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NDSC

Newsletter

The Network for the Detection of Stratospheric change

www.ndsc.ws

The NDSC Newsletter is published by
the NDSC Steering Committee.This
is the first issue. The plan is to make
one or two issues per year.

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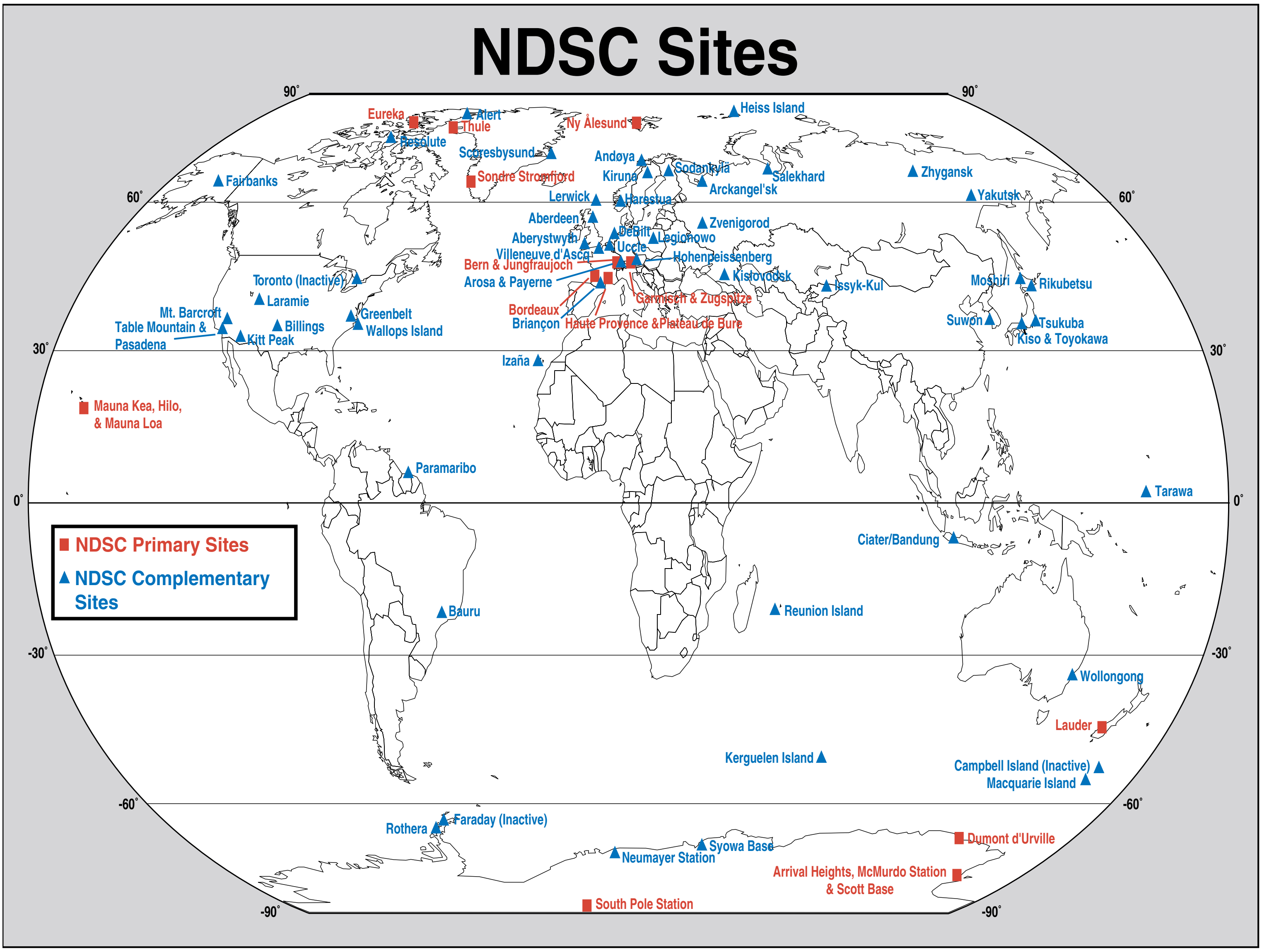


Cover photos: Leftmost column from the top: The Eureka station in the Canadian Arctic; Ozonesonde launch from the Koldewey station in Ny-Ålesund, Spitzbergen; Ozonesonde launch from the South Pole station.
Rightmost column from the top:Polar stratospheric clouds above Kiruna in January 2000; The International Scientific Station of the Jungfraujoch, Switzerland; The ARCLITE Rayleigh lidar in operation at Søndre Strømfjord, Greenland.

