Network for the Detection of Atmospheric Composition Change

Minutes of the NORS/NDACC UV-VIS Working Group Meeting

3-4 July 2012

Belgian Institute for Space Aeronomy (BIRA-IASB), Brussels, Belgium

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1. Participants

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2. Agenda

Day 1: 3 July 2012

13:00 Welcome (MVR)

13:05 Introduction, agenda (MVR, KK)

Individual team reports
(status of stations, instrument upgrades, data delivery to data base, funding issues, etc)

13:10 BAS (HKR)

13:25 BREMEN (FW)

13:40 LATMOS (MP)

13:55 INTA (OP)

14:10 TORONTO (XZ)

14:25 NIWA (KK)

14:40 BIRA-IASB (MVR)

14:55 HEIDELBERG (UF)

15:10 Coffee break

Post-CINDI activities and other science highlights

15:45 Intercomparison of NO_2 profiling algorithms (FW)

16:00 HONO retrievals in Beijing and Xianghe (FH)

16:15 Aerosol retrievals in Beijing and Xianghe (FH on behalf of Tim Vlemmix)

16:30 Intercomparison of MAX-DOAS aerosol profiling algorithm (UF)

16:45 Surface ozone and NO_2 at Izaňa Observatory from MAXDOAS measurements (LG)

17:00 BrO intercomparison during the CINDI campaign (OP)

17:15 Intercomparison of HCHO slant columns (GP)

17:30 NO_2 sonde for satellite validation (NO2SAV) (AP)

17:45 Adjourn

19:00 Dinner

Day 2: 4 July 2012

NORS session

09:00 NORS: overview and project status (M. De Mazière, project coordinator)

09:15 NORS WP3 status/discussion (Lead: FH)

- GEOMS data formatting
- Rapid delivery service
- QA/QC procedures

09:45 NORS WP4 status/discussion (Lead: FW on behalf A. Richter)

- Harmonisation of stratospheric NO_2/O_3 data products (FH/MVR)
- Stratospheric NO_2 photochemical correction tool (FH)
- MAX-DOAS horizontal averaging effects (TW)
- Harmonization of MAX-DOAS algorithms (NO_2/HCHO/aerosol) (all)
- Intercomparisons (e.g. MAX-DOAS vs. FTIR) (FW/FH)
- Uncertainties (FW on behalf of Andreas Richter)
- Satellite comparisons (OP ?)

11:00 Coffee break

11:30 NORS WP10: extension of NORS to other (NDACC) stations (all)

11:45 Plans for validation activities involving NORS data sets (all)

12:30 Lunch break

13:30 **Follow-up campaign in Madrid 2014 – CINDI-2**

- Introduction (MVR)
- Facilities at INTA (OP)
- Discussion (all)

14:30 **Future of the NDACC UV-VIS network**

(discussion on new molecules, new stations, …)

15:00 AOB

15:15 End of meeting

3. Minutes

3 July 2012

- Welcome by MVR and approval of the agenda
- **Individual team reports**

(status of stations, instrument upgrades, data delivery to data base, funding issues, etc)

BAS (HKR):

- SAOZ at Rothera: since 1996 with an overlap of one year (2007) with a new SAOZ. Difference of maximum 5% between both SAOZ for ozone and 10% for NO_2. Several studies have been published the last three years: Estimation of Antarctic ozone loss (Kuttippurath et al., ACP, 2010 and 2012), NO_2 and NO_y trends and their relation with the Brewer-Dobson circulation (Cook and Roscoe, ACP, 2009; Cook and Roscoe, Atmospheric Science Letters, 2012)
- MAX-DOAS at Halley: 1 miniDOAS and one AVANTES instrument, focusing on BrO and IO. Study on tropospheric BrO enhancements using MAX-DOAS, long-path DOAS, in-situ, and satellite data (Roscoe et al., AMTD, 2012): these measurements show that substantial amounts of BrO should be present in the free troposphere during enhancement events. The miniDOAS instrument also participated to a ship cruise in Antarctic in January-March 2009 with focus on IO (Atkinson et al., ACP, 2012). New AVANTES spectrometer since January 2012 in Halley.
- Spare SAOZ at Halley: plans to use it in Halley in winter for O_3 measurements when no possibility to operate the Dobson instrument. Still some work to be done on AMF (continuing work of Sarkissian) for a 3 DU accuracy in Antartic spring. MVR's comment: try the O_3 AMF

climatology developped by FH in the framework of the NDACC harmonisation of O_3 retrievals. Regarding the Dobson-SAOZ difference, some investigations are needed about the temperature dependence of the Dobson measurements.

BREMEN (FW):

- BREDOM network: Bremen (since 1993), Merida (March 2004 to May 2009), Ny-Ålesund (since 1995), Nairobi, and Crete. Merida is not maintained for logistic reasons and Heraklion was stopped in January 2010 (data from March 2004). New stations are planned: FINO platform in the North Sea (January 2013) and Athens (September 2012). The Bremen Group were also involved in several field and ship cruise campaigns and temporary stations.
- Several upgrades on instruments: at Ny-Ålesund with new CCD in 2012 and pan-tilt head since 2010 and in Bremen with plans for new head and new spectrometers this year.
- Development of a more robust MAX-DOAS instrument in 2012 for the Deutshe Bucht project MeSmart: measuring marine traffic emissions in the North Sea. Installation of the new instrument on the FINO 1 platform in the North Sea beginning of 2013 with focus on NO_2 and SO_2.
- Plans for Athens: at the Pentelli hill with free view to almost the whole Athens area. In-situ instruments and aerosols observations are also available at this site.
- New MAX-DOAS instrument installed in Bremen for testing.
- Data delivery to NDACC: Last update in September 2011 for Ny-Ålesund, Nairobi, and Bremen. NRT analysis successfully tested in Ny-Ålesund in the framework of NORS.
- Financial support for all sites till 2014.
- Last publication: HCHO and NO_2 measurements over remote Western Pacific Ocean with validation of SCIAMACHY and GOME-2 (Peters et al., ACPD, 2012).

LATMOS (MP):

- SAOZ network: 12 french stations + 4 stations operated by other groups. Measurements at Tarawa stopped in 1999. At Zhigansk and Salekhard, episodic shutter problems at cold temperatures. 2 types of data reported: real time data on SAOZ website and on WOUDC, WMO, CAL-VAL, GEOmon, ETHER, and NORS databases and consolidated data on SAOZ website, and NDACC, NORS, and ETHER databases (updated once a year). In NDACC, 2 vesions of the SAOZ data: v1 with annual O_3 and NO_2 AMF and v2 with seasonal O_3 AMF (AMF LUTs developped by BIRA). Aberystwyth and Ny-Ålesund data sets not up to date in the archive. Kerstin Stebel (NILU) is currently cheking the differences

between v1 and v2 in Ny-Ålesund; funding issues for the data analysis in Aberystwyth.

