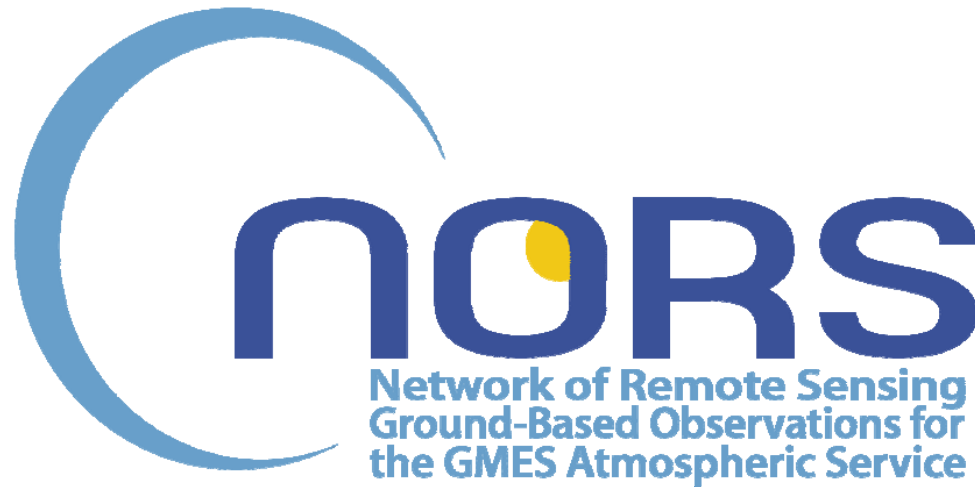


# **NORS validation server achievements and ongoing discussions**



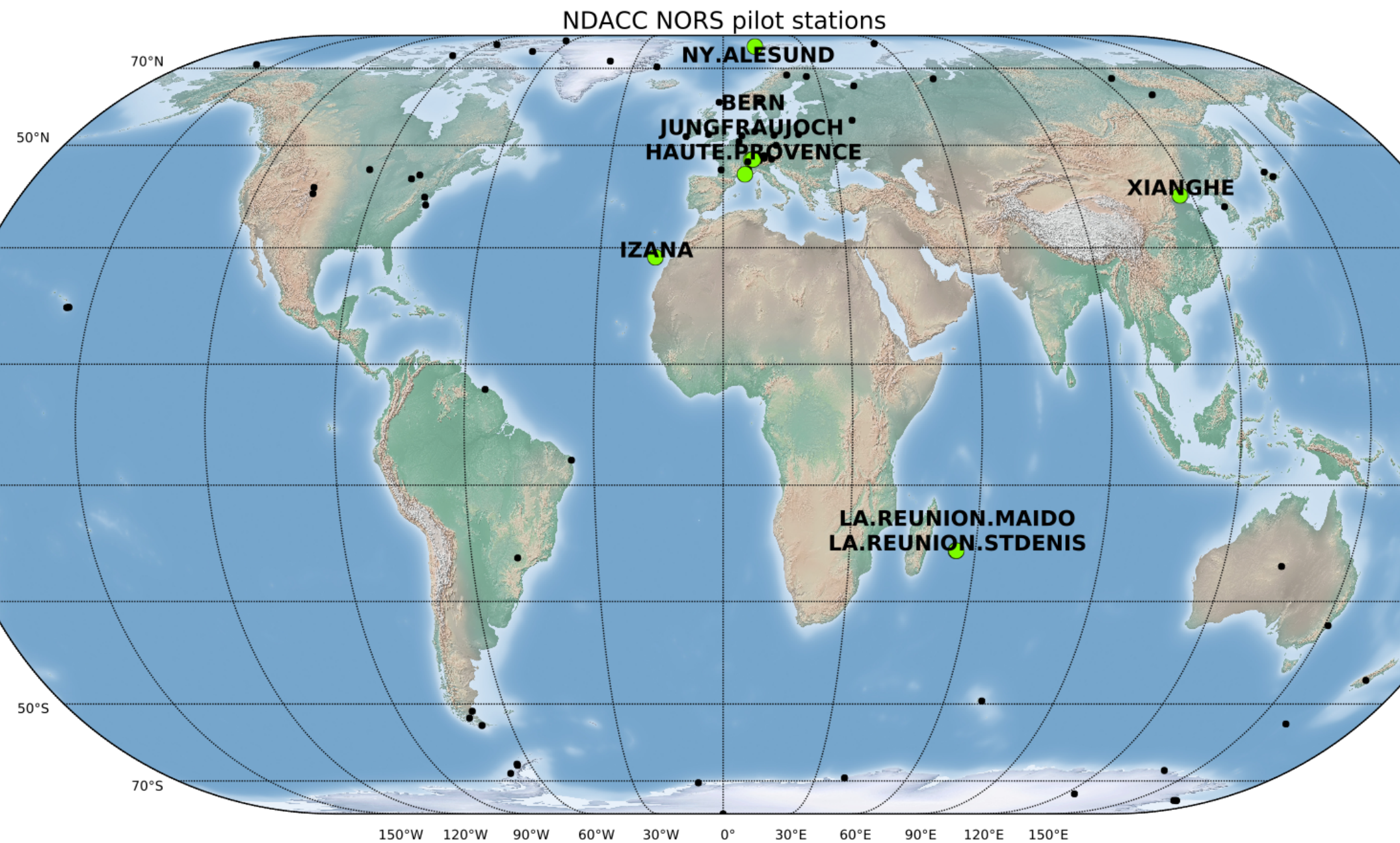
B. Langerock and M. De Mazière

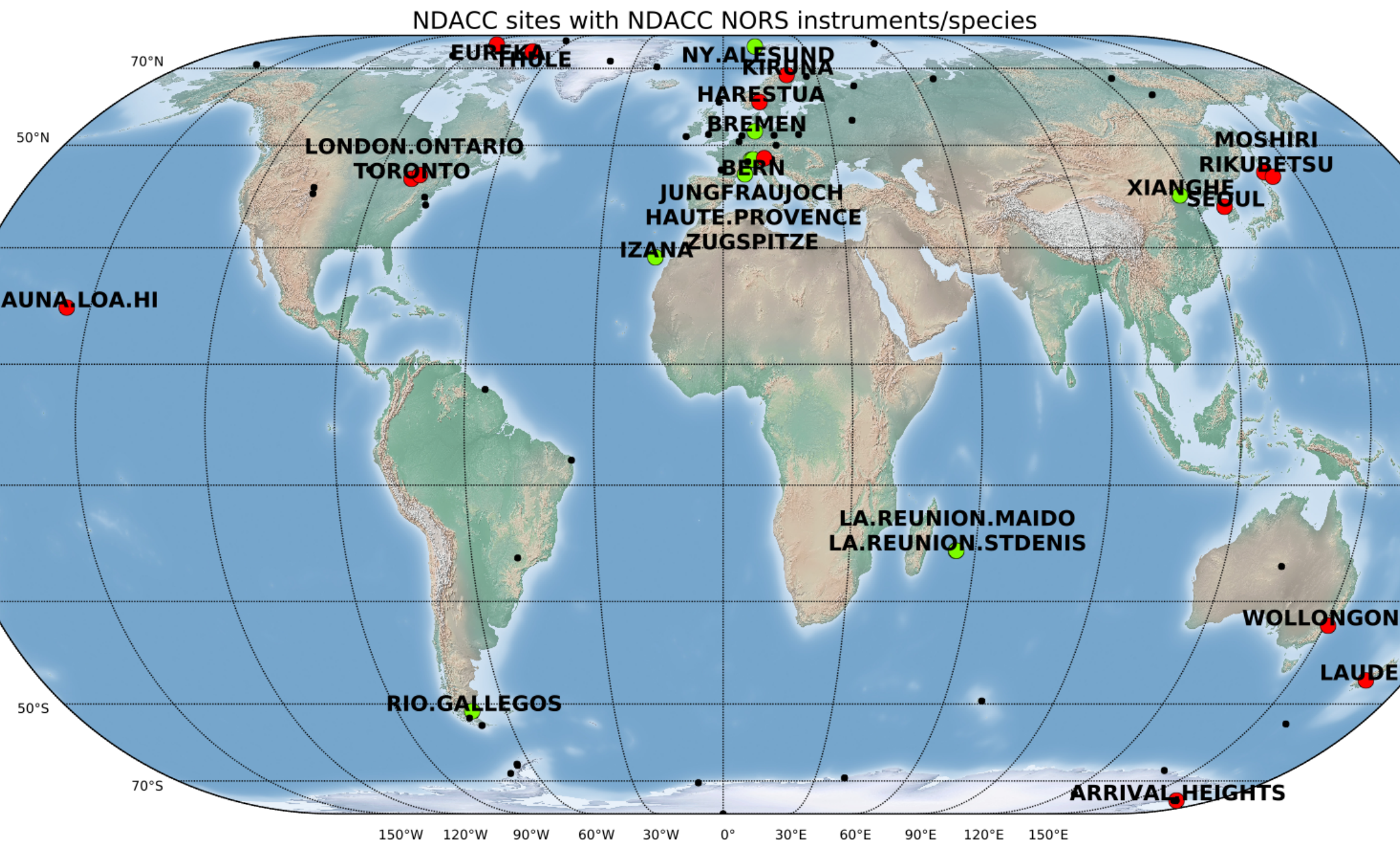
# NORS

“Demonstration Network Of ground-based Remote Sensing Observations in support of the Copernicus Atmospheric Service”

- ▷ To perform the required research and developments for optimizing the NDACC data for the purpose of supporting the quality assessments of the Copernicus Atmospheric Service (CAMS) MACC-II,III
- ▷ To develop and implement a Web-based Validation Server of the MACC products using selected NDACC data products

Instruments	Species	Affiliation	Locations
UVVIS.DOAS	O3.C (strato) NO2.C (strato) NO2.C (tropo)	CNRS.LATMOS	HAUTE.PROVENCE
			LA.REUNION
		BIRA-IASB	JUNGFRAUJOCH
UVVIS.DOAS (MAXDOAS)	O3.C (strato) NO2.C (strato) NO2.(P,C) (tropo) H2CO.C AEROSOL.(P,D) (tropo)	BIRA-IASB	JUNGFRAUJOCH
		INTA	IZANA
		IUP	NY.ALESUND
FTIR	O3.(P,C) CO.(P,C) CH4.(P,C)	BIRA-IASB	LA.REUNION