Contents

Working Group news

The NDSC consists of 9 working groups representing the various techniques that are used in the network: Dobson and Brewer, FT-IR, Lidar, Microwave, Ozone and Aerosol sondes, Satellite, Spectral UV, Theory and Analysis, UV-visible. In this section we bring news from the various working groups.

Spectral UV Working Group

Richard L. McKenzie

National Institute of Water and Atmospheric Research, New Zealand

UV paper

Data from the NDSC was used in the following paper:

McKenzie, R. L., G. Seckmeyer, A. Bais, J.B. Kerr and S. Madronich, Satellite retrievals of Erythemal UV dose compared with ground-based measurements at Northern and Southern mid-latitudes, J. Geophys. Res., 106, 24,051 -24,062, 2001.

Report from the 2002 NDSC Steering Committee meeting

The Spectral UV Working Group was represented by Richard McKenzie at the NDSC Steering Committee Meeting in Toronto 11-13 September. This report combines information from that meeting and the results of subsequent discussions.

There have been significant changes and growth in the Spectral UV Working Group over the past year.

- New complementary site status for Briançon, France (44.9ºN, 6.65ºE, 1310 m) with Alain de La Casinière (IRSA, UJF Grenoble) as PI (alain.de-la-casiniere@ujf-grenoble.fr).
- New complementary site status for Villeneuve d'Ascq, France (50.65ºN, 3.08ºE, 70 m) with Colette Brogniez of Laboratoire d'Optique Atmosphérique, USTL, as PI (Colette.Brogniez@univ-lille1.fr).
- Retirement of Barry Bodhaine co PI of the Mauna Loa UV. Richard McKenzie will remain the PI for those data, and the local contact point is Mike O'Neill of NOAA/CMDL at Boulder (Michael.O'Neill@noaa.gov).
- Dr Stephan Thiel is now the PI responsible for NDSC data from Garmisch and Zugspitze (stephan.thiel @imk.fzk.de).

The NDSC Steering Committee welcome Drs. Thiel, de la Casiniere, and Brogniez.

All members had provided their Annual Short Form reports to the NDSC Steering Committee, and had updated the databases. It was particularly pleasing to see a re-continuation of IFU data from Garmisch-Partenkirchen and Zugspitze. It is hoped that the missing data from 2001 and 2002 can be delivered from these sites as well.

Two more groups are still interested to join the UV group, but are presently operating in research mode only

- NDSC primary site in Ny-Ålesund with Otto Schrems (AWI) as PI
- NDSC primary site in Thule, Greenland with Paul Eriksen (DMI) as PI.

These PIs or institutes still intend to submit proposals for NDSC acceptance for their UV instruments

In future three more groups are identified to possibly join the Spectral UV Working Group:

Dr. Paul Simon (Paul.Simon@oma.be) and Dr. Didier Gillotay (Didier.Gillotay@oma.be), IASB, Belgium.

Dr.Rocky Booth, San Diego, USA, NSF – network with different stations in the Arctic and the Antarctic (booth@biospherical.com).

Dr.Harry Slaper (Harry.Slaper@rivm.nl), RIVM, Netherlands, Bilthoven (RIVM already has other involvements in the NDSC).

With the enlarged UV group, there is a need to have more formal flow of information than we have had in the past (hence this report). The distribution list includes several people who are not contributors to the NDSC, but who are interested in the group's activities.

New NIST Scale

New NIST detector-based irradiance scale which has been used since Jan 2001, is 1.3% higher than the previous standard.