- Participation to the following campaigns: ACE/EUREKA Arctic campaign in February-March 2012 (O_3 and NO_2) with comparison to canadian spectrometers, validation of SCIAMACHY tropospheric NO_2 with the SAOZ instrument on the roof of the University UPMC in Paris, and the DEMEVAP campaign in OHP in December 2011 focusing on water vapor.
- Scientific activities: Homogenisation of SAOZ O_3 and NO_2 data sets in the framework of the NORS WP4; O_3 loss evaluations in Artic and Antarctic (on progress for publication); long-term comparison of satellite nadir and SAOZ O_3 and NO_2 columns at Bauru and La Réunion in the Southern Tropics (Pastel et al., to be submitted to AMT); trend analysis of stratospheric NO_2 at Bauru and La Réunion (Pastel et al., to be submitted to ACP); Improvement of the tropospheric NO_2 column retrieval with correction for the multiple scattering (already applied in Paris and OHP retrievals)
- Remark: HKR is very intersted in the version v3 of the NO_2 columns at polar stations for his trends analysis.

INTA (OP):

- Izaňa station: 2 instruments are currently being operated at this station: RASAS II (visible) from 2010 and Artist II (UV) from 2011. DSCDs are available but not yet the VCDs and vertical profiles. Data series of consolidated stratospheric NO_2 and O_3 columns available from 1993 to 2012.
- Delivery of stratospheric NO_2 and O_3 columns in the NASA-AMES format to the NDACC database every 2 months; last delivery in May 2012. Adaptation to the GEOMS/HDF format currently under progress; HDF test file sent to the NDACC database as part of the NORS WP4.
- Future plans: the NORS and AMISOC projects are supporting the instruments till 2014. AMISOC is a project funded by the Spanish Science Agency aiming at studying the vertical distribution of minor trace gases from the MBL to the free troposphere and their interaction with Saharan dust. Within this project, there are plans to install extra MAX-DOAS instruments on top of the volcano and on the coast together with a long-path DOAS (group of Alfonso Saiz-Lopez). The campaign will take place in July 2013. The participation of an aircraft for particles, O_3, and AMAXDOAS measurements is still uncertain due to the current cost cuts in science in Spain.
- Remark: UF suggested to put perform long-path DOAS measurements from the coast using several retro-refletors on the mountain. Not realistic due to the presence of clouds between the coast and the mountain.

TORONTO (XZ):

- Status of the PEARL site (Polar Environment Atmospheric Reasearch Laboratory) in Eureka operated by the Canadian Network for the Detection

of Atmospheric Composition Change (CANDAC) since 2005: about 25 experiments at three sites; ACE validation campaign in February-April 2012.

- Since 30 april, end of full-time year-round operations due to funding issues. Efforts to find money, but currently, no operators on site (MAX-DOAS is working in an automated way), there are only personnel for campaign measurements. Funding for science and students is better (6-year training program for 2010-2016)
- Several publications in 2010-2012 by Cristen Adams et al. (JGR, 2012; AMT, 2012; GRL, 2012; ACPD, 2012) using ground-based UV-vis data at Eureka.
- NDACC delivery: finished reanalysis of stratospheric NO_2 and O_3 columns up to 2011, will be submitted soon to the database.
- Description of the 2 instruments: the University of Toronto Ground-Based Spectrometer (UT-GBS; zenith only) and the PEARL Ground-Based Spectrometer (PEARL-GBS; zenith, MAX-DOAS, and direct-sun geometries).
- Improvements for the future: cooling system (temperature fluctuations of about 10°C in the room) and fiber for depolarisation (so far, only 1 m long). Cristen Adams did some plots on RMS during the year and thinks it is related to polarisation issues. A longer fiber (3m) will be used. Also plans for negative azimuth suntracking, and moving the suntracker higher to have a free view. Future work on tropospheric profile retrievals is planned as well as comparison with other instruments on the site.
- Preliminary BrO and O_4 DSCD for the 2011 campaign are shown. Bromine explosions are observed in 2011 but not in 2012. In the latter campaign, RMS twice as big; reasons are unknown.
- Use of the new NDACC NO_2 AMF: the difference with respect to the first version of the AMF is of about 4% in spring and then decreases after. FH's comment: in the new version of the NO_2 AMF, the NO_2 profiles are complemented by SAOZ ballons below 18km while in the first version of the AMF, the NO_2 concentration is set to zero below 18 km. It could be the origin of the difference between both data sets. To be checked.
- MVR asked more information on the polarisation and suggested to calculate the polarisation efficiency of their current fiber. They have only 1 polarizer in the visible (and they need 2) – but in the UV, polarizers are less expensive. UF said that it can be other things, like illumination of the grating changing with the time. To be cheked. HKR asked if it is possible to perform measurements using moon-light: it is planned but they are not doing them yet due to problems with the fitting results of the direct sun - AC said that it could be due to their retro-reflecting neutral filter, being at the vertical. If they tilt the neutral filter a little bit, there will be less retro-reflecting light coming as straylight. MVR and UF said that using a diffuser plate would help for having a very homogeneous illumination of the slit.

NIWA (KK):

- Status of the Lauder station: UV-vis (NO_2, O_3, and BrO), but also FTIR spectrometer, Dobson, ballons, lidar, microwave, ozone, aerosols lidar, UV spectrometers, and chemistry climate modelling. Staff: 6 scientists, 5 technicians, and usually 2 PhD and 2 overseas students. Funding are being cutted down. It would mean staff cutting down to 3 scientists. UV-vis data archived from December 1980, quality-check and processing up to date.
- Status of the other NIWA stations: Kiruna stopped in april 2010 (because funding issues, but there is the Mainz instrument). Moshiri/Rikubetsu in Japan (April 91 to December 2007); Mauna Loa (2009 to now), Macquirie Island (quality-check and processing up-to-date); Arrival Heights (since 1991; quality-check and processing up-to-date; since 1998, a MAX-DOAS from NIWA is measuring continuously with UF's instrument).
- Big problem of funding for UV-vis activities at NIWA; KK doesn't know what is going to happen to all these stations. MAX-DOAS is a very low priority in NIWA science interests. Best case scenario: continuing measuring until any problems arise. It should be more clear at the end of July 2012. HKR suggested to include NIWA in European Projects in order to get soft money. Lobbying is needed to try to save the Lauder station.