		FZK	IZANA
		IUP	NY.ALESUND
		ULG	JUNGFRAUJOCH
LIDAR	O3.P (strato)	CNRS.LATMOS	HAUTE.PROVENCE
		UREUNION.LPA	LA.REUNION
MWR	O3.P (strato)	UBERN	BERN
		IUP	NY.ALESUND





online stations →

only GEOMS HDF data

`nors-server.`  
`aeronomie.be`

LOCATION	
[ALL]	466
BERN	120
BREMEN	133
EUREKA	8
HARESTUA	34
HAUTE.PROVENCE	72
IZANA	279
JUNGFRAUJOCH	333
LA.REUNION.MAIDO	191
LA.REUNION.STDENIS	57
LAUDER	44
MAUNA.LOA.HI	46
NY.ALESUND	159
SEOUL	32
XIANGHE	91
ZUGSPITZE	121

## Systematic use of NDACC data

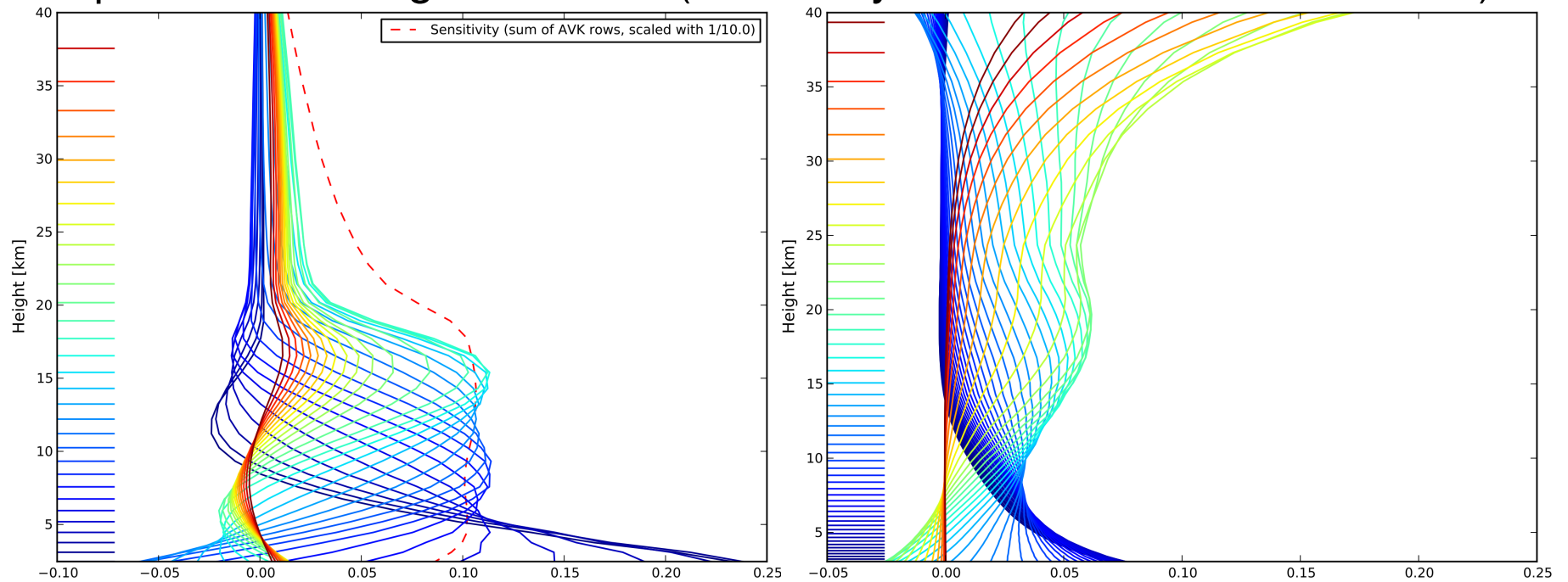
The server uses all available FTIR, MWR, LIDAR and UVVIS data for the target species

A validation job uses many reported variables: AVK, pressure, temperature, boundaries ...

▷ NDACC data health test:

- ▶ bad units
- ▶ incomplete data sets (pressure, temperature profiles unavailable)
- ▶ consistency between variables in a file (altitude vs boundaries)
- ▶ assessment of the retrieval quality (spectrum → target profile): often reflected in the shape of the AVK.