Implications:

- Need to re-process and re-submit early data with reference to the new standard.
- Need to update Metadata files accordingly.
- Need to know how the new NIST scale relates to the PTB standard used by

some NDSC groups.

- Recent information from PTB on this issue is that they are presently evaluating the results from a recent intercomparison. The most recent intercomparison had shown unexpectedly high deviations between NIST, PTB and NPL in the order of several percent. It is presently unclear whether this situation is still valid or whether the agreement is better.

Seckmeyer's Travelling Standard

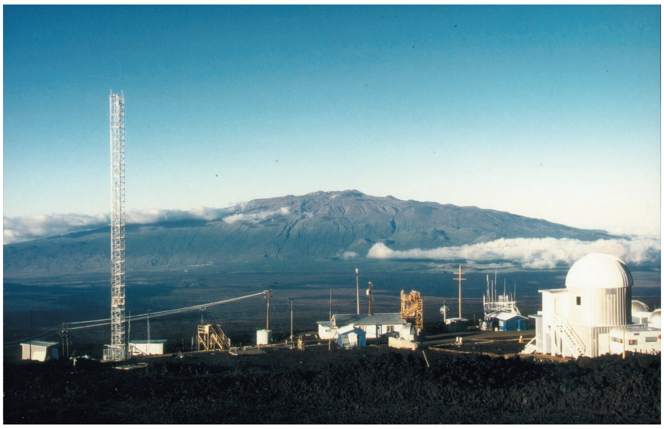
Data from Seckmeyer's new instrument was shown. The results look promising. The plan is to use this instrument as a travelling standard among the NDSC UV instruments. This would be particularly useful in validating the non-transportable DMI spectrometer at Thule.

NDSC Intercomparison Campaign

We plan to have an intercomparison between NDSC UV data providers as soon as possible. One option would be to have this in France in June/July 2004, and to invite the following groups:

- NIWA (Richard McKenzie)
- IFU (Stephan Thiel)
- Briançon (Alain de La Casinière)
- Villeneuve (Colette Brogniez)
- AWI (Otto Schrems)
- DMI (Paul Eriksen)
- Hannover (Gunther Seckmeyer)

The intercomparsion will not be open to all comers, but will be by invitation only. It will be important to limit the number of groups participating to avoid problems with logistics. Alain de la Casiniere has suggested that Observatoire de Haute Provence (OHP: 43.94ºN, 5.71ºE, 650 m) would be a suitable unpolluted site to host this campaign. Inexpensive accommodation may be available, so that one could plan on an extended campaign period of up to 4 weeks spanning the last two weeks of June and first two weeks of July 2004. The most intensive cross calibration period could be the first week in July.



Spectral UV measurements are carried out at the three sites shown here. Upper left: Zugspitze, Germany (47.42N, 11.06E). Lower left: Mauna Loa, Hawaii (19.54N, 155.58W). To the right: Lauder, New Zealand (45.04S, 169.68E)

Ozone and aerosol sonde Working Group

Terry Deshler[1] and Geir Braathen[2]

[1]University of Wyoming; [2]Norwegian Institute for Air Research

The QUOBI project

The QUOBI project is described later in this newsletter. In this project there is a continuous effort to assure that the ozone series from the various stations constitute a homogeneous data set. This work benefits the objectives of the NDSC. The QA work is led by Esko Kyrö of FMI.

The BESOS intercomparison campaign

Measuring ozone in the free troposphere and lower stratosphere has been a challenge only partly met by current measurement techniques. The wet-chemistry technology for ozonesondes emerged more than three decades ago, and has remained the preferred choice for a network of stations providing routine measurements. However, a consensus on standard procedures for ozonesonde preparation and flight has been difficult to obtain. In 1996, a series of four intercomparison experiments was begun with the goal of defining standard operating procedures (SOPs) for electrochemical ozonesondes. This work was sponsored by the World Meteorological Organization's (WMO) Global Atmospheric Watch (GAW) program. The experiments utilized a facility at Forschungszentrum Jülich, Germany, to simulate balloon flights within an environmental chamber. More than 10 countries have taken part in these chamber simulations, that ended in 2000. The participants were chosen to represent the full spectrum of preparation procedures independently developed by different research groups. These participants and other experts met in Geneva in early May 2001 to evaluate the environmental chamber experiments and to discuss their implications for SOPs. The meeting resulted in unanimous agreement on preliminary SOPs for the electrochemical ozonesondes most commonly in use.