BIRA-IASB (MVR):

- Status of BIRA stations: Harestua (dual channel zenith-sky system operated since 1998; installation of a MAX-DOAS spectrometer in summer 2012 to have overlap with the zenith-sky system; it will operate first in zenith geometry and then upgraded to MAXDOAS), Uccle (miniDOAS since May 2011 focussing on NO_2 and aerosols; a lot of complementary measurements available on site like a CIMEL sun photometer, a Brewer, ozonesondes, ceilometer, and in-situ NO_2), Jungfraujoch (SAOZ since 1990 and a dual channel MAX-DOAS system since July 2010), OHP (UV zenith-sky spectrometer focussing on BrO since 1998; upgraded in 2005 to allow for MAX-DOAS measurements of tropospheric NO_2 and HCHO columns; will be replaced in 2013), China (Beijing from June 2008 till April 2009 and then Xianghe (~50km outside the Beijing city centre) since March 2010; it will be included in NDACC in the near future), Burundi/Bujumbura (plans for installation of a MAX-DOAS system in December 2012 in cooperation with University of Bujumbura in the framework of the national project AGACC-2)
- Data evaluation tools developed at BIRA: (Win)QDOAS for DSCD retrieval (over 100 users around the world), UVSPEC/DISORT RTM coupled with PSCBOX and SLIMCAT photochemical models, bePRO (LIDORT-based tool for profile retrieval). Ongoing development with RT-solutions (Rob Spurr): LIDORT-based twilight tool with capabilities to handle 2D photochemical fields, linearised jacobians, and horizontal averaging kernels.
- Ongoing projects and plans: SHIVA, NORS, ACTRIS (EU projects), national AGACC-2, satellite validation activities (ESA multi-taste, SQWG, ESA O3-CCI, O3MSAF)

- Future: maintain and sustain the stations, operate Burundi, improve the operational aspects of the monitoring in support of satellite validation and GMES (NORS).

HEIDELBERG (UF):

- Heidelberg network: Alert (installed in 2008 but various instrumental problems since then, now continuously in operation), Hohenpeißenberg (new instrument with 2D scanner since 2008, extended geometry with direct light and almucantar since March 2012), Zugspitze (since 2001), Cape Verde (since 2006 with varying data quality), Suriname (MAX-DOAS instrument since 2002 and optics improved in 2009), Neumayer (continuous operation since 1999), Arrival Height (continuous MAX-DOAS measurements since 1998 in collaboration with NIWA; re-analysis using the new NDACC recommendations in progress), and instrument on the Polarstern vessel (permanently installed and no problems since autumn 2011).
- Profiling algorithm (aerosols and trace gases): new version with user-friendly interface recently released and running on a IDL virtual machine. Several examples of aerosols and trace gas retrievals from the EUCAARI 2009 and OASIS 2009 campaigns are shown together with comparisons with correlative measurements.
- Hohenpeißenberg: located at 200m altitude and looking downward (-2° and -10°) and upward. Good comparisons with in-situ NO_2 surface mixing ratio. MVR's question: how to calculate the downward elevations, i.e. how to simulate the orography ? UF said that it is not a big issue because at Hohenpeißenberg the surroundings are quite flat. Moreover, Monte Carlo simulations of TW showed low sensitivy to mountain flanks.
- Zugspitze (altitude: 2650m): some pollution is coming up from the valley sometimes. Both MAX-DOAS instruments at Zugspitze and Hohenpeißenberg will be combined in order to estimtate the NO_2 vertical profile in both the boundary layer and free troposphere.
- Polarstern measurement: examples of IO and HCHO measurements on the West Coast of Africa (contributions from Johannes Lampel and Katja Großmann); Discussion on possible interference of water vapor on IO measurements.

• Post-CINDI activities and other science highlights

HONO retrievals in Beijing and Xianghe (FH):

- So far, sparse HONO measurements based on field campaigns only, so continuous MAX-DOAS measurements are highly valuable to better understand the HONO formation mechanism and its contribution as OH source.
- HONO and aerosols extinction profiles retrieved with the bePRO tool developed by Clémer et al. (AMT , 2010). HONO averaging kernels show a maximum of sensitivity below 700m altitude. Tests on the influence of

the HONO a priori profile show that the choice of the a priori has an impact on the retrieved profiles but not where the sensitivity is maximum (0-400 m altitude range). It is also shwon that the choice a priori has an impact of maximum 10% on the retrieved HONO VCDs.

- HONO VCD time series show a large variation at both stations. Smaller minimum values during the winter in Xianghe than in Beijing. Time series of HONO VCD monthly means at 70°SZA AM and PM further confirm the larger HONO column values at Beijing. A reasonably good correlation is found between HONO VCDs and NO_2 VCDs estimated using the geometrical approximation (R>0.6).
- Investigation of the diurnal variation of the HONO VMR in 0-200m layer at both sites and validation of the MAX-DOAS HONO VMR at surface using in-situ data from the CAREBeijing 2006 campaign.
- Ongoing work: Retrieval of NO_2 profiles from MAX-DOAS observations in the visible region. Investigation of the HONO/NO_2 VMR ratio and the HONO-NO_2 VMR correlation close to ground. Estimation of the OH production from the HONO concentration and photolysis rate.

MAX-DOAS observations of tropospheric aerosols and HCHO (FH on behalf of Tim Vlemmix)

- Main subject of the talk: Since the information content of MAX-DOAS measurements is quite low (DOFS typically of about 1.5-2), what is the impact of the a priori settings on the aerosols and HCHO retrievals ?
- Focus on 1 year (2011) of MAX-DOAS observations in the UV range at Xianghe. Use of the bePRO profiling algorithm (Clémer et al., AMT, 2010).
- Use of exponentially decreasing a priori profiles characterized by a scaling height (SH) for both aerosols and HCHO. 3 different scaling height values were used: 0.5 km, 2.5 km and SH=boundary layer height (BLH) derived from ECMWF analyses. The last case is investigated because the boundary layer height shows a large variability from day-to-day and with season. Therefore, using a fixed SH can introduce systematic effects in the aerosols and trace gase retrievals.
- Nice correlation between AOD retrieved using SH=0.5 km and 2.5 km; not the case for HCHO columns. Similar results for HCHO concentration and aerosols extinction coefficient at surface.
- Introduction of the H75 quantity for profile comparison, which corresponds to the altitude (in km) below which 75% of the integrated aerosol/HCHO retrieved profile resides.
- Three different scenarios were investigated:
    - Low AOD (<0.2) days: only H75 aerosol corresponding to the SH=BLH case reproduces qualitatively the diurnal variation of the ECMWF BLH. A good agreement is found between retrieved AOD for the three SH values and AERONET data. Regarding HCHO VCDs, the three retrievals are in reasonably good

agreement with the geometrical approximation and direct-sun data. The HCHO surface concentrations retrieved using the three different SH values differ quite a lot.

