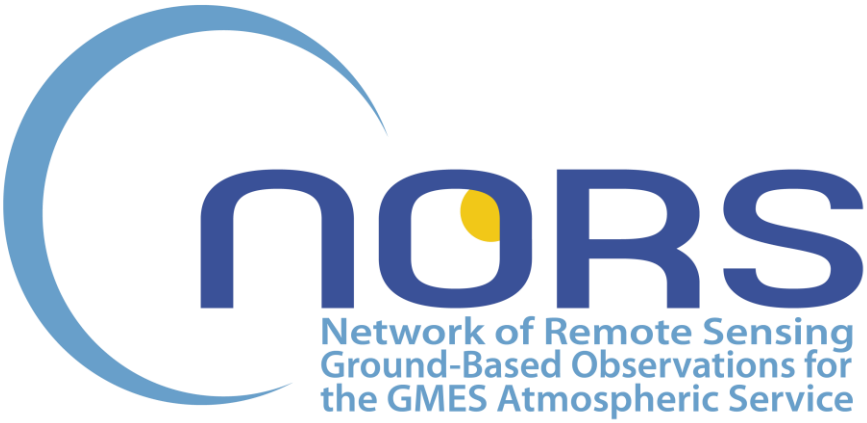

Milestone report covering MS 10 & 11

Milestone date: 30/04/2013

Date of issue: 03/05/2013

Introduction

The milestone of the 30th of April 2013 (M18) concerns:

- MS 10 Uncertainties in NORS data products
- MS 11 Start verification of consistency of NORS data products

For MS 12 'Guidelines for re-analysis of timeseries', originally scheduled on the same date, a two months delay has been requested because it requires various conclusions to be drawn from WP4. Much progress was made in WP4 but it has not been summarized yet into firm conclusions.

1. MS 10 Uncertainties in NORS data products

Written by Andreas Richter, University of Bremen.

As for all atmospheric measurements, proper characterisation and reporting of uncertainties is essential for the NDACC data products covered by NORS. This includes several aspects, all of which are treated in the project in WP4:

- Identification of sources of uncertainties
- Characterisation of each term as random / systematic (or type A / type B)
- Quantification of each term using either formal error calculations (as available within the optimal estimation framework) or statistics on the data or – if nothing else is available expert judgement
- Description of error sources and their impact on the results in a format and level of detail appropriate for data users
- Inclusion of key uncertainties and overall uncertainty parameters (flags, error limits) in the data products

As an important milestone, a report on uncertainties in NORS data products has been compiled (D4.3) and a description of key uncertainties been included in the data user guide (D4.2). The basic decisions on uncertainty inclusion in data files have already been taken in the data format description (D4.1).

Building on these results, additional work is foreseen for the coming months which will add more information on uncertainties in the NORS data products:

- Detailed investigations of the data consistency between NDACC measurements of the same quantity (D4.5) and between different retrieval approaches (D4.6) will give a better assessment of the level of agreement that has been reached
- Technique specific studies on uncertainties comparing different retrieval approaches (for example in the retrieval of MAX-DOAS vertical profiles) as well as further analysis of parallel measurements of a large number of similar instruments (for example for MAX-DOAS during CINDI) will enabled more detailed and more realistic error budgets to be derived
- The issue of data representativeness which is very relevant when comparing in-situ observations, remote sensing data and model results will be investigated in (D4.4). While this does not deal with an uncertainty of the NDACC observations, the effect for data users is similar and will therefore be discussed in the same context.

2. MS 11 Start verification of consistency of NORS data products

Written by Andreas Richter, University of Bremen.

Many NDACC quantities are measured by several instruments in parallel, providing both variable sensitivity to different altitudes and some level of redundancy. An overview over such measurements is given in Table 1.

Quantity	Instruments	Locations
O_3 column	FTIR, MW, DOAS, Brewer	Ny-Alesund, Reunion, Izaña
O_3 profile	FTIR, MW, lidar, sonde	Ny-Alesund, Reunion, Izaña
NO_2 column	FTIR, DOAS	Izaña, Reunion, Ny-Alesund
HCHO column	FTIR, DOAS	Jungfraujoch, Bremen, Paramaribo
AOD	DOAS, sun-photometer, ceilometer	Hohenpeißenberg, Mainz

Table 1: Overview over potential comparisons between parallel observations of the same quantity

Some previous studies have already addressed this topic, for example the papers by Vigouroux et al., 2009 for HCHO observations in Reunion and within NORS for NO_2 observed at Jungfraujoch station by Hendrick et al., 2012. This work builds the fundament on which more extensive comparisons will be performed which will be summarised in a report in month 24 (D4.5).

In preparation for D4.5, several activities have been initiated:

- A first intercomparison between NO_2 observations by FTS and DOAS performed in Ny-Alesund was made. Preliminary results show good overall agreement but a large impact of the a priori used in the FTIR retrieval. Also, the diurnal variation of NO_2 is a problem in the interpretation of results, and additional FTIR measurements were scheduled to decrease the time interpolation needed to compare results of the two instruments. Also, analysis of the DOAS data is currently being extended also to low SZA periods which are better suited for FTIR observations but result in larger uncertainties for DOAS retrievals.
- For ozone, parallel measurements of a Brewer and a DOAS instrument in Izaña were compared, and very good agreement was found. The need for seasonal air mass factors in DOAS retrievals was again demonstrated and some pollution events with larger deviations were identified, which can be explained by different sensitivities of the instruments. The comparisons have also been extended to analysis of FTIR and DOAS ozone columns with good preliminary results.
- Detailed analysis of parallel AOD measurements by DOAS and sun-photometer performed in Cabauw during the EUCAARI campaign revealed interesting differences between different retrieval approaches for the DOAS instrument and highlighted the need for further analysis.
- In Mainz, parallel observations of a multi-directional DOAS and a sun-photometer were initiated and will continue throughout NORS, creating an interesting AOD data set in a polluted, inhomogeneous location.
- In summary, dedicated parallel measurements have been initiated, first comparisons performed and areas of discrepancies and agreements been identified, providing a basis for a more detailed analysis of parallel observations.

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