Philippe Demoulin, also with GIRPAS, he is the PI of the Jungfraujoch NDACC-affiliated FTIRs.
Bernard Lejeune got his master in geography at the University of Liège in 2006. He joined the GIRPAS in early 2009 and is essentially involved in data retrieval and interpretation, using the SFIT-2 and PROFFIT algorithms. He is also participating to data acquisition at the Jungfraujoch station.

In addition, the GIRPAS team plans to hire additional personnel which will partly be funded by the NORS project, essentially to contribute to the characterisation of the products and to the data reanalyses. We will likely look for a scientist with a master degree in e.g. chemistry, physics.

Other members of the staff (including technicians) will further support software developments and implementation of the fast delivery procedure (from the spectrum to the archive), contribute to the maintenance and constant improvement of the Jungfraujoch instrumentation and, last but not least, to the essential step of collecting supplemental FTIR observations to extend our database, remotely or on site.

Partner 9: Max Planck Gesellschaft zur Foerderung der Wissenschaften / MPIC

Expertise and experience of the organization

The Max Planck Institute for Chemistry was established in Mainz in 1949, and focuses on the chemistry of the atmosphere, particle chemistry, biogeochemistry, remote sensing for Earth systems sciences, and chemistry of the geosphere. Prof. Thomas Wagner leads the satellite remote sensing group at MPI which was established in 2006.

Role and contribution

The satellite group at MPIC has large experience in the operation and analysis of UV/visible remote sensing measurements from ground or satellite platforms. One main focus is the development of spectral retrieval algorithms, the second focus is on the interpretation of the retrieved results using atmospheric radiative transfer modelling. MPIC will contribute to WP4 and 10. In WP4 the main contribution will be on radiative transfer modelling using the 3D radiative transfer model TRACY-II. In WP10 we will support the export of expertise acquired in the project to Chinese partners who performs MAX-DOAS measurements in Beijing.

Principal personnel involved

Prof. Thomas Wagner led the satellite remote sensing group in the Institute for Environmental Physics at the University of Heidelberg until 2006, when he came to the MPIC to lead the newly formed satellite remote sensing group there. He has many years of experience in developing new retrieval algorithms for IR/Vis/UV satellite instruments, especially GOME and SCIAMACHY, and is the author of numerous papers applying these data to understand current issues in tropospheric pollution, such as the outflow from major urban regions, and trends in pollution levels.

Dr. Steffen Beirle did his PhD, and worked as Post Doc afterwards, in the satellite remote sensing group led by Prof. Wagner. He works on trace gas retrievals from UV-vis satellite instruments, as well as on the application and interpretation of these data sets with respect to current topics of atmospheric science, resulting in several peer-reviewed publications. Within a (closed) research project funded by the DFG (German Research Foundation), he particularly focussed on the production of nitrogen oxides by lightning. Recent work focussed on the development of a profile inversion algorithm from ground-based MAX-DOAS measurements.

Partner 10: Ruprecht-Karls-Universitaet Heidelberg / UH

The atmospheric group of the Institute for Environmental Physics at the University of Heidelberg has more than 20 years of experience in tropospheric chemistry of free radicals, spectroscopic measurements of atmospheric constituents, in particular of halogen oxides, and other free radicals. The group is one of the inventors of the DOAS technique and is continuously developing improved algorithms and new applications for ground-based, airborne and satellite borne measurements of atmospheric trace gases. Further topics include the chemistry of oxidised nitrogen species in the atmosphere (NO_X, NO_3, HONO etc.) and radiation transport in the atmosphere, the role of clouds in the radiation and energy balance of the atmosphere, the investigation of stratospheric ozone loss and trace gas cycles including halogen radicals, and the study of tropospheric and stratospheric trace gas distributions from satellite sensors. During the last few years, an important activity has been to develop instruments for the measurement of the vertical distribution of tropospheric trace gases and aerosols based on Multi-Axis Differential Optical Absorption Spectroscopy.

Contributing senior scientists

Prof. Dr. Ulrich Platt: Ph.D. in physics from the University of Heidelberg in 1977, habilitation in Geophysics at the University of Cologne in 1984, since 1989 full professor of experimental physics at the University of Heidelberg (dean of the faculty of Physics of the University of Heidelberg in 1995/96). Since 1989 he has been director at the Institute for Environmental Physics, University of Heidelberg. He has more than 25 years of experience in the field of transformation-, transport-, and mixing processes in our environment, in particular in the atmosphere. He is member of the SOLAS and IGAC Scientific Steering Committees, and of the GOME (Global Ozone Monitoring Experiment on the ESA satellite ERS-2) and SCIAMACY (SCanning Imaging Absorption spectroMeter for Atmospheric CHartographY on ESA satellite ENVISAT) science advisory committees.

Dr. Udo Frieß has been working in the field of spectroscopic measurements of atmospheric trace gases since 1996. The main focus of his research activities is the chemistry and dynamics of the atmosphere, with emphasis on halogen radicals (BrO and IO) and related compounds (NO2, OClO and ozone) in the polar troposphere and stratosphere. As a postdoctoral research assistant, Dr. Frieß is responsible for the ground-based DOAS network of the IUP Heidelberg, consisting of instruments based in the Arctic (Kiruna/Sweden), mid-latitudes (Hohenpeißenberg/Germany) the Tropics (Paramaribo/Suriname and Cape Verde), and Antarctica (Neumayer Station and Arrival Heights). He was involved in the development of various ground-based and ship-borne MAX-DOAS instruments. Udo Frieß has developed advanced numerical algorithms for the retrieval of trace gas and aerosol vertical profiles from MAX-DOAS. He has been involved in numerous national and international field campaigns and projects, such as QUILT, SCIAVAL, SOLAS, SOPRAN, EVERGREEN, EUSAAR, GEOMON, HALOPROC, and OASIS IPY.

Partner 11: Science and Technology B.V. / S&T

Science & Technology BV (S&T) is a private company and SME, based in Delft, conducting high-tech software projects and consultancy. S&T has a history and proven track record of successfully participating in many complex software projects (both production and research, both proprietary and open source) for clients such as the European Space Agency (ESA), NATO, major European Space industries, and scientific research institutes (TNO, Astron). Other clients S&T has worked for include the Dutch Army, ASML, Shell, KNMI, and IBM. One of the core lines of business of S&T is to develop scientific and technical software in a variety of domains. These systems often require extreme performance, accuracy and may involve huge datasets. Typical applications are scientific data analysis and (3D) visualisation, quality monitoring and reporting (e.g. for satellite mission data), and (ubiquitous) sensor networks. One of the projects that S&T worked on as a subcontractor is the Generic Cal/Val Analysis Environment (GECA). Within this project S&T developed an open-source inter-comparison and reporting toolkit to support cal/val analysis, collocation, and inter-comparison of satellite data vs. correlative data. Within NORS, S&T wants to achieve two goals: first to extend/adapt this toolkit to make it suitable for an operational validation chain, and secondly to gain experience with building an operational web-based service, which in this case will be a service around the cal/val toolset.