  - High AOD (>0.6) days: Good agreement between the three retrievals regarding H75 aerosol and AOD. However, the diurnal variation of the BLH is not reproduced by any of the three retrievals. Regarding HCHO VCDs and surface concentrations, a good agreement is found between the SH=0.5 km and SH=BLH cases.
  - Scenario with strong AOD gradient between morning (low AOD) and afternoon (high AOD): H75 aerosol qualitatively follows the BLH variation only in the morning (low AOD). Good agreement between the retrieved AOD corresponding to the three SH scenarios and AERONET data. Reasonably good agreement between retrieved HCHO VCDs and geometrical approximation and direct-sun data.

- Scatter plots between H75 aerosol for the three SH scenarios and BLH: for AOD<0.2, the three retrievals reproduce more or less the a priori. H75 aerosol follows the BLH dirunal variation only if this information is provided in the a priori. For high AOD, H75 aerosol is almost independent form the a priori.
- Future work: similar study in Xianghe on NO_2/aerosols in the visible, and in Uccle using miniDOAS and ceilometer data.
- Remarks: 1) UF: changing the a priori with time introduces variations in the results and then you don't know if it is related to the a priori change or if it is information contained in the measurements. 2) FH and FW: Case with SH=2.5 km is most of the time not realistic; it's the only one giving the very different results with respect to the two other retrievals (SH=0.5 km and SH=BLH). 3) UF: one possibility to get rid of the a priori is to use the Tikhonov regularisation, but tests performed by the University of Heidelberg showed that it does not work.

Aerosol profiling during CINDI (UF)

- Aerosol profile comparisons during CINDI: several groups (BIRA, Bremen, Heidelberg, KNMI, MPI, JAMSTEC) are involved either with full extinction profiles or AOD only or AOD+layer height. It is still time to submit data. Correlative observations available: RIVM backscatter lidar, KNMI ceilometer, RIVM Raman LIDAR, PSI nephelometer, TNO CIMEL, TNO absorption photometer
- Comparison between MAX-DOAS and ceilometer measurements: All MAX-DOAS data converted to 477nm using the Angstrom coefficient from the CIMEL; vertical resolution of the back-scatter signal from the ceilometer first degraded from 7.5 m to 200m, then convolved with the MAX-DOAS averaging kernels; comparison only on the golden days. Features seen by the ceilometer are most of the time also found in MAX-DOAS retrievals, including uplifted layers; sometimes some higher signal

are seen in MAX-DOAS data but not in the degraded ceilometer data; Good consistency between the MAX-DOAS groups regarding the diurnal variation of the extinction profile.

- Comparison of AOD and surface extinction between MAX-DOAS retrievals and humidity-controlled nephelometer and sun photometer data (Zieger et al., ACP, 2011): sometimes big descipancies in the afternoon where all the MAX-DOAS retrievals have higher surface extinction and AOD.
- AOD correlation between MAX-DOAS and the sun-photometer: Good correlation for all groups (R higer than 0.8) and slope between +/- 30%.
- The CINDI aerosols paper is in progress.
- Discussion: 1) KNMI has a new retrieval version with AOD and layer height as Mainz. They will send the data ASAP to UF. 2) UF: during the EUCAARI campaign, much more clear sky days were available and the use of intensity and several O_4 bands were possible. It improved the retrievals (robustness of the algorithm). Not possible for CINDI, so most algorithms uses only one O_4 band and only KNMI used the intensity. 3) All: discussions about the impact of clouds, differences in reference spectra, small differences in measurement time.

Surface ozone from MAXDOAS measurements at Izaňa Observatory (LG):

- Development of an OEM profiling code in progress. Difficulty: Since the Izaňa station is in the free troposphere, the trace gases concentrations are low and show no strong variation.
- CIMEL data shows that there two typical situations regarding the aerosols: very clean days with low AOD and Saharan dust events associated with high AOD.
- Typical detection limit of O_3 DSCDs: 1-5x10^{17} molec/cm².
- O_3 retrieval tests using the geometrical approximation for 0° and 90° elevation (assumption: same scattering path for both). Optical paths are calculated from O_4 DSCD measurements and from RTM (LibRadTran) simulations using the single and multiple scattering modes.
- Comparison of retrieved surface O_3 with in-situ data: quite good agreement with the RTM simulations method.
- Future work: same study with NO_2; extension to other clean days; try OEM
- Discussion: Very nice results. It seems to work well, and the retrieval of surface ozone is a new application for MAX-DOAS observations.

BrO intercomparison during the CINDI campaign (OP)

- Very preliminary intercomparison of MAX-DOAS BrO during CINDI. 5 groups have sent data so far: Bremen, BIRA, Heidelberg, MPI, and INTA. Waiting data from NIWA. Not very good overlap in measurement days

between the different groups. Two different settings baselines: a common one and the preferred settings of each group.

- Common settings: overwiew of DSCD diurnal variations for different viewing angles and different groups. Not very good agreement, often very noisy.
- Preferred settings: give sometimes better agreement. Between BIRA, Bremen and Heidelberg, the correlation coefficient is around 0.7 and slopes around 0.8.
- When averaging several spectra: less noisy but not better agreement.
- Concluding remarks: better comparison for higher elevations (less affected by O_4 and Ring). Important differences from day to day.
- Discussion: bad agreement between the different groups compared to previous similar comparisons (e.g. the Andoya campaign; but it was only the zenith sky measurements and probably also higher BrO columns). Some groups are not noisy and compare quite well. In this case, one can expect to see the more DOAS-specific errors due to fit, interferences (O_4, HCHO, Ring…). It is better to perform a zenith sky comparison first since we don't expect large BrO amounts in the troposphere.