## Example of CO AVK good vs bad (sensitivity should vanish around 20km)



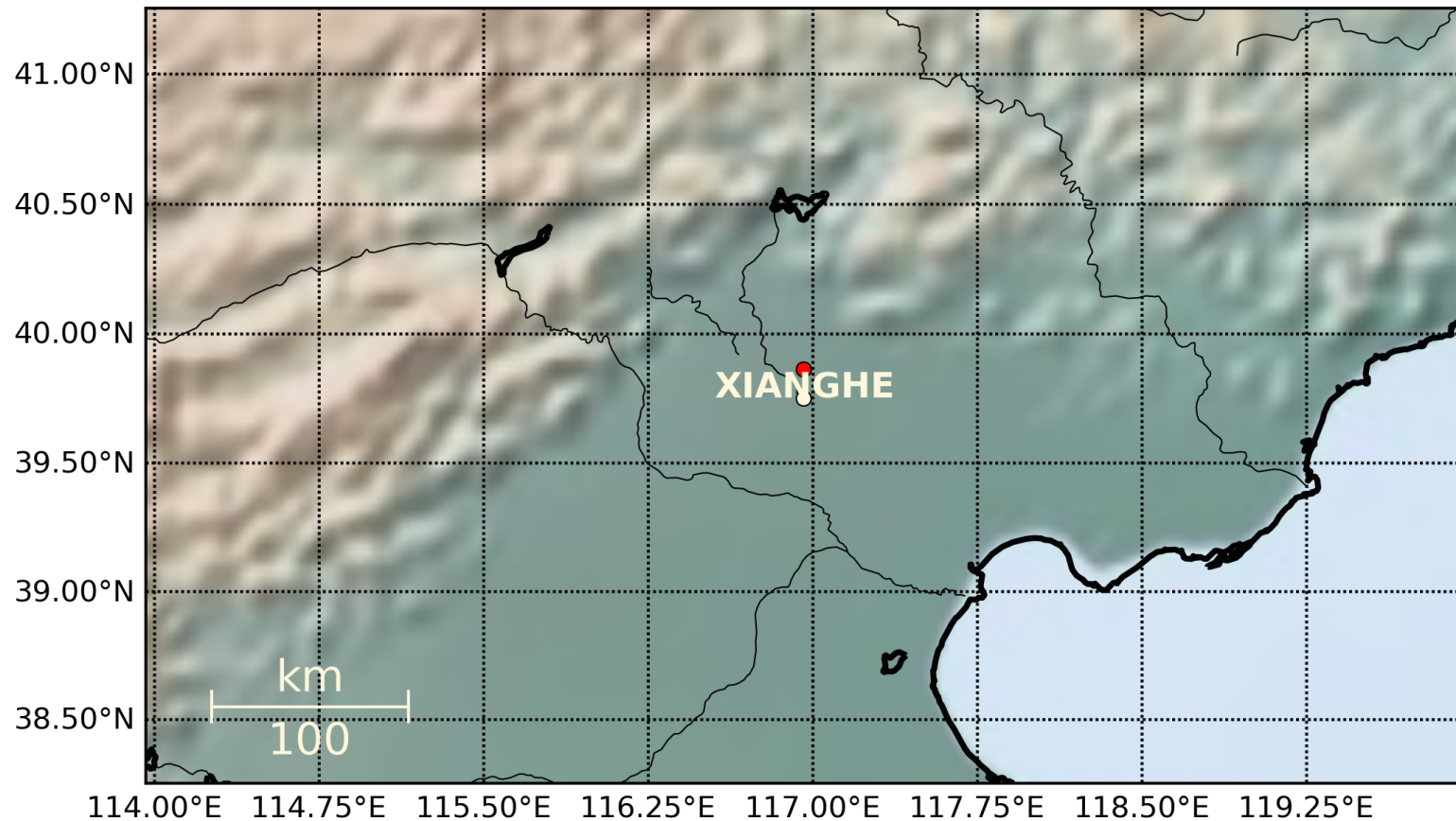
This leads to very weird validations

Individual data providers were contacted where problems were discovered

- ▷ NORS targets + FTIR.NO<sub>2</sub>, FTIR.H<sub>2</sub>O and MWR.H<sub>2</sub>O
- ▷ Constructed an algorithm to ‘get most recent data file on NDACC’
  - ▶ problems with data file versions
  - ▶ problems with overlapping time ranges ...
- ▷ Description of algorithms: (almost) published in GMDD, a MACC Special Issue
- ▷ Data formats and data templates
  - ▶ UVVIS, FTIR, LIDAR and MWR template updated
  - ▶ storage of the AVK was not unambiguously defined in the templates
    - $\approx$  half the stations stored AVK's differently

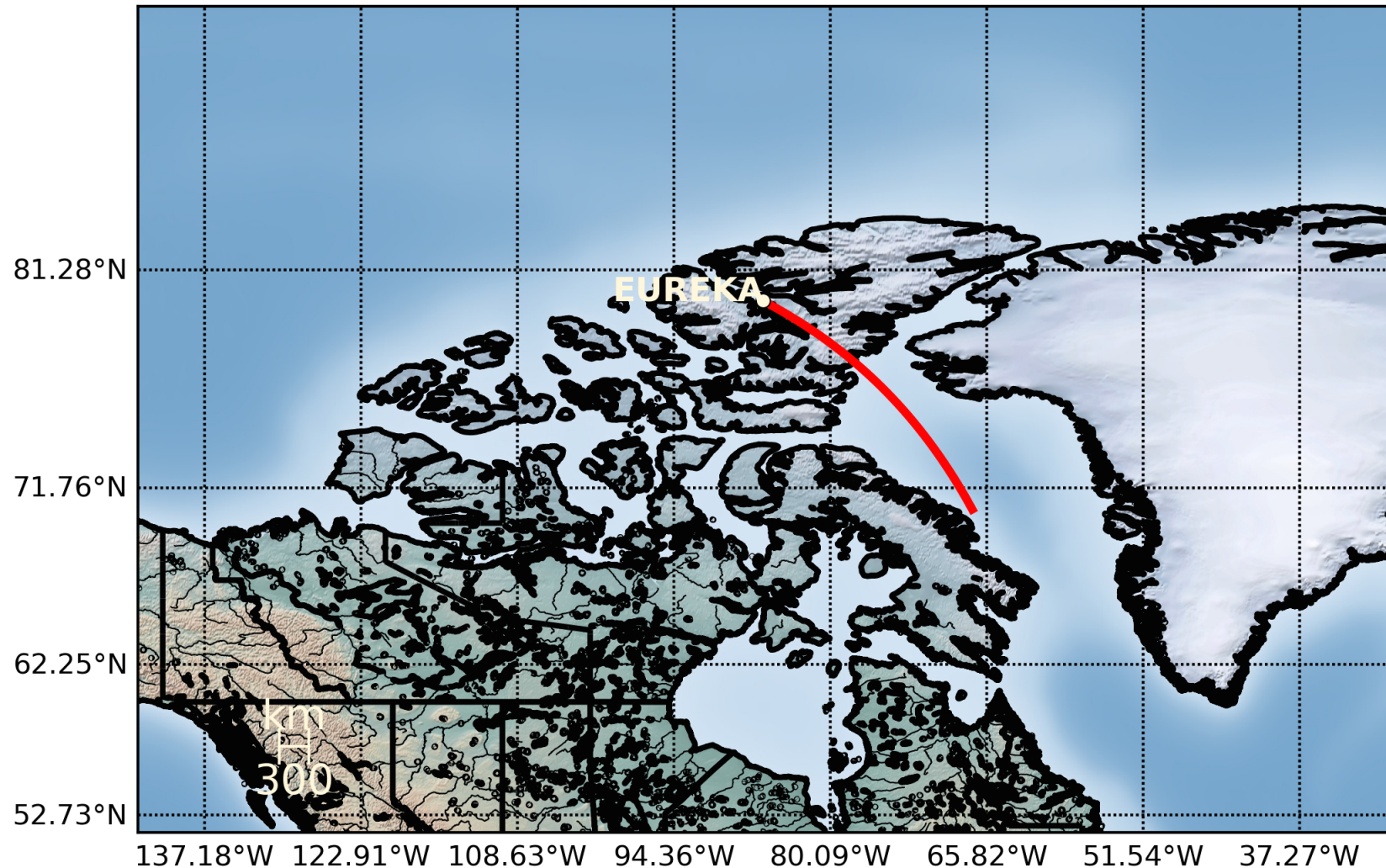
- introduction of LATITUDE, LONGITUDE variables for horizontal displacement of a measurement only UVVIS

Horizontal displacement plot at XIANGHE (92.0m) on 2013 Jan 01 02:54:27 UVVIS.DOAS.OFFAXIS.H2CO



► FTIR, off-location calculated by the server (not yet in FTIR template)

Horizontal displacement plot at EUREKA (610.0m) on 2013 Feb 28 15:28:48 FTIR.O3



## NDACC data ready for validation purposes

NORS is present in MACC NRT service validation reports (3monthly reports):

- ▷ used since NRT#7, October 2013: O<sub>3</sub> MWR at Ny Alesund and Bern
- ▷ NRT#9, March 2014: + O<sub>3</sub> FTIR at Jungfrauoch and La Reunion Maïdo
- ▷ NRT#10, May 2014: + O<sub>3</sub> FTIR at Izaña and LIDAR at Haute Provence
- ▷ NRT#1, Sept. 2014: + CO FTIR, H<sub>2</sub>CO UVVIS
- ▷ NRT#2, Dec. 2014: + aerosol and UVVIS zenith O<sub>3</sub> ?
- ▷ NRT#3, March 2015: + tropo-, stratospheric NO<sub>2</sub> and CH<sub>4</sub> ?