Sander.V.Niemeijer is Project Manager at S&T, The Netherlands. He has performed project management, lead architect, and consultancy roles in several ESA earth observation projects related to end user toolboxes (BEAT, BRAT, GUT) and data quality control (GECA, ACMF, QCC, SWARM_CVQ, IDEAS). Within GECA he has also contributed to the evolution of the correlative meta-data standard, GEOMS, which is applicable to NORS.

B2.3. Consortium as a whole

The NORS consortium gathers leading experts in all areas needed to fulfill the objectives of the project. This includes experts in remote-sensing and in-situ measuring techniques, as well as experts in operational computing software having demonstrated experience with atmospheric chemistry data handling. The NORS data products are derived from observations with NDACC instruments at different sites managed by the partners, which means that NORS participants have an in depth knowledge of the activities of the NDACC and they are familiar with other connected international networks such as TCCON, GAW, EMEP, etc. Two partners also have direct or indirect involvement in the development of the GMES Atmospheric Service that is currently taking place in FP7 projects such as MACC and PASODOBLE, which will facilitate the necessary links to GMES activities. The other partners are not yet involved in GAS.

Expertise in remote-sensing techniques
NORS data products are derived from remote-sensing observations performed using the well-established techniques of FTIR, Microwave, Lidar and UV-Visible DOAS spectroscopy. Focusing on measurements at 4 comprehensively equipped pilot stations of the NDACC in Europe and the southern tropics, the project gathers the main leading European experts affiliated to NDACC. As can be seen in Table 2.3.1, NORS participants bring complementary expertise in all relevant measurement techniques, including in-situ surface measurements that will be used in the project to investigate the connection between NDACC remote-sensing observations and standard surface monitoring network data sets. With this team, leading experts in each technique will be present to ensure successful completion of all key research and development tasks planned in WPs 4, 5 and 6. Note that the relatively strong emphasis on FTIR and UV-Visible DOAS techniques in Table 2.3.1 is in line with the user-driven emphasis on trace gases measurable by these techniques.

Table 2.3.1 Expertise in measurement techniques available from each NORS participant.

#	Participant	Measurement technique expertise				
		FTIR	**UV-Vis**	**MW**	**Lidar**	**In-situ**
1	BIRA-IASB	**x**	**x**			
2	EMPA					**x**
3	INTA		**x**			
4	UBern			**X**		
5	KIT	**x**				
6	CNRS		**x**		**x**	
7	UBremen	**x**	**x**	**X**		
8	ULg	**x**				
9	MPIC		**x**			
10	UH		**x**			

Involvement in NDACC and related international ground-based networks
All NORS participants except EMPA, MPIC and S&T are actively involved in the NDACC, being responsible for data provision at one or several sites of the network. Co-chairs of the UV-Visible, FTIR and Satellite working groups of the NDACC are at BIRA-IASB, while the co-chairs of the Lidar and Microwave working groups are respectively at CNRS and UBern. All of these key NDACC scientists are directly involved in NORS. Moreover 3 FTIR partners also participate to the FTIR-connected TCCON network. Although not involved in NDACC, EMPA operates the Swiss Air Quality Monitoring Network NABEL and has an outstanding role within the Global Atmosphere Watch (GAW) programme of WMO. It also hosts one of GAW's four Quality Assurance/Scientific Activity Centres (QA/SAC) and operates the GAW World Calibration Centre (WCC) for ozone, carbon monoxide, methane and carbon dioxide.

All NORS participants have long-standing experience with monitoring activities and data delivery to international data bases, which is a prerequisite for successful achievement of data delivery tasks in WP3 and WP7. Also, the record of past achievements from NORS partners on validation activities performed in precursor projects such as COSE and GEOMON will be fully used to the benefit of WP4, WP8 and WP9.

Links to and involvement in the GMES Atmospheric Service
BIRA-IASB and UBremen are participants in the FP7 MACC and PASODOBLE projects, which respectively constitute the precursor projects of the GMES Atmospheric Core and Downstream Services. In the MACC-II project, UBremen and BIRA-IASB are involved in the VAL sub-project which deals with validation of the GMES Atmospheric data products, although with a very limited contribution.
Additionally, BIRA-IASB is involved in the management WP of MACC called 'System Engineering for the GAS'. BIRA-IASB is also involved in the PASODOBLE core management team and coordinates its CC-QUALITY WP. As a consequence, the necessary pre-existing links are established with GAS activities and coordinating structures. This will ensure the smooth integration of NORS activities within GMES in compliance with the specific requirements for the operational validation of GAS data products.

Expertise with Cal/val data base and the establishment of standards for correlative data reporting
BIRA-IASB and S&T have actively participated to recent projects aiming at the definition of standards for data reporting and operational calibration/validation systems, in particular within the ENVISAT Cal/Val framework and more recently as part of the ESA Generic Environment for Calibration/Validation Analysis (GECA) project and the evolution of the Generic Earth Observation Metadata Standards (GEOMS). The GECA system will provide a server for consistent validation of European satellite sensors using ground-based data and will be extended in this project to validation of GAS products. The GEOMS standard will be implemented and verified for its adequateness for the NORS purposes. Such developments are essential to enable efficient, reliable and fast quality control of GMES atmospheric chemistry data products. Our past expertise will thus be fully exploited to the benefit of WP3, WP4, WP7, and WP8 and WP9, respectively concerned with the rapid delivery of data, the definition of the metadata needed to characterise the data, the delivery of long-term reprocessed data sets, and the validation server for GAS.

SME role
The transition from standard science-driven NDACC operations to GMES compliant data delivery will be strongly aided by the SME Science & Technology BV (S&T). S&T has a proven track record of successfully participation in a number of complex software projects for clients such as the European Space Agency (ESA), NATO, major European Space industries, and scientific research institutes such as TNO, Astron. Typical applications are scientific data analysis and (3D) visualisation, quality monitoring and reporting (e.g. for satellite mission data), and sensor networks. As already mentioned S&T has worked on the development of the GECA system and GEOMS which will both be used in NORS. Within GECA, S&T developed an open-source inter-comparison and reporting toolkit to support cal/val analysis, collocation, and inter-comparison of satellite data versus correlative data. Within NORS this toolkit will be expanded to make it suitable for an operational validation chain of the GAS products. S&T will also bring appropriate technical expertise for the building of an operational web-based service compliant with GAS requirements and linked to relevant GAS services. It will also provide consultancy to NORS scientific teams in relation to data format conversions and timely data stream production.

Third Parties The consortium will be reinforced by the presence of two 'Third Party' partners, of which the contributions are briefly summarized below.

AGENCIA ESTATAL DE METEOROLOGÍA (AEMET), third party making their resources available to the beneficiaries BIRA-IASB, EMPA, INTA, KIT, CNRS free of charge
The inclusion of AEMET benefits the project for following reasons:

- AEMET is co-managing the NDACC observations performed at Izana and included in the NORS project, namely the MAXDOAS observations by INTA and the FTIR observations by KIT.
- AEMET is also performing ECC ozone sondes at Izana which can be put at the disposal of the NORS project in the frame of the WP6: integration of Ozone products. It can also provide Brewer data if useful. These are also NDACC data.
- AEMET is in charge of the in-situ data of reactive gases and greenhousegases performed at Izana. The data on an hourly basis are available from public databases, but EMPA - in the context of WP5 'Integration of tropospheric products' - would need all the individual data. AEMET agrees to provide these without cost, even if this needs some additional work by them.
- AEMET can also provide meteorological data at the Izana station if useful in the frame of WP 5.
- Occasionally, they will attend some NORS meetings and share the scientific work.