Intercomparison of HCHO slant columns (GP)

- Very good comparisons of HCHO DSCDs retrieved by 9 groups using harmonized retrieval settings. The scatter plot slopes are close to one, within ~15%.
- Sensitivity study has been performed leading to new recommended DOAS settings (a 5th order polynomial and the O_4 Greenblatt cross-section are needed in order to reduce interference and misfits with Ring and BrO).
- An error budget has been derived for HCHO DSCD, with total errors around 20-30% (8-15x10^{15} molec/cm²). Larger systematic contributions: Ring effect and HCHO and O_3 cross-sections uncertainties.
- The paper is ready to be sent to all co-authors for last checks and then it will be submitted to AMTD.

NO_2 sonde for satellite validation (NO2SAV) (AP):

- Project developed within the ESA Innovation Triangle Initiative. The purpose is to build a NO_2 sonde ready for serial production in cooperation with the industry (GRAW radiosondes). Timeline: user evaluation model by end of 2013; final product by end of 2015.
- Launches: during CINDI, at KNMI (De Bildt), and participation to the DISCOVER AQ (Baltimore/USA) and PEGASOS (Cabauw) campaigns. Still have some calibration issues, so another NO_2 measurement is needed to get the good scale, but the shapes and large and small variations are very well captured.

- Comparison to models (CHIMERE and LOTUS-EUROS) and back-trajectories study to interpret the differences in higher layers between the sondes and the models.
- Next steps: determination of what affects the sensitivity, optimization of design and calibration procedure, knowledge transfer to GRAW radiosondes, analyses of DISCOVER-AQ and PEGASOS data.

Intercomparison of NO_2 profiling algorithms (FW):

- Status of the NO_2 profiling intercomparison paper: internal review until 15/7, then will be sent around and comments will be collected until 10/8 and submission on 20/8.
- The paper is mainly focussed on the simulation study consisting of retrieving NO_2 vertical profiles from simulated NO_2 DSCDs corresponding to known NO_2 profiles and aerosols scenarios. Participation of 9 groups, 6 of them with OEM, and the other 3 with the trace gas parameterisation approach.
- Simulations of several types of profiles (shapes and pollution content) and focus on NO_2 VCDs and surface concentrations:
  - VCD comparison: generally within 25% of the true VCDs for the different groups. The geometrical approach also works fine but has a larger scattering. Larger differences between the different groups are obtained for block profiles and shallow layer (especially for the parameterization approach).
  - VMR in the lowest 200m: most of the groups can get them, for most of the scenarios.
  - Ranking plot of the different groups for all the scenarios (will not be in the paper)
- Conclusions: VCD and VMR within 25% for most cases; LOS <3° are crucials for good profile retrievals; problems above 75° SZA and often for low azimuth values (<20°); DOFS generally between 1.5 and 3.
- Discussion on next step: 1) We need to improve the aerosol part of the retrieval. 2) What is the recommendation for NORS ? Should every group use their own best retrieval ? Should we report profiles (and AK and error matrix) or should we report only surface concentration and columns ? The first suggestion seems to be the best. For the first layer, 0-200m would be the best choice for the different groups and different scenarios. 3) Can we do more on these data or not?

4 July 2012

- **NORS session**

NORS: overview and project status (MDM, project coordinator)

- Introduction to the NORS ("demonstration Network Of ground-based Remote Sensing Observations in support of the GMES Atmospheric Service") FP7 project in the context of the European initiative GMES (Global Monitoring for Environment and Security). The overall objective of NORS is to perform the required research and development to optimize the NDACC data and data products for the purpose of supporting the quality assesments of the future GMES Atmospheric Service (GAS):
  - Target data products: tropospheric and stratospheric O_3 and NO_2 columns and vertical profiles, tropospheric profiles of NO_2, HCHO, and aerosol extinction, tropospheric and stratospheric CO and CH_4 columns.
  - 4 NDACC techniques: FTIR, MAXDOAS, microwave, and lidar.
  - 5 pilot stations: Ny-Ålesund, OHP, Jungfraujoch, Izaňa, and Reunion Island
  - Partners: BIRA, EMPA, INTA, UBern, KIT, CNRS, UBremen, ULg, MPIC, UHeidelberg, and S & T
- NORS started on 01/11/2011 for a duration of 33 months. KO meeting was held on 14/12/2011 at BIRA. Website: nors.aeronomie.be
- An important NORS objective is to develop and implement a web-based application for the validation of MACC-II model products using the NORS data (set up of the system: April-July 2013). The User Requirements Document (URD) for the validation server will be delivered in the course of July 2012.
- MDM's questions to the NDACC UV-vis Working Group:
  - Related to the URD: What are the spatial and temporal colocation criteria for the validation of MACC-II products using MAX-DOAS data (location of the effective airmasses, quantities to compare) ?
  - Related to WPs 3 and 4: GEOMS/HDF format issues and user guide of the data, harmonisation and characterization of products, comparison between FTIR and UVVIS data for NO_2 and HCHO
- Invitation for all NDACC UV-vis teams to contribute with their data to the NORS data stream and validation server but according to the guidelines (HDF format, etc) decided by the UV-vis Working Group.
- It is decided that all these issues will be discussed later in the sessions related to the different WPs.

NORS WP3 status/discussion (lead: FH): Rapid Data Delivery at the 4 NDACC pilot stations

- Overview of the WP objective (implementation of procedures for the delivery of the data in the GEOMS/HDF format to the NORS validation server with a delay of maximum 1 month after acquisition) and related tasks

- The set up of the data delivery systems was due for month 6 (April 2012); next tasks: Optimisation and testing of the data delivery systems; routine data delivery due for July 2013.
- GEOMS/HDF data format issue: format description, template, and tools for the creation of HDF files for UV-vis data are available on the AVDC website (**http://avdc.gsfc.nasa.gov/index.php?site=1876901039**). The 3 geometries (zenith-sky, MAXDOAS, and direct sun) are implemented in the same file. If data are reported only for one geometry, fill-in values are used for the variables corresponding to the two other geometries.
- Quality Assurance/Quality Control: some verifications are already done by the IDL program routine used to create HDF files like checks for values outside the specified range, inconsistencies with the datetime variable, uncorrected fill-in values. Discussion about additional quality checks like e.g. remove OEM-based retrievals corresponding to low DOFS and/or large residuals:
  - In the FTIR community, there is no common choice and every group has its own treshold values and submit only what they think to be good retrievals. The drawback is to have differences between groups on how the RMS is defined and on the retrievals rejection criteria. There is also the risk to be too restrictive and to reject too much data.
  - TW suggested to add quality flags in the files like a flag describing if the aerosols profile retrieval was successful or not, a flag for sky conditions (cloudy or not). For instance, a flag system is commonly used in the satellite community. Here, there are four difficulties: 1) The current HDF template for UV-vis data does not support the use of quality flags; 2) How to implement such a flag system for NRT delivery ? 3) How the end user will use these flags (sometimes the trace gas retrieval is very good even if there are clouds) ? 4) Regarding clouds, how to discriminate large aerosol events from clouds ? It should be also noted in the other communities, no one has introduced quality flags in GEOMS data files. The GEOMS file should be also self-consistent, with the explanation of the file in a metadata attribute, and not somewhere in a document.