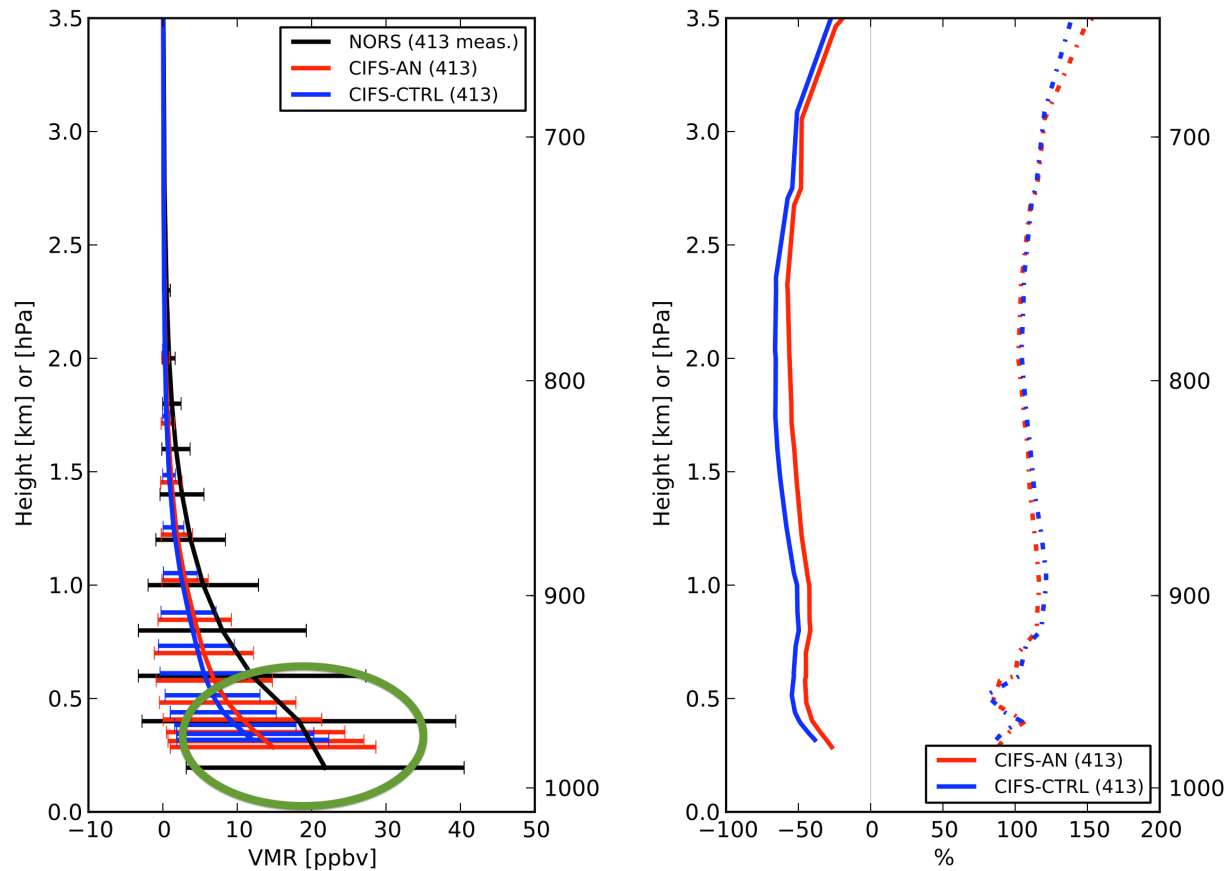
<b>3</b>	<b>Validation results</b>	
3.1	Tropospheric Ozone	
3.1.1	Validation with sonde data in the free troposphere	
3.1.2	Validation with IAGOS Data	
3.1.2	Validation with Global Atmosphere Watch (GAW) and ESRL Global Monitoring Division Surface Observations	
3.2	Tropospheric nitrogen dioxide	
3.3	Carbon monoxide	
3.3.1	Validation with Global Atmosphere Watch (GAW) Surface Observations	
3.3.2	Validation with IAGOS Data	
3.3.3	Validation against FTIR observations from the NDACC network	
3.4	Formaldehyde	
3.4.1	Validation against satellite observations	
3.4.2	Validation against UVVIS DOAS observations from the NDACC network	
3.5	Aerosol	
3.5.1	Global comparisons with Aeronet	
3.5.2	Dust forecast model intercomparison: Validation of DOD against AERONET, and comparisons with Multimodel Median from SDS-WAS	
3.6	Stratospheric ozone	
3.6.1	Validation against ozone sondes	
3.6.2	Stratospheric ozone Validation against observations from the NDACC network	
3.6.3	Validation against FTIR observations from the NDACC network	
3.6.4	Validation against LIDAR observations from the NDACC network	
3.6.5	System intercomparison over the latest annual cycle	
3.7	Stratospheric composition	
3.7.1	Stratospheric NO <sub>2</sub>	

- ▷ NORS used by
  - ▶ A. Inness (Data assimilation experiments with CIFS developed in the MACC project): FTIR. CO and tropospheric UVVIS.NO<sub>2</sub> validation
  - ▶ M. Parrington: UVVIS.NO<sub>2</sub> validation
- ▷ reanalysis 2003-2012, June 2014: O<sub>3</sub> FTIR Izaña, MWR Ny Alesund and LIDAR Haute Provence

# Ongoing discussions

## ▷ validation of Beijing UVVIS NO<sub>2</sub> profile (2008)

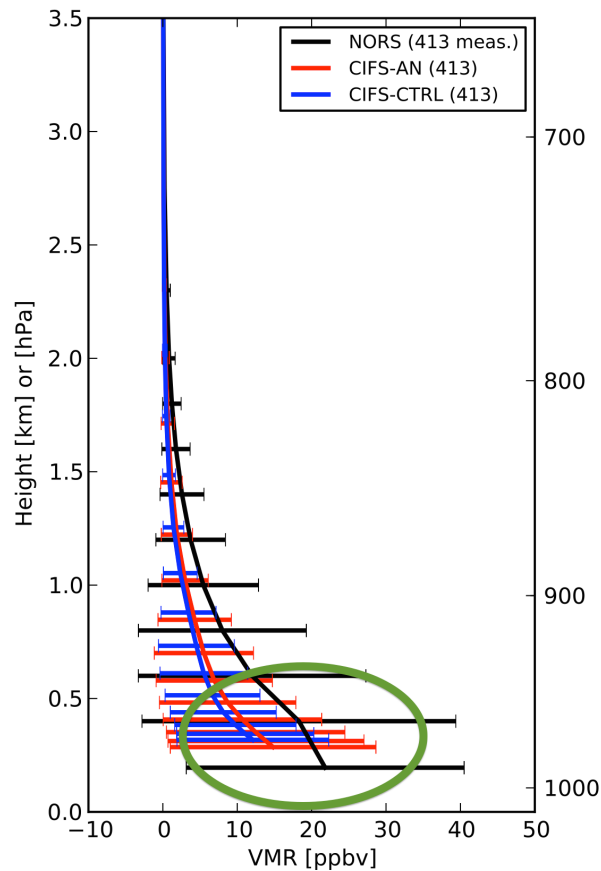
UVVIS.DOAS.OFFAXIS.NO2 mean VMR profile and profile bias (M-O)/O  
with std, BEIJING (lat.=40.0°) unsmoothed profiles