AEMET, which will be included in the project as a third party making their resources available to a beneficiary free of charge, requests no EU funding for its activities.

Université de Versailles Saint-Quentin-en-Yvelines (UVSQ), Third Party Special Clause 10 partner contracted to CNRS (Third Party carrying out work)

The objective of the participation of UVSQ as a Third Party Special Clause 10 partner is to ensure the quality and delivery of NDACC/SAOZ (DOAS) data. SAOZ UV-Visible instruments are part of NDACC-France, a French Service d'Observation, depending on UVSQ. A. Pazmino, personnel of UVSQ and PI of NDACC/SAOZ network is responsible for the continuous operation of SAOZ instruments. For the NORS project, she will be responsible for the provision and characterization of SAOZ UV-Visible measurement products. A. Pazmiño will contribute to WPs 3, 4, 6, 7 and 10 (4.25 Personnel months).

Sub-contracting

Sainte-Lorette (SL) subcontractor to CNRS

- SL will assist CNRS in WP3 for the rapid delivery of DOAS ozone and NO2 columns at OHP and Reunion stations: SL will provide support to LATMOS/CNRS to build the necessary algorithms in order to automatize the rapid delivery of data.
- SL will also assist CNRS in WP4 and WP6 for the evaluation of NORS data products in comparison with satellite data and the comparison of NO2 tropospheric columns from DOAS and MAX-DOAS instruments at OHP: SL will provide support to LATMOS/CNRS to adapt and improve the comparison algorithms for these tasks.
- SL will assist CNRS in WP7 for the provision of long-term consistent time series at OHP and Reunion to be delivered to NORS and the NDACC database in GEOMS-compliant HDF format: SL will provide support for the algorithms used to analyse the long-term time series of O3, NO2 and tropospheric NO2 at OHP and Reunion, and check the consistency of the data.

Dr. F. Goutail will be responsible for the Sainte-Lorette (SL) contract to CNRS in the frame of the NORS project. Dr. F. Goutail has a strong scientific expertise on SAOZ/DOAS UV-Visible instruments. She was one of the two scientists who developed the SAOZ instrument in the late 80's and she has been PI of the SAOZ network and its monitoring activities during 20 years. As such, SL has a unique position to provide this service to CNRS.

In summary, the contribution of SL will be to facilitate the delivery of SAOZ data products to the NORS project. This support is not a core activity to the project and is in accordance and respect of the French rules: the SL contract to CNRS amounts to 15 000 EUR. In France, for contracts under 20 000 EUR there is no need for a selection process.

SL will be a sub-contractor of CNRS for all the above described minor tasks.

AWI, subcontractor to Univ. Bremen

The objective of the participation of AWI as a Third Party is to ensure rapid data delivery of NDACC measurements from the NDACC Primary site Ny-Ålesund, Spitsbergen as part of WP3.

The Alfred Wegener Institute (AWI) operates the atmospheric observatory which is specifically installed for the NDACC instruments. It provides the on-site overwintering personnel (engineer) to perform regular as well as non-scheduled additional measurements of the NDACC instruments Microwave Radiometer RAM, UV-vis-spectrometer DOAS, and the FTIR-spectrometer. The motivation for the work is pecuniary, not the research work itself: the engineer is only performing the measurements, no research. This means that the work carried out by AWI is not the core part of the project, it is just measurement work at one site, whereas the research is the analysis, which will be done by Uni Bremen. There is only one entity in Spitsbergen who can offer the required engineer work to run an FTS, and that is AWI, so there is no issue about a selection procedure. It is absolutely clear that there is no other company worldwide who can run the FTS instrument in Spitsbergen on such an irregular mode, like waiting for the sun, performing measurements when the sun is above the horizon, no clouds, ...
AWI also provides the computer network and high speed internet connection, which facilitates the online data transfer from Spitsbergen to Univ. Bremen.

AWI will be a sub-contractor of University of Bremen for all the above described measurement tasks within WP3 for a budget of 18.000EUR.

Funding for beneficiaries from “third” countries

N/A

Additional beneficiaries / Competitive calls

N/A

B2.4. Resources to be committed

All partners in the consortium will spend more than half of the total NORS budget on the direct costs of salaries of a PhD student or post-doc researcher working specifically on the NORS activities in the various workpackages in which they are involved. In some cases, part of the salary expenses will also be used to support IT personnel (e.g., for writing the automatisation scripts for the data analysis, formatting and submission in WP3).

For all partners, the remaining direct costs of the NORS budget are associated with travel and subsistence expenses associated with NORS meetings, and with participation to international symposia or workshops for presenting NORS achievements.

To avoid that the Steering Committee members could not attend the planned NORS meetings for budgetary reasons, a significant part of the RTD travel budget of the coordinator, namely 7500 EUR, has been allocated to travel and subsistence costs for the Steering Committee members.

The NORS budget partitioning among the partners has been established on the basis of each partner's contributions to the project, in particular the number of sites/instruments operated.

For several partners, permanent staff members (scientists and technical IT staff) represent a significant additional and indispensable resource for the project. Staff who supports underlying operational activities is not accounted for in the total project costs. On the contrary, the manpower related to specific tasks for NORS and provided by personnel on own resources (typically staff members) is indicated in Table 2.4.2 below. The associated personnel cost has been accounted for in the total cost of the project, but it has not been included in the budget requested from the EU. Some institutes provide additional financial means for specific NORS activities: these are included also in the total cost of the project and are indicated and explained in Table 2.4.2 and corresponding justifications here below.

The basic data acquisition and pre-processing at the stations involved will not be funded through NORS, nor will the basic infrastructure and maintenance costs at the stations involved be funded with the NORS budget. These costs will be covered by funding sources external to NORS; in most cases these funds are provided by the national authorities within long term arrangements or other projects, or by the partners' institutes themselves. Table 2.4.1 lists such additional resources complementing the NORS EU grant.

It must be stressed that the projects mentioned in the Table deal with complementary activities, not with activities proposed in NORS and as such are not defined as "receipts" as specified in Article II.17 of the ECGA.