    Action item #1: MDM will ask to GEOMS colleagues if the GEOMS format is still open to include quality flags with different numbers meaning different conditions/problems.

    Action item #2: TW will perform additional investigations on how to implement a flag for clouds in an operational way based on e.g. the color ratio, the intensity, and the O_4 absorption.
  - Remark from all: A quality flag will be an ancillary information, a kind of warning, but it does not mean that the data are not usable.
  - AC: Another way could be the use of different data version like in the AERONET network.
  - All: A different way to proceed would be to include all these effects in the error budget.

- In the context of NORS/GMES, it is important for the NDACC UV-vis groups to move to this new data format. Question: what to do with the past NASA-AMES data ? A discussion in the FTIR Working Group is ongoing, with idea of reprocessing the old data in the HDF/GEOMS format. MVR's remark: GEOMS is a metadata format, and it could be coupled with other format files like NETCDF.
- Technical issue: The IDL virtual machine is not easy for an automatic processing of HDF files. There is a script to do it in an automatic way, but it seems that a licence is needed and it does work fine only with IDL 8 (UHeidelberg and CNRS have problem: the routine is working but the quality check is complaining because the name of the variables has been cutted and then the format is not GEOMS compliant anymore).

  Action item #3: FH will ask to the BIRA IT team if it is possible to overcome this problem.

  Action item #4: AC said that Christian Retscher when at AVDC used Python tools to create HDF files. He will ask him if these tools can be distributed.
- Question from FW: Is the moon pointing mode included in the current HDF template. FH: It is not the case but this mode can be added if needed.

NORS WP4 status/discussion (lead: FW on behalf Andreas Richter): Advanced characterisation of NORS data products

- Objective of the WP: produce the data in a way that it is directly usable by the GMES Atmospheric Service. So, there are needs for data harmonisation (format and content), full characterisation (integration volume, resolution, sensitivity), full description of uncertainties, and comparison to satellite data used for assimilation.
- Changes with respect to the current NDACC UV-vis approach: interest (both the stratosphere and troposphere), data format (GEOMS/HDF), data provision (NRT), detailed error budget, and application (automated use for daily validation)
- Overview of the different WP tasks.
- Specific presentations:
  - Harmonisation of stratospheric NO_2/O_3 data products (FH):
    - Due to the lack of consistency between the different stations, an harmonisation of NDACC UV-VIS total O_3 and stratospheric NO_2 retrievals was decided at the UV-vis Working Group meeting in Cambridge in November 2007. Regarding O_3, recommendations for DOAS settings and AMF look up tables based on TOMS V8 climatology were made available by BIRA at http://uv-vis.aeronomie.be/groundbased.
    - The SAOZ team has applied these recommendations to their stations and made a validation of the new data sets through comparison with Dobson and Brewer data at OHP and Sodankyla.

The differences between satellite nadir and SAOZ data sets were also investigated (Hendrick et al., ACP, 2011). This study clearly shows an quality improvement of the new SAOZ data sets.

- Similar recommendations for the NO_2 stratospheric column retrieval were released by BIRA a few months ago. They include NO_2 AMF look-up tables based on the combination of the Lambert et al.'s climatology of stratospheric NO_2 profiles based on HALOE and POAM III data and a climatology based on SAOZ balloon observations. These recommendations are also available on the http://uv-vis.aeronomie.be/groundbased web page.
- Climatologies of total O_3 and stratospheric NO_2 averaging kernels have been also made available by BIRA at http://uv-vis.aeronomie.be/groundbased
- An additional questionnaire was also sent about the DOAS settings for stratospheric NO_2 retrieval. There was a good consensus between the different groups regarding temperature correction (to be estimated from a monthly zonal climatology of temperature profiles and to be coupled directly to the AMF tool), filtering of data with tropospheric pollution (Langley plot method), Ring effect (post-processing based on SZA parameterisation), impact of twilight photochemistry (sensitivity tests needed and to be included in the error budget), estimation of errors (random uncertainty derived from fitting residuals and systematic uncertainty to be estimated off-line based on sensitivity studies for each station. Note that both errors must be provided separately according to GEOMS), AMF correction for Pinatubo eruption period (sensitivity tests made by FH showed an impact of up to 10 % at Jungfraujoch. Should be investigated for different latitudes and seasons; not easy to implement).
- Discussions on the questionnaire:
  - Which SZA range for the Langley plots ? The Langley plot method can be used to exclude tropospheric pollution events but also to infer the residual amount in the reference spectra. In the latter case, the SZA range can play a significant role. There are also different strategies for the determination of the reference spectra: daily or fixed for a long period; strategies can be also different for polar sites and for mid-latitude sites with tropospheric pollution. Consensus about the fact that even with a fixed reference spectra, a photochemically modified Langley plot is needed to check that the instrument is stable on long time periods.
  - What is the SZA representative of a twilight measurement ? It is not a simple average of the SZA range; it depends on the error bars and integration time associated to each measurement. Also, for polar stations, there is a need to go to much lower SZA values (FW uses SZA down to 75° at Ny-Ålesund). It is also possible to submit the whole time-series during the day

and not only AM and PM single values but it depends on the location (polluted or not) and the quality of the instrument. This SZA issue is very important if we want to convert those twilight data to the time of satellite overpasses or model output.

Action item #5 (all): try to harmonize the SZA for which we report twilight data.

- TW also pointed out that some UV instruments can not follow the DOAS recommendation of 425-490nm. It should be said that visible instruments are preferrable than UV ones for NO_2 but a good UV instrument is better that a bad visible one. It is recommended to derive an error estimate representative of the instrument.

- Comparison between satellite nadir and SAOZ NO_2 data sets has been started. First tests at OHP and Jungfraujoch show good consistency. This exercise should be extended to other stations.