It was also agreed that the preliminary SOPs must be tested with an intercomparison in the real atmosphere before they could be judged suitable for the GAW global network of stations. This intercomparison will be made during the WMO "Balloon Experiment for Standards for Ozone Sondes" (BESOS) in Laramie, Wyoming during June 2003. A single balloon will carry, to an altitude of at least 30 km, four sets of 3 ozonesondes prepared identically using the preliminary SOPs. The four sets of three are required to include instruments from the two sonde manufacturers and the two most common solution strengths (0.5 and 1.0%). In addition 6 sondes testing variations on the SOPs and a standard reference ozone dual-beam photometer will be included.. The sondes will be prepared by groups that participated during the chamber intercomparisons and the reference photometer will be provided by the Jet Propulsion Laboratory. BESOS is expected to complete the establishment of the GAW SOPs for the world-wide ozonesonde network.

Latest news

Due to problems with the availability of the reference ozone photometer the BESOS campaign has been postponed. One is currently trying to find a new date where the photometer will be available.

Launching and ozonesonde at the NDSC station Neumayer, Antarctica

Ozonesonde launch at the Observatoire de Haute Provence, France

UV-Visible spectroscopy Working Group

Kjersti Karlsen Tørnkvist[1], Paul Johnston[2] and Jean-Pierre Pommereau[3]
[1]*Norwegian Institute for Air Research;* [2]*National Institute of Water and Atmospheric Research, New Zealand;*
[3]*Centre National de la Recherche Scientifique, Service d'Aeronomie*

Intercomparison at Andøya

Scientific Objectives

The primary objective of this intercomparison campaign, was the improvement of factors leading to uniformity and standardisation of measurement and evaluation procedures for slant columns of BrO, NO_2 and OClO within the UV-Vis community of the NDSC. A secondary objective was to produce a high quality data set of slant column NO_2, BrO and OClO that can be used for satellite validation purposes. In particular, this data will be of great value for the validation of the SCIAMACHY and GOMOS instruments onboard the ENVISAT satellite, GOME onboard ERS-2, as well as for SAGE-III. The campaign took place from 14 Feb to 7 March 2003. The measurement site was the Andøya Rocket Range at Andenes, Norway.

Method of Instrument Intercomparison

One part of ensuring accuracy of measurements is to compare instruments and analyses when measuring and analysing identical fields, and the NDSC holds refereed blind intercomparisons of instruments and analysis techniques when there is a need. In 1992, an NDSC intercomparison campaign for the measurement of slant column NO_2 was conducted in Lauder, New Zealand (Hofmann et al., 1995). This was followed by a second intercomparison in 1994 in Cambourne, UK (Vaughn et al., 1997) which also included slant column ozone. In 1996 a third NDSC campaign took place at the Observatoire de Haute Provence (OHP) in Southern-France (Roscoe et al., 1999). This third campaign, in addition to the blind intercomparison of slant column NO_2 and ozone, also included a first ever open intercomparison of slant column BrO (Aliwell et al., 2000). The intercomparison campaign at Andøya focused on the measurement of slant column NO_2 and halogen species, namely BrO and OClO. Since this intercomparison took place during the winter, NO_2 levels are generally quite low. This would give a unique opportunity for testing the

Oksebåsen, Andøya, Norway, the location of the NDSC UV-Visible spectroscopy intercomparison that took place in February and March 2003.

performance of NDSC instrumentation for the measurement of NO_2 near or below the detection limit. OClO on the other hand, is generally only observed during winter polar vortex conditions. For this reason, it was important that an intercomparison campaign be conducted at a high latitude site during the winter. The ALOMAR site at Andenes, officially classified as a secondary NDSC site, was well suited for this exercise. Unfortunately, Andenes was not within the polar vortex during this period, except for one occasion. However, the campaigcan be declared as very successful. Dr. Ann-Carine Vandaele from the Free University in Brussels was the official NDSC referee. She has much experience in the subject, both in terms of DOAS technique and in campaign management. As a referee, she did a very good job.