Table 2.4.1 Complementary funding ensuring the viability of NORS

Partner ordered according to partner number	Running projects and funding sources that support operational activities which are underlying the specific NORS objectives.
BIRA-IASB	- statutory staff and basic funding of the institute (dotation) are available for supporting basic instrument maintenance, data acquisition, and pre-processing. - National projects (AGACC-II, PRODEX project A3C) and possibly the successor of the ESA Multi-TASTE project provide some complementary funding for the observations at the sites operated by BIRA in NORS.
EMPA	- operational research activities supply model-support and development - institute funding is available for providing 2 years of in-situ data sets and retrieval of the EMPA satellite product (EOMINO) for the integration/comparison study. - funding by the Swiss Federal Office of Environment (FOEN) and Empa is available for providing in-situ data sets by the Swiss Ambient Air Monitoring Programme (NABEL)
INTA	- NDACC Izana DOAS station operates since 1993 under the Agreement for Scientific Collaboration between the Spanish Weather Service (now AEMET) and INTA. The spectrometers are jointly maintained by INTA structural funding and AEMET. - Additional support is obtained through ESA projects (Multi-TASTE and its possible successor project).
UBern	- University of Bern funds the permanent operation of the microwave radiometer at Bern. - Other running projects at IAP (GAW-CH programme and Swiss National Fund projects MIMAH and DIAMO) provide complementary funding for joint publications, travels, computers, ...
KIT	- Support for for operation and maintenance of instruments is provided by o basic funding of KIT o other EU and ESA projects - Computer systems and support for data analysis is also supplied via KIT - The FTIR instrument at Izaña is jointly operated by KIT and AEMET - FTIR instrumentation for new sites such as Addis Ababa and Mexico is provided by KIT.
CNRS	- Support for operation and maintenance of the NDACC instruments and stations is provided by the NDACC-France Observing Service, which receives recurrent funding from CNRS. In addition, French NDACC stations have permanent staff from CNRS and Université de La Réunion for the operation and the maintenance of the instruments. - Complementary support is provided by the ESA EQUAL project.

Partner ordered according to partner number	Running projects and funding sources that support operational activities which are underlying the specific NORS objectives.
UBremen	- Funding from AWI and the University of Bremen secures the continuous operation of the FTIR and microwave instruments at Ny-Alesund, and the associated basic continuous processing of the data (performed and funded by University of Bremen). - Additional funding is obtained within different projects from the EU, ESA or the DFG. - The maintenance of the instrumentation requires annual visits to Ny-Álesund which are financed by the basic funding and the additional funding. - The DOAS measurements Ny-Alesund are operating automatically but are maintained by staff from AWI. Routine data analysis is also covered by University of Bremen funding as well as some additional funding for satellite validation provided by ESA and DLR.
ULg	- Permanent University staff and recurrent budgets are supporting the data acquisition, and instrument operation and maintenance at the Jungfraujoch. - Complementary funding is available via national and international agencies and programs (Belgian Science Policy projects, the GAW-CH programme 2010-2013, ESA Multi-TASTE successor project, FRS-FNRS, Communauté française de Belgique,…).
MPIC	- The operation of the MAX-DOAS instrument at Mainz is ensured by the MAX-Planck Institute for Chemistry in Mainz. - Data analysis is supported by internal funds and through complementary activities linked to ESA and EU projects.
UH	- The Institute of Environmental Physics of the University of Heidelberg funds the operation of the MAX-DOAS instruments at Hohenpeißenberg/Germany, Neumayer Station/Antarctica and Paramaribo/Suriname. - Infrastructure, site support and maintenance of the instruments is provided by the Alfred Wegener Institute for Polar and Marine Research (Neumayer Station), the German Weather Service (Hohenpeißenberg) and the Meteorological Service of Suriname (Paramaribo). - Complementary funding for the operation and maintenance of the UH remote sensing network is provided by o ENVIVAL-LIFE: BMBF (German ministry for education and research) project: Support of long-term measurements for satellite validation. o HALOPOLE II : DFG (German Research Association) Project FR2 4973/3-1: Long-term measurements in Antarctica. o SOPRAN II: BMBF (German ministry for education and research) project: Support of long-term measurements on Cape Verde.

Table 2.4.2 Budget partitioning

Workpackage	Type of Activity	Partner Number	Partner short name	Personnel months (PM)	Additional PM on own resources	Sum of other direct costs [in k€]	Other direct costs [in €]					Subcontracts [€]
							Consumables	Durable equipment	Data (EO and in-situ)	Travel and subsistence	Other specific costs	
WP1	RTD	1	BIRA-IASB	2.5	1.5	7500				7500		
		2	EMPA	1		5200				5200		
		3	INTA	0.5		4500				4500		
		4	UBern	0.5								
		5	KIT	0.5		3000				3000		
		6	CNRS	0.5		4000				4000		
		7	UBremen	1		3000				3000		
		8	ULg	0.5		1600				1600		
		9	MPIC	0.5		2000				2000		
		10	UH	0.5		2000				2000		
		11	S&T	0.5		2700				2700		
WP2	OTHER	1	BIRA-IASB	1.5	1.5	4000				3000	1000	
		2	EMPA	0		2025				1000	1025	
		3	INTA	0		2800					2800	
		6	CNRS	0		4500	1500			3000		
		7	UBremen	0		8750				2750	6000	
		8	ULg	0	0.5	1875				1875		
		9	MPIC	0		3000				3000		
WP3	RTD	1	BIRA-IASB	9	1	2000				2000		
		3	INTA	1		3500	1500			2000		
		4	UBern	13.5								
		5	KIT	6.0								
		6	CNRS	10.5		34000	20000			14000		2500
		7	UBremen	9	2	4330	2000			2330		18000.00

Workpackage	Type of Activity	Partner Number	Partner short name	Personnel months (PM)	Additional PM on own resources	Sum of other direct costs [in k€]	Other direct costs [in €]					Subcontracts [€]
							Consumables	Durable equipment	Data (EO and in-situ)	Travel and subsistence	Other specific costs	
		8	ULg	4		4400				4400		
		11	S&T	0.5								
WP4	RTD	1	BIRA-IASB	12	0.5							
		3	INTA	3.5	1	4400	1400	3000				
		4	UBern	1								
		5	KIT	4.0								
		6	CNRS	15		9500	6500			3000		5 000
		7	UBremen	13	2	590	590					
		8	ULg	4								
		9	MPIC	8.5		1000	1000					
		10	UH	6		5994	3494	2000		500		
		11	S&T	0.5								
WP5	RTD	1	BIRA-IASB	3								
		2	EMPA	10		2100	1500			600		
		3	INTA	1.5	1.5	8500	500				8000	
		7	UBremen	2.5		500	500					
WP6	RTD	1	BIRA-IASB	2								
		4	UBern	2								
		5	KIT	2.0								
		6	CNRS	14		11000	5 000			6000		2500
		7	UBremen	2.5	1							
WP7	RTD	1	BIRA-IASB	8								
		3	INTA	1.5		3500	500			3000		
		4	UBern	3								
		5	KIT	3.0		1,585.00	1,585.00					
		6	CNRS	5.5		2000				2000		5000

Workpackage	Type of Activity	Partner Number	Partner short name	Personnel months (PM)	Additional PM on own resources	Sum of other direct costs [in k€]	Other direct costs [in €]					Subcontracts [€]
							Consumables	Durable equipment	Data (EO and in-situ)	Travel and subsistence	Other specific costs	
		7	UBremen	9	1							
		8	ULg	3								
WP8	RTD	1	BIRA-IASB	4								
		3	INTA	1		500	500					
		4	UBern	1								
		5	KIT	1.0								
		7	UBremen	4	1							
		8	ULg	1								
		11	S&T	17		1300				1300		
WP9		1	BIRA-IASB	5								
		3	INTA	1		500	500					
		4	UBern	1								
		5	KIT	2.0								
		6	CNRS	1.5								
		7	UBremen	4								
		8	ULg	3								
WP10	OTHER	1	BIRA-IASB	5	3	3150				3150		
		2	EMPA	0.5								
		3	INTA	2		1460	460			1000		
		4	UBern	2								
		5	KIT	3.0								
		6	CNRS	1.5		6000				6000		
		7	UBremen	5	1	2750				2750		
		8	ULg	1		1875				1875		
		9	MPIC	3		4000				4000		