- UV-vis data on the NORS validation sever (FH):
  - Temporal and spatial interpolation are important steps in the validation chain.
  - Temporal interpolation: should be handled differently depending on the gases: O_3 columns at 90°SZA AM and PM (no diurnal variation), NO_2 columns and/or profiles at 90°SZA AM and PM (diurnal variation has an impact), and MAX-DOAS columns every 30 minutes. There are MACC model output every 6 hours (UT time). Suggestions on how to proceed for temporal interpolation:
    - Total O_3 columns at 90°SZA AM and PM: All UV-vis data in a time frame of 6 h around MACC outputs (MACC time +/- 3h) will be used for comparison.
    - Stratospheric NO_2: more difficult because of the strong diurnal variation. So the suggestion is to convert AM (PM) MACC output to sunrise (sunset) observations using scaling factors calculated using a stacked box photochemical model.

      Action item #6 (FH): Create look-up tables of stratospheric NO_2 scaling factor based on the stacked box photochemical model PSCBOX intialized with chemical and meteorological fields from the 3D-CTM SLIMCAT. Entry parameters would be latitude, altitude, month of the year, and NO_2 column (special behaviour of the NO_2 diurnal variation in case of denoxification conditions).
    - Remark from UF: for Antarctic stations, ozone should be also an entry parameter because in case of ozone depletion, there are no N_2O_5 and no AM-PM difference anymore.
    - Remark from HKR: in polar regions, the NO_2 diurnal variation could also vary with the amount of PSC (i.e. with the

temperature). After discussion, it is decided that this parameter will not be included.

- ❖ MAX-DOAS data: it is suggested to do an average of the MAX-DOAS data within the MACC output time +/- 30 minutes. MVR's comment: could this time window of 1 hour be adjusted by the user ? BL: not for the moment, but probably can be done. To be checked with S&T.

  Action item #7 (BL): Check with S&T if this time window can be adjusted by the user.

- o Spatial interpolation: So far, the location of the station is reported in the file, but maybe it would be good to report the location of the airmass, and then interpolate the 4 surrounding MACC model data to this location. Discussion: The resolution of the MACC global model is 1° by 1° (~100km x 100 km), so the interpolation at the airmass location would be only useful for zenith-sky data. J.-C. Lambert (BIRA) has developed a tool for the estimation of the airmass location for zenith-sky observations.

  Action item #8 (FH): Ask to J.-C. Lambert information about his airmass location tool (easy to implement ?, MATLAB code or not ?, documentation available ?).

- o Smoothing and vertical gridding of profiles: MACC profiles should be regridded to the NORS grid, and then should be smoothed with the NORS averaging kernels. In the FTIR community, they decided that, if the DOFS is less than 5 (generally also the case for MAX-DOAS observations), they report partial columns, with boundaries defined by the PI. Discussion: The partial columns height are then fixed. If we apply a smoothing, we can loose for instance information on uplifted aerosols layers (see UF's presentation on pages 11-12). It is decided to report profiles on the retrieval grid.

- o Smoothing and vertical gridding of columns: for twilight retrievals not based on the OEM, look-up tables of O_3 and NO_2 column averaging kernels have been developed by BIRA and made available at http://uv-vis.aeronomie.be/groundbased. So we can provide column averaging kernels but not a priori profiles. So how to proceed for the smoothing ? Discussion: suggestions are either to put the a priori to zero, either use the vertical profiles used to calculate the column averaging kernel look-up tables as a priori. It is also decided not to include horizontal averaging kernels.

- MAX-DOAS horizontal averaging effects (TW):

  - o 4-azimuth MAX-DOAS system developed in Mainz: useful to get information on horizontal gradients (master thesis of Julia Remmers). Some days, the NO_2 DSCDs in the 4 azimuth directions are very consistent, some other days, there is a time shift between the telescopes or systematic differences. Gradient plots are shown: they consist in the sum for each scan of the NO_2 DSCD vectors in

the four azimuth directions. This can give information on the local NO_2 sources.

- The information content is characterized using the 3D RTM MCARTIM. 0-1 km box AMFs are calculated for different wavelengths, SZAs, elevation angles, and aerosols conditions. For 1° elev, 70° SZA, and no aerosol, the AMF is still about 1 around 150 km far for the instrument. At 360 nm, this distance is reduced to a few tens of kilometers. When aerosols are added in the calculations, the distance is further reduced. These calculations showed that the 3D-distribution of the sensitivity of the MAX-DOAS measurements depends strongly on wavelength and aerosol loading.
- Spatial resolution of the SCIAMACHY nadir instrument matches that of the 4-azimuth MAX-DOAS system.
- Few slides with examples of cloud selection based on O_4 DSCD, color index (CI), and radiance (Cabauw zenith-sky data) are shown, illustrating the fact that a cloud flagging should be possible fro strong signals (cf WP3 discussion on the introduction of flags in GEOMS/HDF files on page 16).

- Satellite comparisons (OP):
  - Within the framework of the MULTITASTE project, calculation of the effective optical path for zenith sky measurements. 2 extreme cases are observed: at summer and winter solstices, the effective airmasses at 90°SZA can be located at a distance larger than 300km from the Izaňa station.
  - Comparisons of AM twilight values with satellite NO_2 data: An important issue is to consider the SZA at the location of the effective airmass and not at the station. If no correction is applied, the maximum error on the NO_2 VCD introduced by this effect can be up to 2.5% (summer solstice) and 4.1% (winter solstice).
  - INTA has started the same type of exercice for the Marambio (64°S), Belgrano (78°S), and Ushuaia (55°S) stations.

- Intercomparisons of techniques (FW/FH):
  - FH: Comparison of FTIR and UV-vis stratospheric NO_2 vertical column densities at Jungfraujoch between 1990 and 2009. UV-vis data photochemically converted at the time of FTIR measurements for direct comparison. Both techniques show similar information content and vertical sensitivity (sensitivity to the stratosphere only). It is therefore important when comparing both techniques to use similar a priori information in both retrievals. These datasets have been used to calculate the long-term trend of stratospheric NO_2 (Hendrick et al., ACPD, 2012).
  - FW has started similar comparison at Ny-Ålesund.

- Remarks:
  - In the FTIR community, an homogenization of retrieval settings (a priori profiles, choice of micro-windows,…) has not been conducted for NO_2 so far because it is not a target species. But this will be done in NORS.
  - For NORS, this kind of techniques intercomparisons should be done at the 4 stations. The NO_2 photochemical correction tool developed by BIRA (FH) will be helpful in this context. It will be available for NORS but also for the whole NDACC.