Plans for publication

The results from this NDSC intercomparison will be published in a peer-reviewed publication (Journal of Geophysical Research-Atmospheres or Journal of Atmospheric Chemistry) as was also the case with previous NDSC UV-Vis comparison exercises. The results will also be presented at scientific conferences and meetings.

Participating Groups

Belgian Institute for Space Aeronomy (IASB), Belgium
Institute for Environmental Physics, University of Heidelberg, Germany
Institute for Environmental Physics, University of Bremen, Germany
Instituto Nacional de Tecnica Aerospacial, Torrejon de Ardoz, Spain
Institute of Atmospheric and Oceanic Sciences, Bologna, Italy
National Institute of Water and Atmosphere, New Zealand
Norwegian Institute for Air Research, Norway
Service d'Aeronomie du CNRS, France
University of Leicester, UK

References

Hofmann, D.J. et al., Intercomparison of UV-visible Spectrometers for measurements of Stratospheric NO_2 for the Network for the Detection of Stratospheric Change, J. Geophys. Res. 100, 16765-16791, 1995.

Vaughn, G. et al., An Intercomparison of Ground-Based UV-Vis Sensors of ozone and NO_2, J. Geophys. Res., 102, 1411-1422, 1997.

Roscoe, H.K. et al., Slant Column Measurements of O_3 and NO_2 During the NDSC Intercomparison of Zenith-Sky UV-Visible Spectrometers in June 1996, J. Atmos. Chem. 32, 281-314, 1999.

Aliwell, S.R. et al., Analysis for BrO in Zenith-Sky Spectra - An Intercomparison Exercise for Analysis Improvement, J. Geophys. Res. 2001, 107, D14, 1-20, 2002.

The participants of the NDSC UV-Visible spectroscopy intercomparison campaign at Andøya, Norway in February/March 2003. Back row from left: Serguei Khaikin, Thomas Wagner, Univ. of Heidelberg; Francois Humbled, BISA, Roland Leigh and Gary Corlett, Univ. of Leicester; Paul Johnston, NIWA; Kjersti Karlsen Tørnkvist, NILU; Andreas Richter, Univ. of Bremen; Udo Frieß, Univ. of Heidelberg; Kerstin Stebel, NILU. Front row from left: Ann-Carine Vandaele, BISA; Karin Kreher, NIWA; Olga Puentedura, INTA; Michel van Roozendael, BISA; Margarita Yela, INTA; Caroline Fayt, BISA; Aude Mieville. CNRS. Not on photo: Folkard Wittrock and Hilke Oetjen (behind the camera), Univ. of Bremen; Monica Navarro Comas, INTA; Sven Bugarski and Roman Sinreich, Univ. of Heidelberg.