Workpackage	Type of Activity	Partner Number	Partner short name	Personnel months (PM)	Additional PM on own resources	Sum of other direct costs [in k€]	Other direct costs [in €]					Subcontracts [€]
							Consumables	Durable equipment	Data (EO and in-situ)	Travel and subsistence	Other specific costs	
		10	UH	0.5		1500				1500		
WP11	MGT	1	BIRA-IASB	1	0.5	0 / 0						
TOTAL	RTD/ OTHER	1	BIRA-IASB	45.5/ 6.5	3 / 4.5	9500/ 7150				9500/ 6150	0/1000	
	MGT	1	BIRA-IASB	1	0.5	0						
	RTD/ OTHER	2	EMPA	11/ 0.5		7300/2025	1500/ 0			5800/ 1000	0/ 1025	
	RTD/ OTHER	3	INTA	10/ 2	2.5/0	25400/ 4260	4900/ 460	3000/ 0		9500/ 1000	8000/ 2800	
	RTD/ OTHER	4	UBern	22/ 2		0/ 0						
	RTD/ OTHER	5	KIT	18.5/ 3		4585/ 0	1585/ 0			3000/ 0		
	RTD/ OTHER	6	CNRS	47/1.5		60500/ 10500	31500/ 1500			29000/ 9000		15000
	RTD/ OTHER	7	UBremen	45 / 5	7/1	8420 / 11500	3090 / 0			5330 / 5500	0/ 6000	18000
	RTD/ OTHER	8	ULg	15.5/ 1	0/0.5	6000/ 3750				6000/ 3750		

Workpackage	Type of Activity	Partner Number	Partner short name	Personnel months (PM)	Additional PM on own resources	Sum of other direct costs [in k€]	Other direct costs [in €]					Subcontracts [€]
							Consumables	Durable equipment	Data (EO and in-situ)	Travel and subsistence	Other specific costs	
	RTD/ OTHER	9	MPIC	9/ 3		3000/ 7000	1000/ 0			2000/ 7000		
	RTD/ OTHER	10	UH	6.5/0.5		7994/ 1500	3494/ 0	2000/ 0		2500/ 1500		
	RTD/ OTHER	11	S&T	18.5/ 0		4000/ 0				4000/ 0		

Justification

Partner 1: BIRA-IASB
Travel in WP1 includes travel and subsistence costs for SC members (NORS budget: 4000 Euro; own resources: 3500 EUR).
Travel in WP 2 (3000 Euro) includes travel to international conferences (e.g., EGU, MACC Assemblies, …) and is taken on the NORS budget.
Travel in WP 3 includes travel to the Alpine station and the Ile de La Réunion to take care of the instruments maintenance (NORS budget: 2000 Euro)
Travel in WP 10 (3150 Euro) includes travel to China, Burundi, NDACC SC meetings and EEA, and is taken on the NORS budget.
Publication costs (1000 Euro in WP2) will be funded on own resources.

Partner 2, EMPA:
Consumables: 1000 € Laptop (WP5)
500 € Data storage media (WP5)
Travel: 5200 € Annual meetings (4 meetings x 2 persons x 650 € (400 € flight + 250 € hotel and subsistence)) (WP1)
1000 € Participation and presentation of NORS results at 2 international conferences (WP2)
600 € Visit to stations looked at in WP5 (WP5)
Other costs: 1025 € Publication costs (WP2)

Partner 3, INTA:

Durable: 3000 € Spare tracker. Trackers lifetime in high mountain stations hard meteorological conditions is about 2-3 years (WP4).
Travel: 4500 € Annual meetings (WP1)
Other costs: 8000 € Local maintenance including operation. INTA instrumentation is settled on an AEMET (Spanish Weather Service) observatory. Technical assistance is required for maintenance during periods out of working hours.(WP5)
2000+3000+1000 € Travels to the station in 33 months of the project (WP3, WP7, WP10, resp.)
2800 € Outreach (Publications costs.) (WP2)

Partner 4, UBern

No other direct costs than personnel costs.
Travel to project meetings will be available from other running projects (cf. Table 2.4.1).

Partner 5, KIT

Travel (3000 Euro) is for attending project meetings (WP1)
We assumed 1 meeting per year = 3 meetings in total
3 meetings x 2 persons x 500 Euro = 3000 Euro.

Consumables (1585 Euro) is for computation.
It corresponds to WP 7, reanalysis of the data.

Partner 6, CNRS

Travel includes project meetings for LATMOS scientists (4000 Euros, WP1), travel to the stations (OHP 5000 Euro and La Réunion Island, 8000 Euros (WP3), travel of LACy scientists from La Réunion to Europe for project and NDACC meetings (6000 Euro, WP3, WP4, WP7), travel of LATMOS scientists to NDACC steering committee and instrument group meetings (6000 Euro, WP6), travel to the Rio Gallegos station in Argentina for 2 persons (6000 Euros, WP10) and travels to Symposia for the presentation of project results (3000 Euros, WP2).
Consumables include spare parts for maintenance of the instruments involved in the project including laser parts for the lidars (20000 Euros, WP3), additional balloon soundings at OHP for checking integration of ozone data from lidar measurements (5000 Euros, WP6), consumables for instrument operation (6500 Euros, WP4) and publication costs (1500 Euros, WP2).
Subcontracting is foreseen for The Sainte-Lorette (SL) company, which will provide a scientific expertise based on decades of involvement in UV-Visible ground-based monitoring activities

Partner 7, UBremen

Trips to project meetings: 3000.00 €, money was assigned to WP1
Trips to remote locations: Bialystok, Poland (FTIR), Ny-Alesund, Spitsbergen (FTIR + DOAS), Paramaribo, Suriname and potentially Yekaterinburg (RUS) : 2330 € in WP 3 and 2750 € in WP10
Travel to conferences: 2750 € in WP2.

Publication costs: We estimate 6000.00€ for the whole project which we assigned to WP2
Consumables include laptops and instrument maintenance.

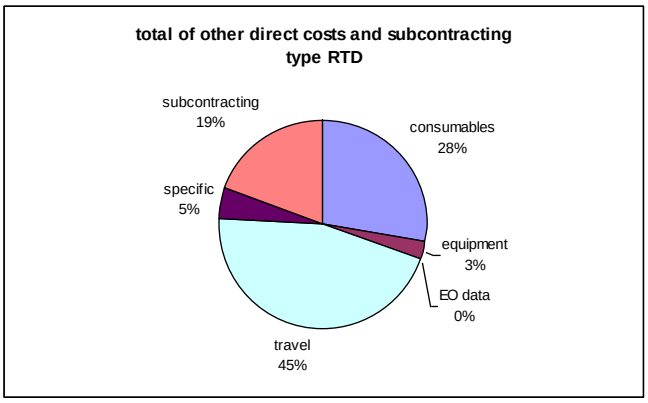
Partner 8, ULg
Travel and subsistence: requested costs cover expenses associated to the participation to NORS meetings (WP1), one/two related conferences or NDACC meetings (WP2 and WP10) as well as travels to the Jungfraujoch station for instrumental repair, maintenance and upgrade (WP3).