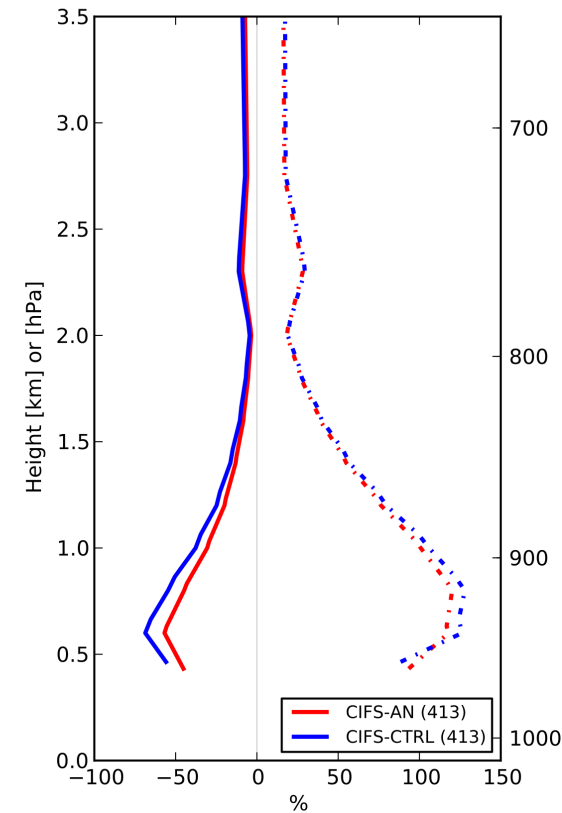
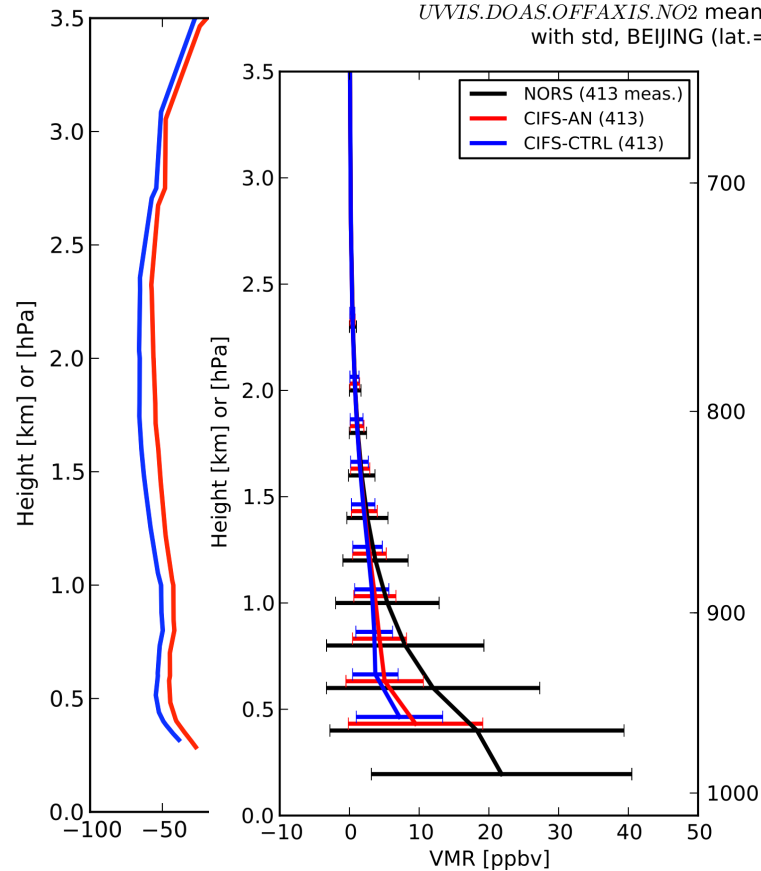
# Ongoing discussions

## ▷ validation of Beijing UVVIS NO<sub>2</sub> profile (2008)

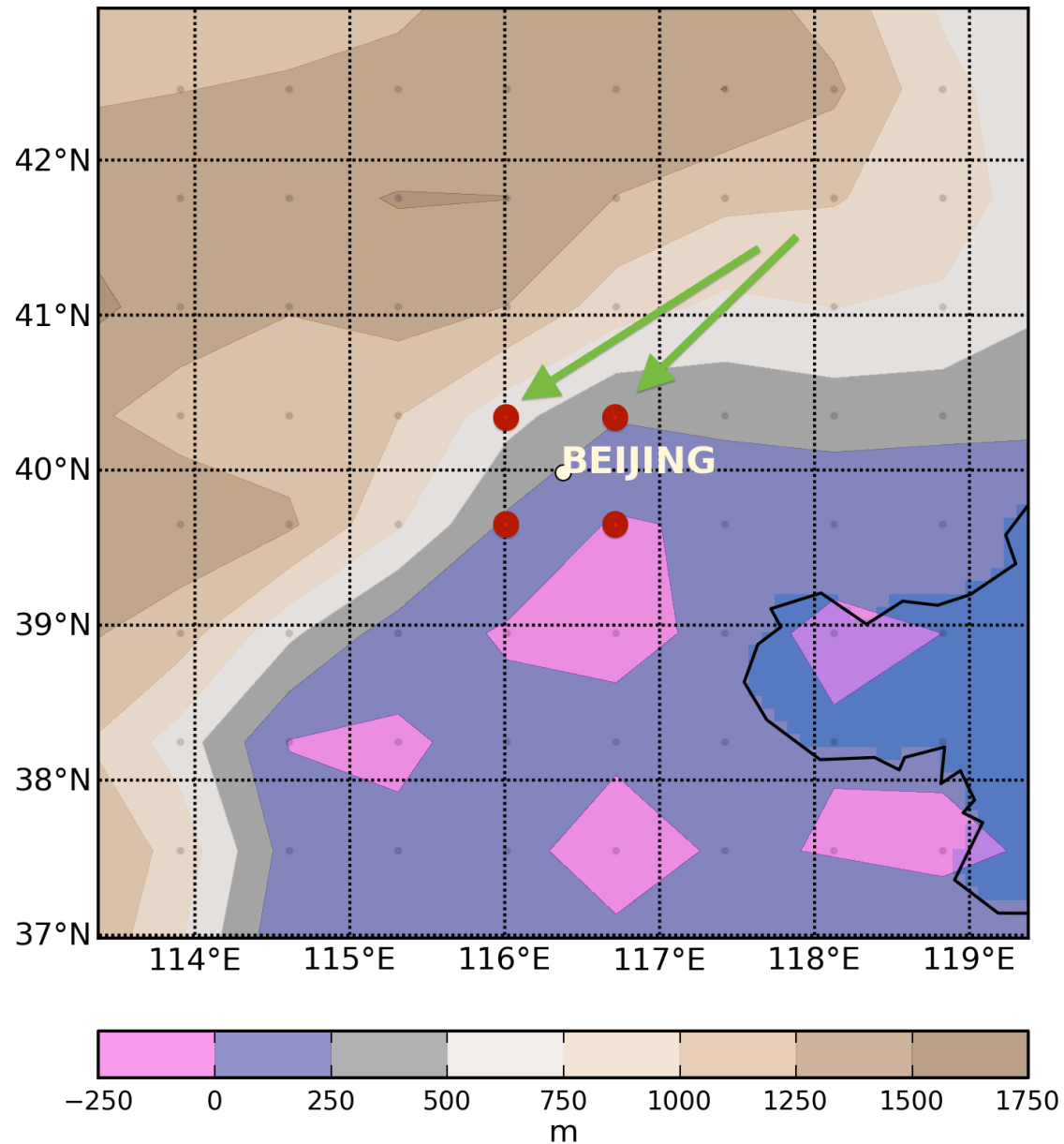
*UVVIS.DOAS.OFFAXIS.NO2* mean VMR profile and profile bias (M-O)/O  
with std, BEIJING (lat.=40.0°) unsmoothed profiles



*UVVIS.DOAS.OFFAXIS.NO2* mean VMR profile and profile bias (M-O)/O  
with std, BEIJING (lat.=40.0°) smoothed profiles