- Uncertainties (FW on behalf of Andreas Richter);
  - Presentation from Andreas Richter about uncertainties of the UV-vis data sets: Identification of error sources and types, approaches to error estimates. Discussion:
    - How much each of these errors sources are correlated to each other ? Sensitivity tests are needed.
    - So far, we only give the random error from the DOAS fit and we don't provide information on the systematic uncertainties.
    - TW: A good qualitative indicator, more than the DOAS residuals, is the fitting results of the profile inversion (the difference between the modelled and the measured DSCD). This parameter includes also some information about the spectral uncertainty and it would be consistent for all groups, and easy to estimate. MVR: It is not separated in random and systematic part; which part of this error is invariant ? How to include this error in an automatic process and in the satellite comparisons ? MDM: In the FTIR community, they created a working group to work on the errors.
    - MDM: In the validation server, the errors are not used so far. One of the goals of NORS is to make progress on this subject and we will see if these errors can be used as parameters for MACC validation.

NORS WP10: Extension of NORS to other NDACC stations (all):

- It is needed to share the concepts and expertise developed within NORS with our UV-vis partners not involved in the project. At the end of NORS, a report about the status of this NORS extension will be required.

Plans for validation activities involving NORS data sets (all):

Action item #9 (all): Provide to the NORS coordinator (MDM) a list of recommendations for the use of UV-vis data in the validation server. This list will be provided to S&T.

- **Follow-up campaign in Madrid 2014 – CINDI-2**

Facilities at INTA (OP):

- INTA is located in a military airport domain at 21 km in the North-West of Madrid and at around 10 km from the Barajas airport. The horizon is free when looking to the East and the South. In a building, there are 2 rooms with terrace with place for 2 times 6 or 7 instruments. Between the two rooms, there is a control tower, with space for 3 to 4 additional instruments. Total place for 17-18 instruments, 3 internet connections (probably not enough), and space at ground level if necessary to put containers. There is also a data server for hosting comparison data.
- From OMI maps: NO_2 present all year round.
- Maximum temperature and clear-sky days in July-August
- Other facilities on the site:
  - C212 aircraft with sondes to measure aerosols and meteorological parameters. There is also a NO_x teledyne on board but does not work satisfactory. Contacts with Dominik Brunner (EMPA) to borrow one. There are also free inlets. A MAX-DOAS instrument was already installed on the plane in the past, with nadir, zenith and horizon viewing geometries. AP asked about the possibility to drop NO_2 sondes from the aircraft: it should be feasible. Flight cost: 3000 euros per hour. Minimum altitude: maybe 400m (OP should check). It would be also possible to make fake landings.
  - Meteorological balloon station (p, T, humidity, wind, and O_3)
  - In-situ NO_x
  - Long-path DOAS from Alfonso Saiz-Lopez; UF would like to bring the Heidelberg long-path DOAS too.
- Discussion: TW is wondering how much we can open the new campaign to new instruments from other groups. We should create a list of potential participants and contact them. There is a limitation on available places in the building. We should start to write down a document with expected costs and then send it to ESA to see if we can get money.

  Action item #10 (MVR/all): Create a list of new potential participants to the campaign and contact them.

  Action item #11 (MVR/all): Write up a document with campaign description and expected costs and send it to ESA for fundings.
- For operations on the site, October-November is a good period (last year fall was very clear). Summer is the best period to be sure of clear sky conditions but is is very hot. INTA can prepare the rooms for the campaign (air-conditionning, internet network,…) but funding is needed.
- Who would be the referee for this campaign?

MVR's presentation:

- For CINDI-2, it would be better to leave Cabauw in order to get more clear sky days.
- Why a follow up of CINDI is needed ? For the first campaign, 24 MAX-DOAS instruments, 4 in-situ NO_2/aerosols, Raman and backscatter aerosols lidars, and NO_2 lidar + demonstration of NO_2 sondes. What more for CINDI-2: More on aerosols ? Better synchronisation of the measurements including pointing accuracy issues ? Better interpretation of NO_2 measurements, especially the horizontal gradients ? More DOAS instruments (long-path, PANDORA network (AC: 12 travelling PANDORA instruments are available; experience from campaigns in the US on 200x100km and smaller areas), miniDOAS) ? Aircraft measurements (in-situ, AMAX-DOAS, imaging DOAS) ? More satellite validation ?
- Email from Dominik Brunner (EMPA) on possibilities to do NO_2 in-situ measurements in the aircraft.
- The possibilities of fundings depend on what we want to do and what will be new with respect to CINDI-1. Funding agencies: ESA (S5P/TROPOMI validation programme – strong interest within MAG), CEOS ? EU ? National ? NASA (probably could pay for US groups) ? AP thinks about EU transnational funding for infrastructure project and suggest to define INTA as a reference measurement site. For aircraft, EUFAR could be also involved.
- TW: car-DOAS measurements should be also included. The new campaign should have a different topic than CINDI-1: aerosols and/or horizontal gradients could be very interesting. INTA is at 20km from Madrid where in-situ sensors are operating, so if wind changes a lot, we can have big gradients. It is very important for satellite validation and it could be the first priority and focus of the campaign.
- FW: We should be careful because the commercial airport is very close, around 10km. We should investigate about the limitations for the campaign due to aircraft flights.

  Action item #12 (OP): Ask for more information about flight plans from both the commercial and military airports and if there is an exclusion zone around the military area.
- Maybe telesondes (sondes fixed by a string to the ground) measurements could also be done.
- What other trace gases ? HCHO ? Is there biogenic emissions ? There must be some background of HCHO.
- Who as campaign referee ?
- Other possibilities than INTA ? TW suggested China, but there are a lot of aerosols there and therefore smaller spatial gradients. It will be also more difficult to get fundings and support. Alternative with the Po valley: a lot of pollution and aerosols and in this region, flights will be a problem everywhere. The conclusion is that it seems difficult to find a better place than INTA inside our community.

Future of the NDACC UV-VIS network

(discussion on new molecules, new stations, …)

- MVR: Data even in the old NASA-AMES format should be delivered in the database before the next steering committee in October 2012.
- Where do we want to go with the NDACC UV-vis network ? NORS is already answering a lot of questions about the future of the network.
- OP: do we want to submit also the slant columns ? All: Data users outside the DOAS community are not interested in these data but it's a question of choice.
- INTA would like to include their 3 new stations in the NDACC network.