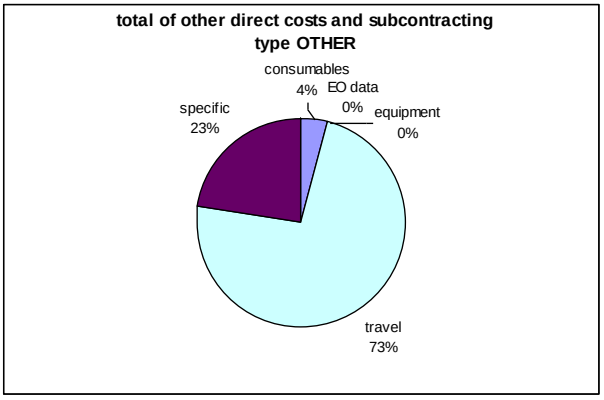
Partner 9, MPIC:
Travel in WP 1 includes project meetings (3 meetings for two persons, each two days) for 2000EUR.
Travel in WP2 includes travel to international conferences (3 conferences for one person, each one week) (3000 EUR).
Travel in WP 10 includes 2 visits to China, each for 1 – 2 weeks (4000EUR).

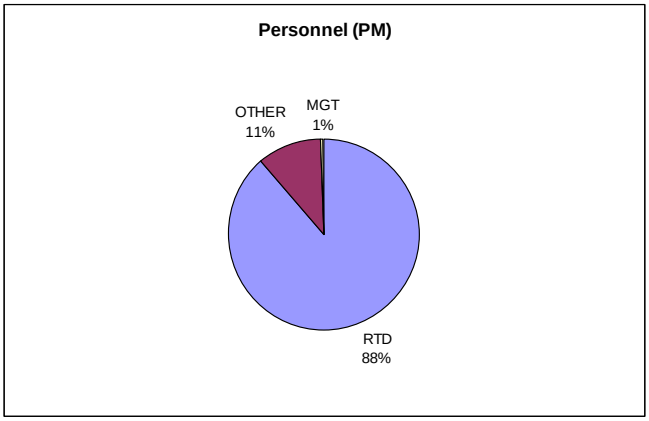
Partner 10, UH:
Travel includes project meetings and international conferences (3 Meetings with 1 Person, 2000 €, WP1), as well as travel to Suriname (1 Person, 1500 €, WP 10) and to Hohenpeißenberg (500 €, WP 4).
Consumables cover costs for the maintenance of the long-term instruments
Durables: Improved telescope system for the MAX-DOAS instrument in Suriname (2000EUR, WP4).

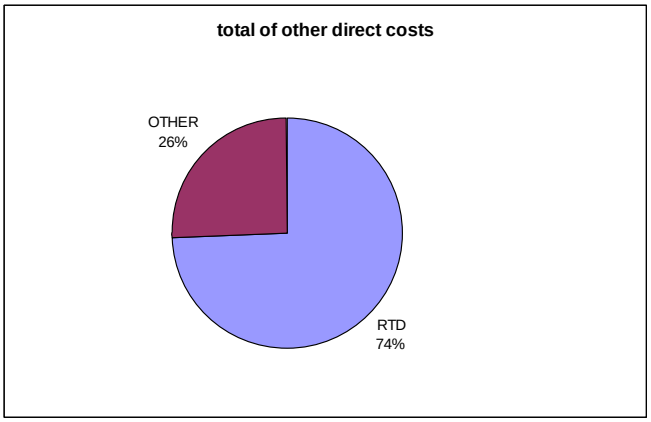
Partner 11, S&T
Travel cost is based on 4 project meetings (KO + 3 project meetings, 2700EUR, WP1) plus 2 additional technical meetings throughout the project with an average of 2 days each and attendance by 2 persons (1.300EUR, WP8).

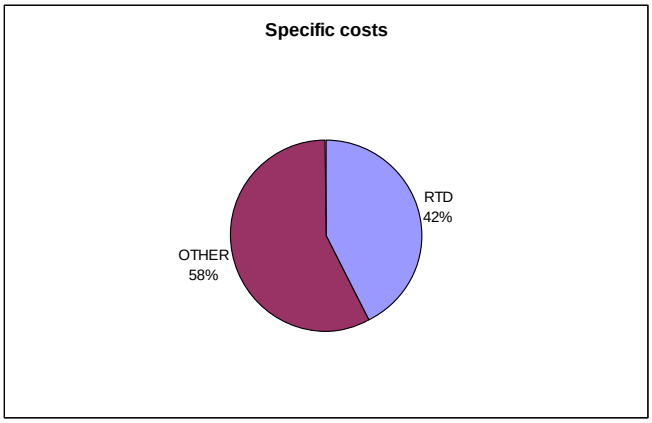
Budget partitioning

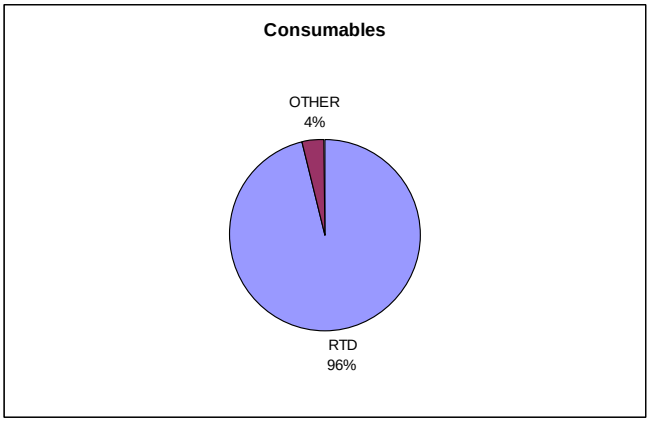


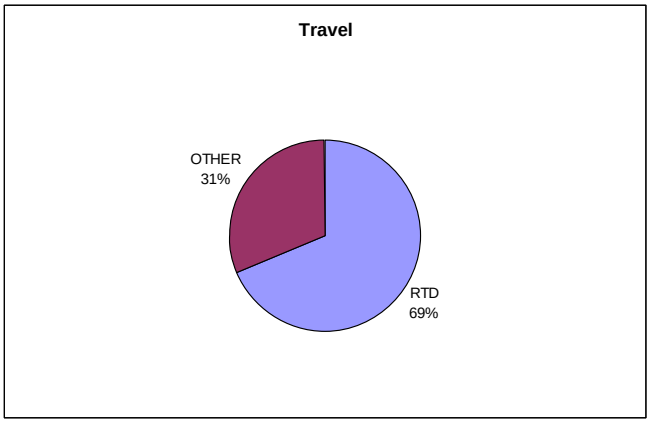












B3. Impact

B3.1. Strategic impact

The project results will increase the public awareness of the benefits of using in an integrated way satellite and ground-based data. Indeed, the GAS products have been based mostly on the assimilation of atmospheric chemistry satellite data in chemistry-transport models, and they have clearly shown the benefits of the satellite data. Now, NORS will show the benefits of integrating high-quality ground-based remote-sensing data in the GAS product validation chain for achieving a better quality assurance of the GAS products. In addition, WP5 will develop a methodology to link the surface in-situ data to the ground-based and the satellite remote-sensing data. Because the surface in-situ data are well calibrated against international gravimetric standards, the results of WP5 will also link the remote sensing data to those standards. In other words, a benefit of the integrated use of satellite and the remote-sensing data in WP5 is an indirect calibration of the satellite and remote-sensing data against a known standard.