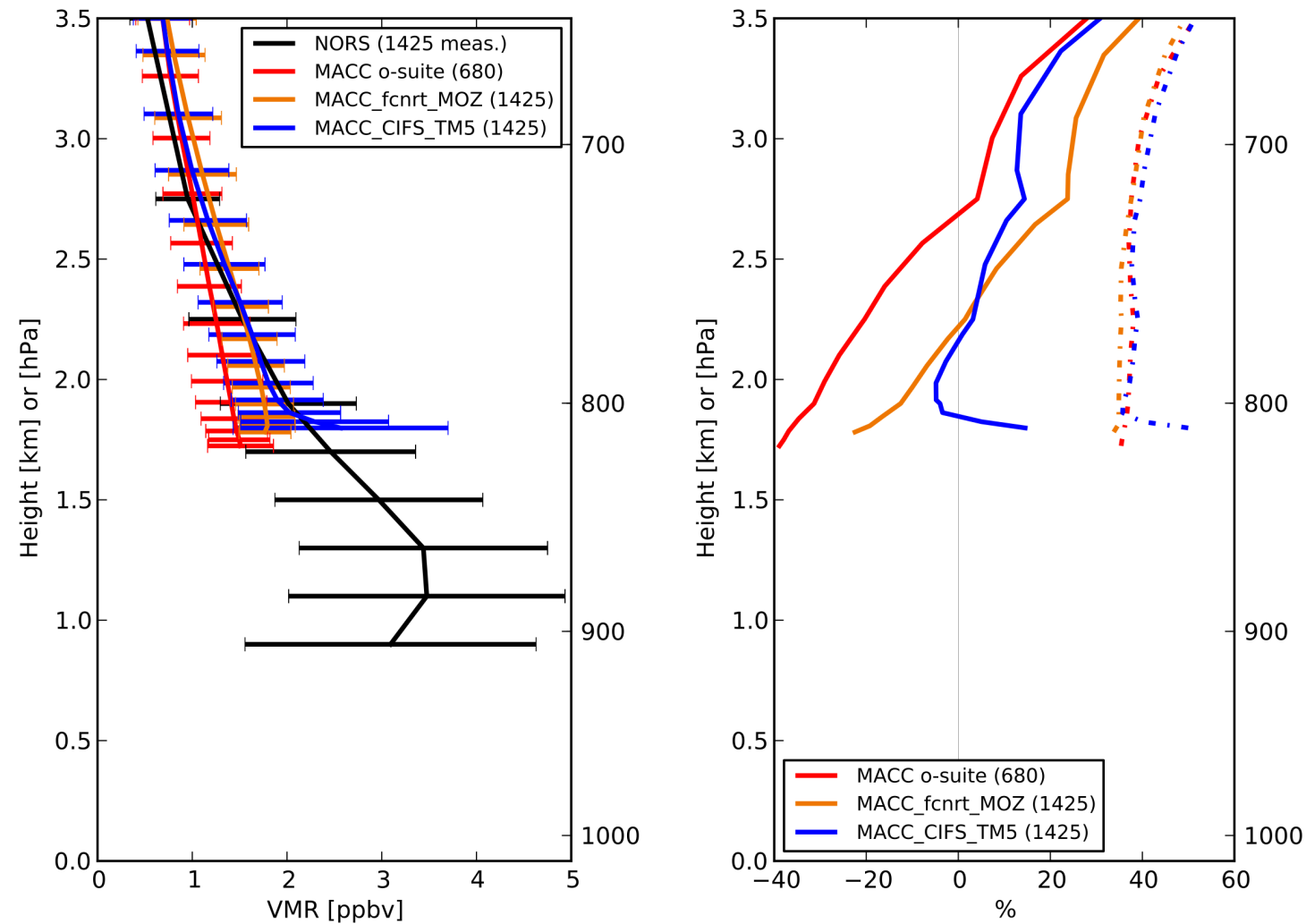


MACC orography N128T255 g54z plot at BEIJING (90.0m)  
OD/DA/Z/global/N128/ECMWF\_AN\_ma\_OD\_DA-Z\_T255-N128\_200101010000\_200101010000.grib



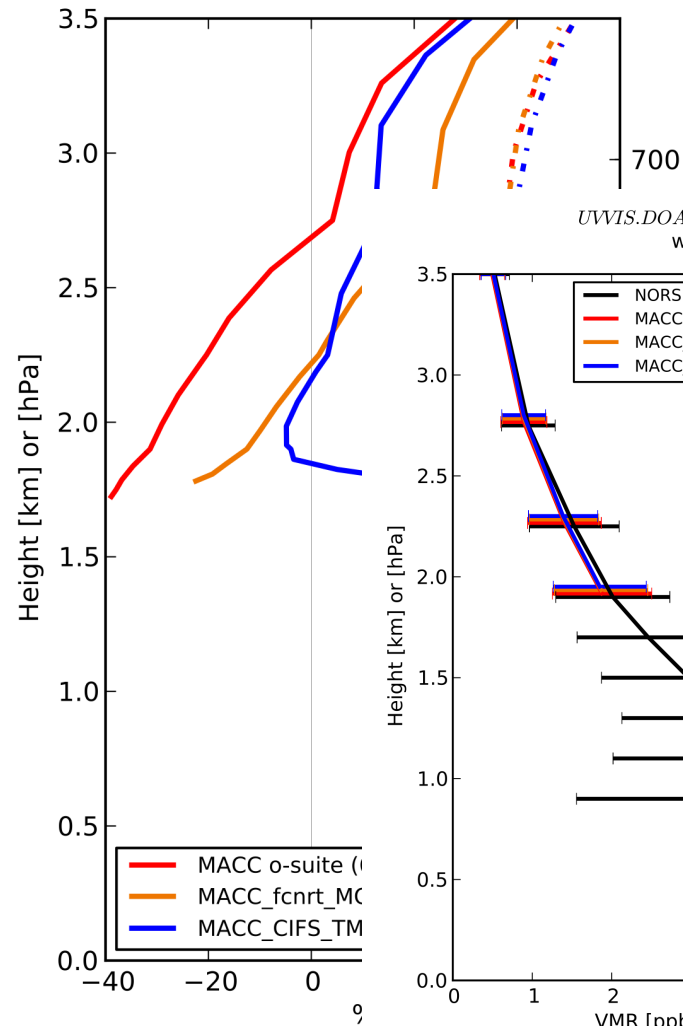
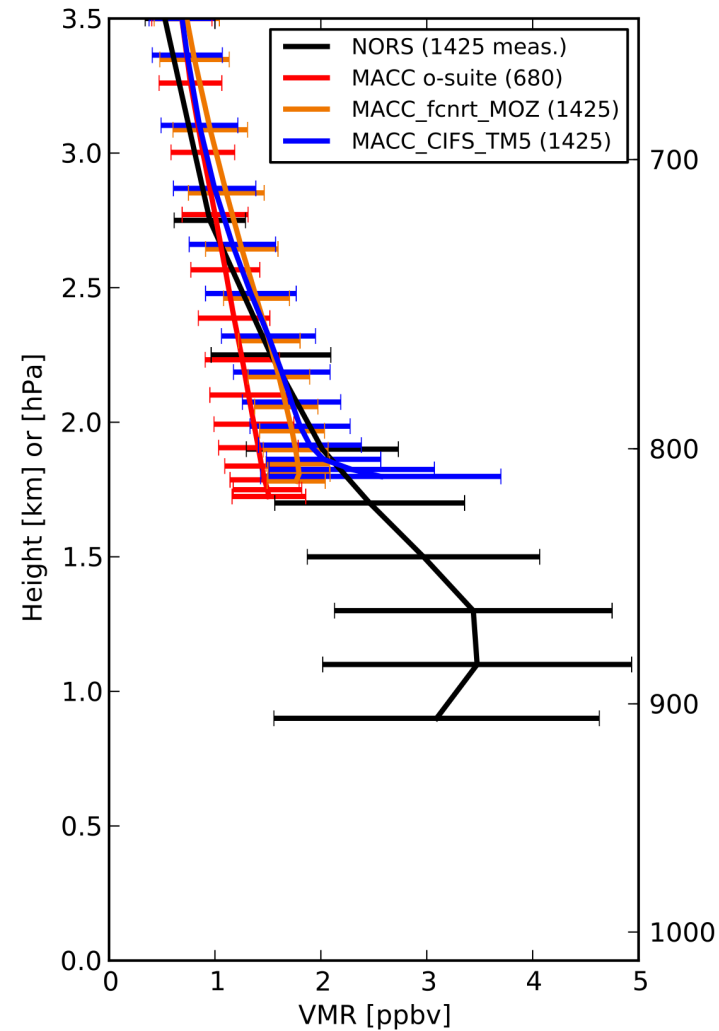
## ► A more extreme situation at Bujumbura, UVVIS H<sub>2</sub>CO (2014)