The project will also contribute to a better assessment of the characteristics of the actual satellite and ground-based remote sensing data, leading to a better insight in what can be expected in the future. Indeed, this assessment is the focus of WP4. In WP4, the various uncertainties associated with the ground-based remote-sensing data will be investigated. Also the multi-dimensional nature of the remote-sensing measurements will be studied for the targeted NDACC observations. Remote-sensing measurements are not a local point-wise measurement but they cover a volume of air in space. The location and extent of this volume will be determined. This is important in any comparisons with other types of measurements and with model fields or assimilation analyses. From the comparisons between the ground-based observations and the satellite measurements, we will draw conclusions regarding the characteristics of the actual satellite data that are used in the GAS. Since we will work with data from a suite of satellites from different generations (e.g., ozone and NO_2 from SCIAMACHY and OMI, CO from MOPITT and IASI), it will be possible to get insight in what can be expected in the future.

The project will establish a web-based validation server for GAS using the NORS ground-based data. This is a new application in the GMES context. Moreover, this application will demonstrate the uptake of additional in situ data products, namely ground-based remote sensing data from NDACC, and contribute to the integration of additional validation services in the GAS product chains. The results will as such contribute to the sustainability and competitiveness of European services.

Potential socio-economic impacts

NORS will involve new actors, namely the NDACC community and a Dutch SME, in the GMES Atmosphere Service.
NORS will also provide job opportunities in several research institutions for (young) scientists.

Additional socio-economic impacts are foreseen indirectly through the expected impacts of NORS on the GMES Atmospheric Services: as NORS will improve the knowledge about the quality of these services, and ultimately will help improving the quality itself, the latter services will achieve a higher level of confidence, they will gain in importance, outreach and impact on policies in the fields of air quality, climate and stratospheric ozone. As such, NORS will indirectly have a significant socio-economic impact and contribute to the reduction of climate change uncertainties and to a better knowledge of our atmosphere and its evolution.

The final project's impact will depend on the eventual achievements realised in NORS, and their visibility. Therefore, dissemination of the results will be crucial. The efforts that NORS will make in this direction are explained in the next section. In addition, the efforts made in WP10 to export the NORS achievements to NDACC and new stations outside of Western Europe should increase the impact of the project beyond its lifetime and beyond Europe. The project will work towards the final aim beyond 2015, which is to have NDACC, including new gap-filling stations in remote areas, contributing as a global network to the quality assessment and assurance of the GAS. This can only be realised because the partnership in NORS involves different teams that are active worldwide.

B3.2. Plan for the use and dissemination of foreground

Dissemination and/or exploitation of project results

As the major activities in NORS are research and technological development activities, the results will be presented at international scientific workshops and conferences and will be reported in the peer-reviewed scientific literature. Because it is one of the objectives of the project to export the achievements of NORS to the global NDACC community, special attention must be given to dissemination of the results in the NDACC community, and that is the reason why we devoted a dedicated task hereto in WP10 (T10.2).
This same task includes reporting of the NORS activities and achievements to the CEOS Working Group on Calibration and Validation. NORS will comply with GAS validation protocols and QA4EO guidelines established by this Working Group. Therefore, the feedback from NORS to this Group is important.
Similarly in WP10, we will establish a close connection to EEA (T10.3) and as such, make EEA aware on a regular basis of the progress achieved in NORS.

Apart from the fact that NORS will generate enhanced scientific knowledge regarding the targeted NDACC data products, NORS will also generate new data sets. These will be available for exploitation via the NORS data server. We will make publicity for this data server in the scientific community, and especially in the GAS community, partly via the Steering Committee members, but also via the Web site of NDACC and the GEOmon portal that is supposed to be maintained by NILU.

The initiative taken in GEOmon 'Stratospheric Ozone and Climate' to provide on the GEOmon Web page a visual display of the rapid delivery data as well as a regularly updated report of the situation at the measurement sites regarding instrument status, data acquisition and analysis, will be advanced in NORS to a more operational service on the NORS data server. This is a feature that is not only useful for the scientific users of the data, but also for the policy makers, the media and the general public. It increases the visibility of the data and enhances the awareness of the existence and benefits of worldwide ground-based monitoring of atmospheric composition, its changes and its possible impact on climate.

Since NORS is strongly tied to NDACC and to the GMES Atmospheric Service Core project, we prefer hosting the NORS Web pages on the NDACC Website, rather than having a separate Website. We will link these Web pages to relevant Web pages on the Website of the GMES Atmospheric Service Core project and - if relevant – to Web pages of other GAS projects like PASODOBLE. The options will be discussed and decided in the Steering Committee meetings.

We will also advertise the NORS activities on the Websites of the 4 pilot stations involved in NORS and at the partners websites.

The validation server that will be built in the project will be integrated in existing systems (GECA or the GAS Atmosphere Core Server system) and therefore become very visible to the scientific community, the policy makers, and the wider public.

As stated in Section 2.1, The Steering Committee members will be invited every 6 months to participate in the project teleconferences, and at all project progress meetings, to keep them informed on a very regular basis of the project's progress. Their involvement in other projects and/or organisations (other relevant GMES Atmosphere Service projects, EEA, ESA, WMO,…) will also ensure a wide dissemination of the project results.

And last but not least, the final project meeting will be organised as an international workshop. The workshop will be announced to a wider scientific community and especially to the GAS community,

with the help of the Steering Committee members. EU and national policy makers will be invited. This workshop will raise the awareness about the benefits of making an integrated use of satellite and ground-based data in the GMES Atmospheric Service.

NORS data will also be useful in the context of PASODOBLE:
PASODOBLE generates data products on atmospheric NO_2, NO_x, O_3, benzene, HCHO, SO_x, NH_x, CO, PM2.5 and PM10, pollens, AQ index, and UV radiation and indexes. A large part of these data products relies on satellite-based measurements by GOME-2, IASI, OMI and SCIAMACHY. NORS will provide data, methods and tools appropriate for the validation of these satellite data resources. In particular, some NORS developments are awaited for more accurate validations of tropospheric measurements from space, for which methods are still in the development phase. Indirectly, NORS contributes to the quality and good performance of PASODOBLE through its contributions to MACC-II: indeed, the development and delivery of the PASODOBLE services require data resources from the GMES Core Service projects (MACC and MACC-II).

NORS data, methods and tools will be valuable also for the evaluation of PASODOBLE data fusion tools like 3Dvar assimilation. The latter generate analysis fields of ground-level pollutant concentration and their data products are to be validated by means of ground-level measurements. Ground-based data provided by NORS are expected to be valuable validation resources. Moreover, the accuracy of ground-level data generated by data fusion tools depends on the accuracy at higher altitudes of boundary conditions and of the description of processes. These higher altitudes are also addressed by the NORS data

As mentioned above, NORS will develop and generate in the course of the project, new datasets and methods that will be exploited directly in NORS for the validation of the GAS products. Of course, these data and tools will also be available to the community for other scientific usage. It is the intention of the partners to continue the generation of these advanced products beyond the lifetime of NORS for exploitation by the scientific community.
It is expected that the advanced NORS data products will also be very valuable for the validation of atmospheric models and assimilation analyses. The re-analysed timeseries (back to 2003) will be useful for trend studies.