*UVVIS.DOAS.OFFAXIS.H2CO* mean VMR profile and profile bias (M-O)/O  
with std, BUJUMBURA (lat.=-3.4°) unsmoothed profiles

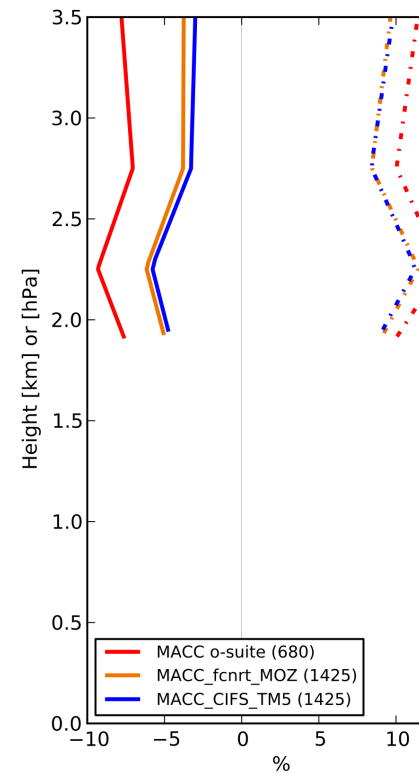
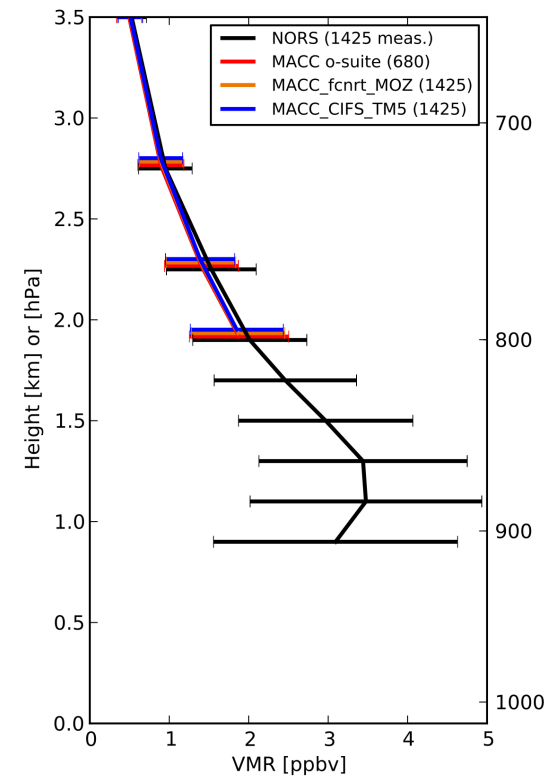


## ► A more extreme situation at Bujumbura, UVVIS H<sub>2</sub>CO (2014)

*UVVIS.DOAS.OFFAXIS.H2CO* mean VMR profile and profile bias (M-O)/O with std, BUJUMBURA (lat.=-3.4°) unsmoothed profiles



*UVVIS.DOAS.OFFAXIS.H2CO* mean VMR profile and profile bias (M-O)/O with std, BUJUMBURA (lat.=-3.4°) smoothed profiles



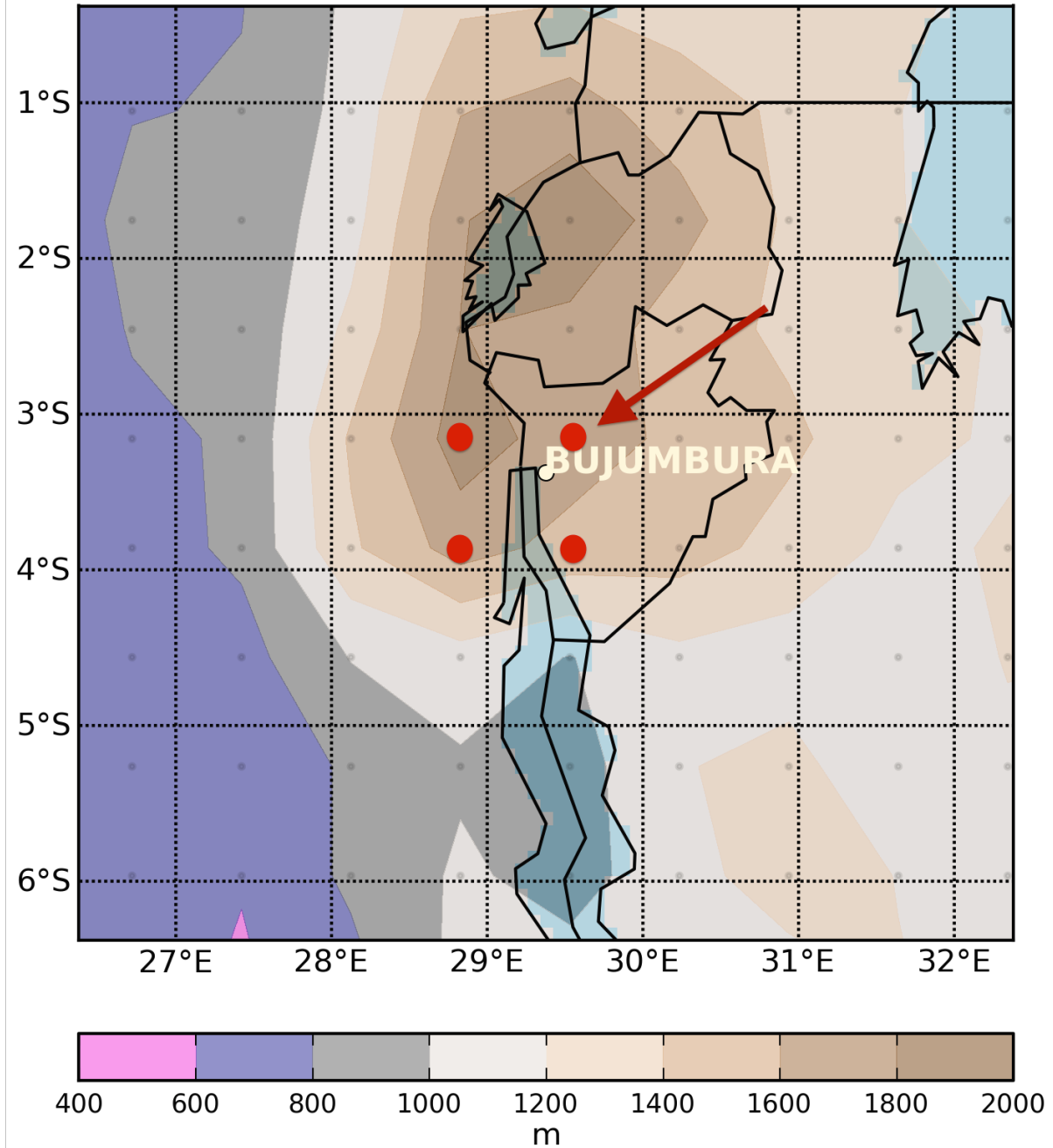
MACC orography N128T213 fnypFC plot at BUJUMBURA (800.0m)  
OD/DA/Z/global/N128/ECMWF\_AN\_ma\_OD\_DA-Z\_T213-N128\_200101010000\_2001

$$z_s = \begin{array}{cc} 17707 & 17855 \\ 15407 & 15117 \end{array}$$

$\neq 800m$

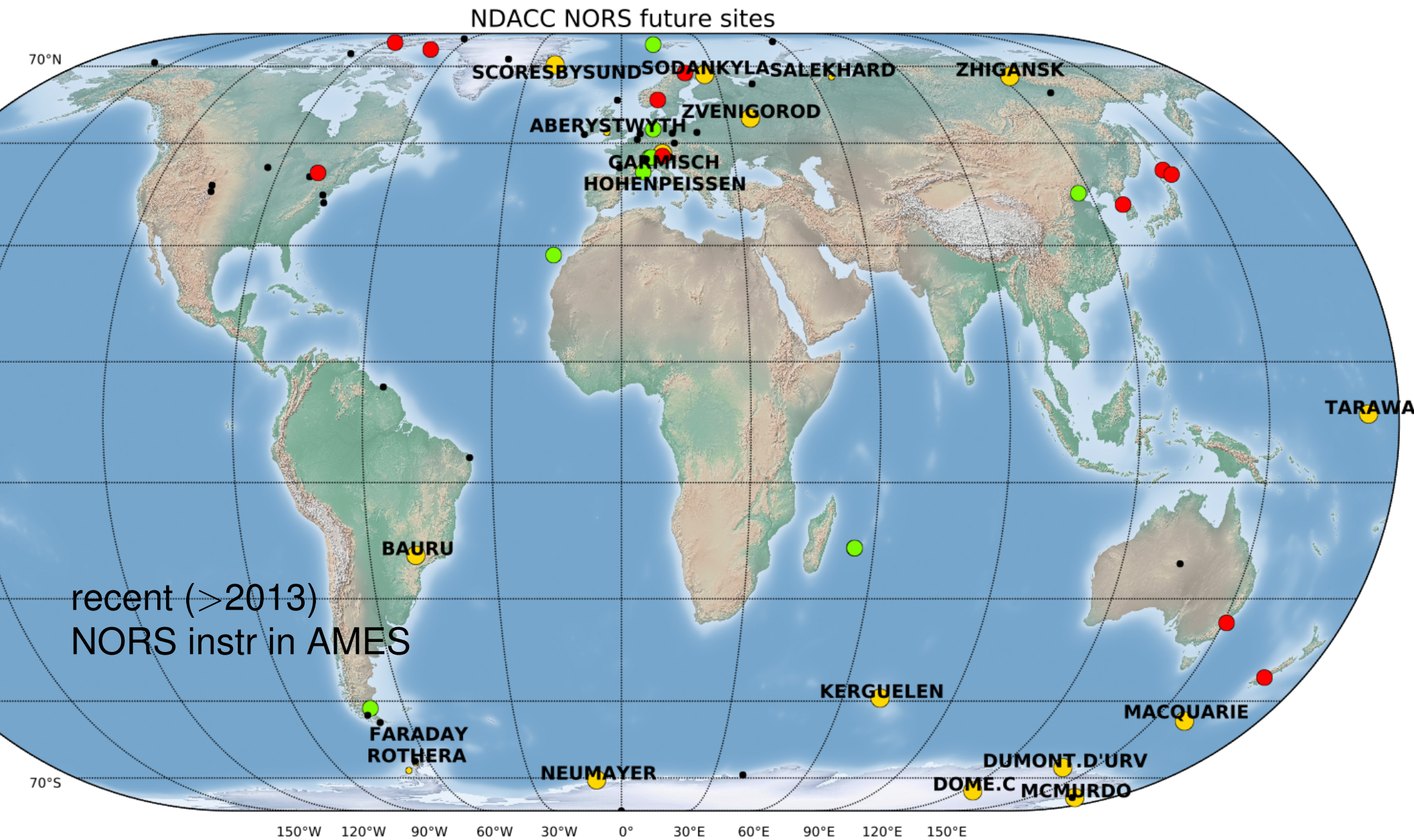
$$p_s = \begin{array}{cc} 84361 & 83506 \\ 85992 & 85292 \end{array}$$

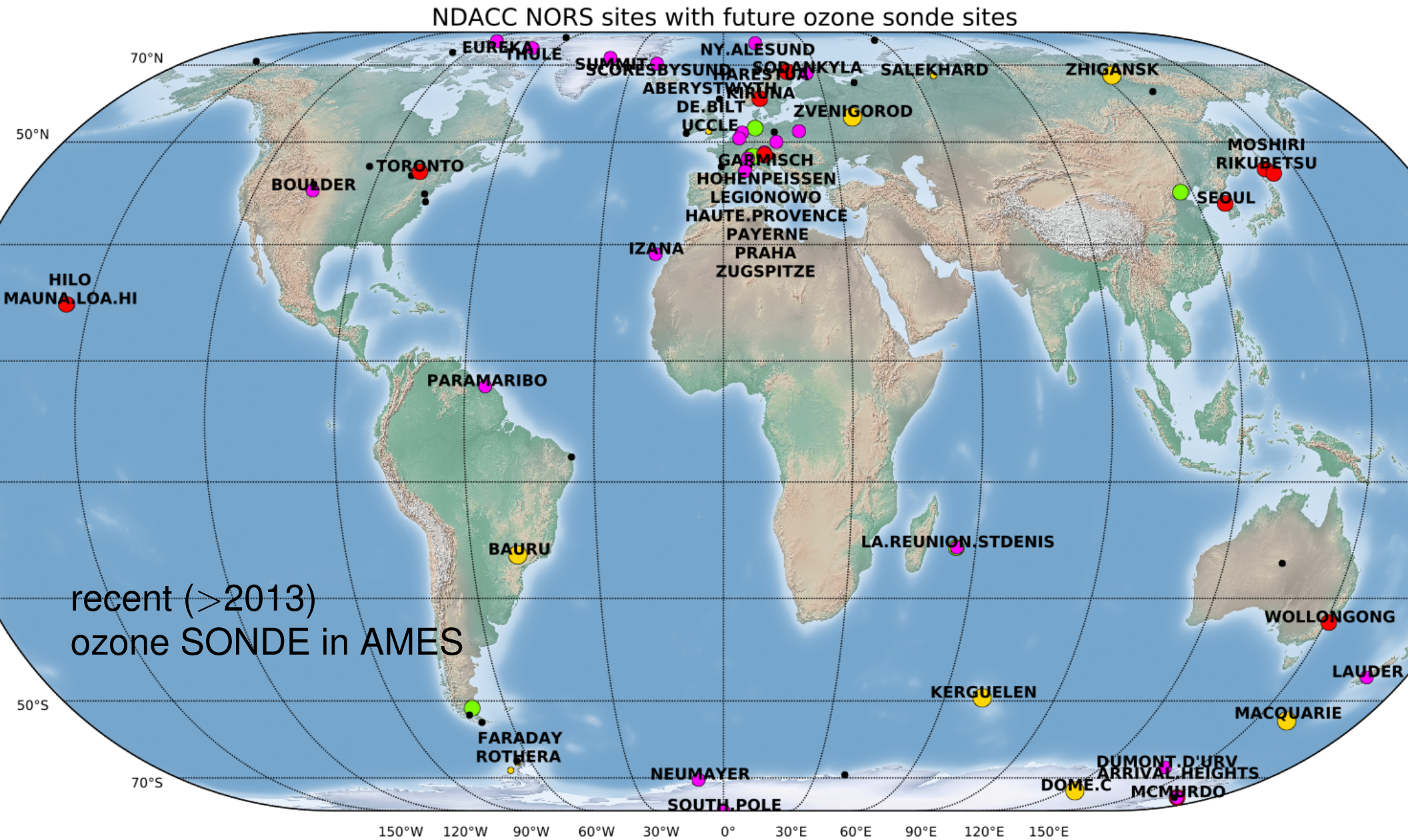
$\approx 1500m$



- ▷ suggestion to use a orography with higher resolution (this does not fix  $p_s$ )
- ▷ MACC-VAL: comparison with unsmoothed model profiles: NDACC data does not contain smoothing uncertainties (FTIR, MWR, UVVIS)

# Future for NORS?





## NDACC NORS sites with future ozone sonde sites