Management of intellectual property rights

The management of intellectual property rights will be defined precisely in the Consortium Agreement, during contract negotiations. This Agreement will also specify the rights of the subcontractors and other third parties in the consortium. We will comply with EU and GAS rules for data access policies. The Consortium Agreement will include the management of the rights as to knowledge generated in the project as well as to the rights regarding pre-existing data and software (e.g., software for data retrieval and error budget evaluations at the contributing partner institutes).
It will be verified that the consortium deals properly with the intellectual property rights of any data or model results that are used in the generation of the NORS data products, like meteorological data, MOZART or TM5 model results, surface in-situ data, … that are not owned by the partners themselves, and that are not in the public domain. Many of these data are in the public domain, but if they are not, proper acknowledgement shall be given to the data or software owner.

Contribution to standards

NORS will indirectly contribute to standards as follows:
WP4 includes cross-calibrations between NDACC and TCCON measurements of CH_4. For the TCCON measurements the calibration factors relative to standards have been verified as part of the European IMECC campaign in September and October 2010 in Germany, Poland and France (Messerschmidt et al.,2011) and are verified regularly at other sites of the network (Wunch et al., 2009). So indirectly, we will have an evaluation of the calibration factors of the NDACC CH_4 data.

As described above, WP5 will develop a methodology to link the surface in-situ data to the ground-based and the satellite remote-sensing data. Because the surface in-situ data are well calibrated against international gravimetric standards, the results of WP5 will also link the remote sensing data to those standards. In other words, a benefit of the integrated use of satellite and the remote-sensing data in WP5 is an indirect calibration of the satellite and remote-sensing data against a known standard.

Contribution to policy developments

N/A

Risk assessment and related communication strategy

N/A

References

Messerschmidt, J., M. C. Geibel, T. Blumenstock, H. Chen, N. M. Deutscher, A. Engel, D. G. Feist, C. Gerbig, M. Gisi, F. Hase, K. Katrynski, O. Kolle, J. V. Lavric, J. Notholt1, M. Palm1, M. Ramonet, M. Rettinger, M. Schmidt, R. Sussmann, G. C. Toon, F. Truong, T.Warneke, P. O.Wennberg, D. Wunch, and I. Xueref-Remy, TCCON column-averaged CO2: the first aircraft campaign over European TCCON sites, submitted to Atmos. Chem. Phys., 2011.

Wunch, D., Toon, G. C., Wofsy, S. C., Stephens, B. B., Blavier, J. L., Keppel-Aleks, G., Sherlock, V., Connor, B. J., Deutscher, N. M.;, Griffith, D. W., Macatangay, R., Wennberg, P. O., A Calibration for the Total Carbon Column Observing Network using HIPPO Aircraft Profiles, American Geophysical Union, Fall Meeting 2009, abstract #A44A-02

B4. Ethics Issues

The consortium confirms that the current project does not involve

- Any research on human embryos or foetus
- Any research on humans
- Any use of personal data; only geophysical data are considered.
- Tracking the location or observation of people
- Any research on animals
- Any research having direct military use or potential for terrorist abuse.

In WP10, NORS partners will collaborate with teams working in the following ICPC countries: Argentina, Mexico, Suriname, Burundi, Ethiopia, China, and Russia. The collaboration implies exchange of scientific knowledge only and does not imply any ethical issues.

ETHICS ISSUES TABLE

(Note: Research involving activities marked with an asterisk * in the left column in the table below will be referred automatically to Ethics Review)

	Research on Human Embryo/ Foetus	YES	Page
*	Does the proposed research involve human Embryos?		
*	Does the proposed research involve human Foetal Tissues/ Cells?		
*	Does the proposed research involve human Embryonic Stem Cells (hESCs)?		
*	Does the proposed research on human Embryonic Stem Cells involve cells in culture?		
*	Does the proposed research on Human Embryonic Stem Cells involve the derivation of cells from Embryos?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT	X	

	Research on Humans	YES	Page
*	Does the proposed research involve children?		
*	Does the proposed research involve patients?		
*	Does the proposed research involve persons not able to give consent?		
*	Does the proposed research involve adult healthy volunteers?		
	Does the proposed research involve Human genetic material?		
	Does the proposed research involve Human biological samples?		
	Does the proposed research involve Human data collection?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT	X	

	Privacy	YES	Page
	Does the proposed research involve processing of genetic information or personal data (e.g. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?		
	Does the proposed research involve tracking the location or observation of people?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT	X	

	Research on Animals [2]	YES	Page
	Does the proposed research involve research on animals?		
	Are those animals transgenic small laboratory animals?		
	Are those animals transgenic farm animals?		
*	Are those animals non-human primates?		
	Are those animals cloned farm animals?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT	X	

	Research Involving ICPC Countries[3]	YES	Page
	Is the proposed research (or parts of it) going to take place in one or more of the ICP Countries?	X	WP10
	Is any material used in the research (e.g. personal data, animal and/or human tissue samples, genetic material, live animals, etc): a) Collected in any of the ICP countries?		
	b) Exported to any other country (including ICPC and EU Member States)?		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT		

	Dual Use	YES	Page
	Research having direct military use		
	Research having the potential for terrorist abuse		
	I CONFIRM THAT NONE OF THE ABOVE ISSUES APPLY TO MY PROJECT	X	

[2] The type of animals involved in the research that fall under the scope of the Commission's Ethical Scrutiny procedures are defined in the Council Directive 86/609/EEC of 24 November 1986 on the approximation of laws, regulations and administrative provisions of the Member States regarding the protection of animals used for experimental and other scientific purposes Official Journal L 358 , 18/12/1986 p. 0001 - 0028

2 In accordance with Article 12(1) of the Rules for Participation in FP7, 'International Cooperation Partner Country (ICPC) means a third country which the Commission classifies as a low-income (L), lower-middle-income (LM) or upper-middle-income (UM) country. The list of countries is given in annex 1 of the work programme. Countries associated to the Seventh EC Framework Programme do not qualify as ICP Countries and therefore do not appear in this list.

B5. Consideration of gender aspects

This project's coordinator is female. Among the WP leaders, 3 are female, 5 are male. We also have some female Steering Committee members.

In the partners teams, there will be no discrimination between female and male co-workers, neither will there be any discrimination when additional researchers will be hired for the project. Partners will be encouraged to hire female applicants and participation in a female led project could provide a positive role model for young female researchers at the beginning of their scientific careers.

We will make an annual survey of the gender partitioning in the partners teams involved in the project. This will be added as an Annex to the annual report and will be highlighted at the project annual meetings. Partners will be encouraged to enhance the participation of female scientists to the project activities and to stimulate women scientists to take important responsibilities in the project.

In the planning of project meetings and teleconferences, we will take into account unavailabilities of concerned partners because of school holidays or other family reasons, to the extent possible.
As far as the execution of the project allows for it, the partners are encouraged to optimize the reconciliation of family life and professional activities at their home institutes.