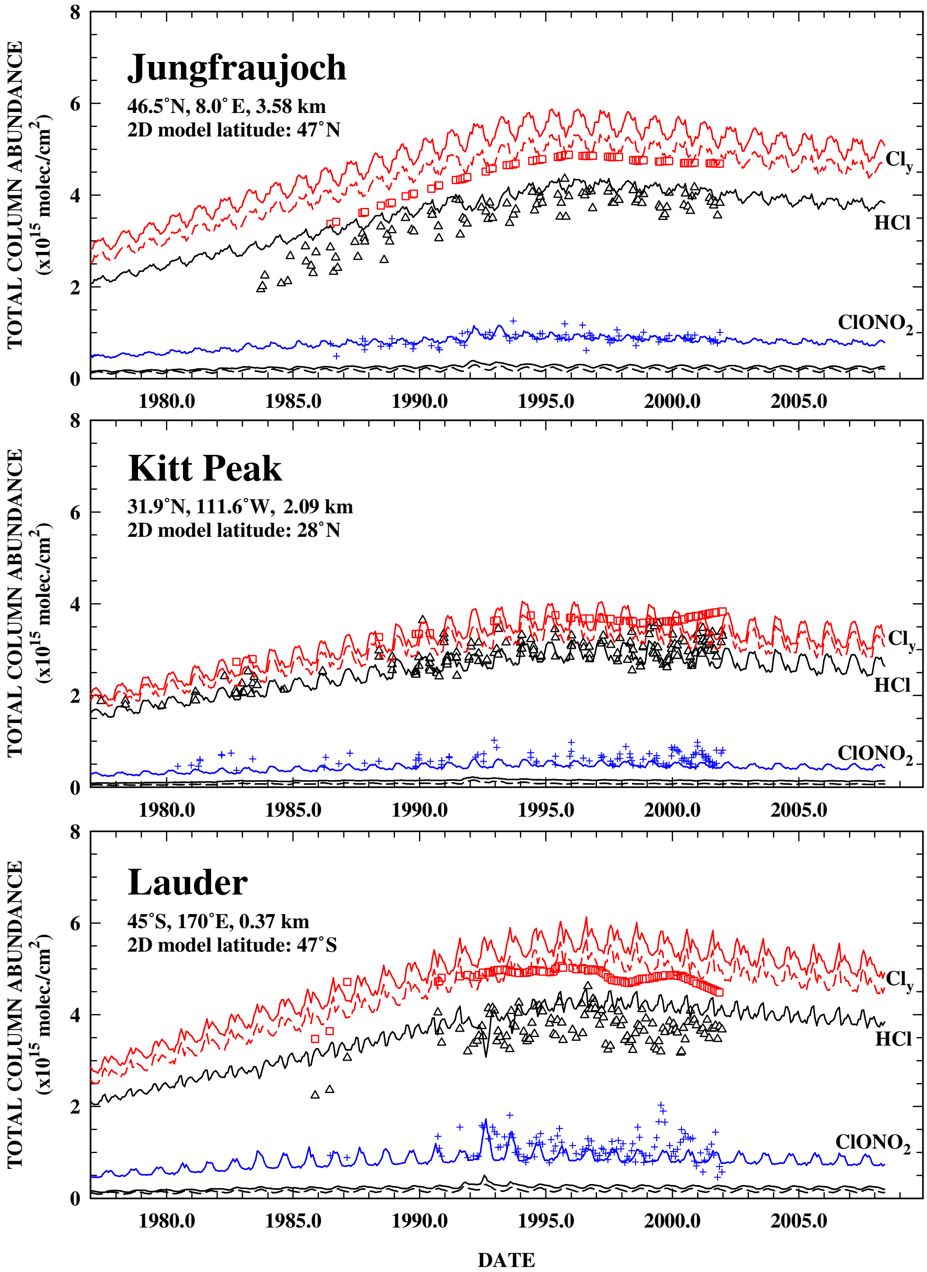
Theory Working Group

Martyn Chipperfield
University of Leeds, UK

The Theory and Analysis Working Group exists to promote the use of NDSC data for scientific studies. In contrast to the other WGs associated with data collection and validation, this WG does not have formal meetings. Rather, we take every opportunity (e.g. Conferences, Meetings) to present the scientific use of NDSC data.

All NDSC data over 2 years old is publicly available. Access to this data is through anonymous ftp access to the ndsc.wwb.noaa.gov server or via the web page (www.ndsc.ws). It is expected that users of these NDSC data will consult the on-line documentation and reference articles to fully understand the scope and limitations of the instruments and resulting data. Scientific users of the data are encouraged to contact directly the appropriate NDSC Principal Investigator (listed in the data documentation on the web page) to ensure the proper use of specific data sets. The PI can also be contacted if you wish to use data less than 2 years old.

As the quantity of NDSC data increases, in terms of species observed, spatial coverage, length of time series etc., the scope of possible scientific studies increases. The report of the 2001 NDSC Symposium in Archachon (see elsewhere in this issue) gives a flavour of the many NDSC-related studies which are on-going. The figure shows a recently published study which compares long-term FTIR observations of HCl and $ClONO_2$ with 2D model predictions [Rinsland et al., 2003]. Overall, the observations indicate a stabilisation of the stratospheric chlorine loading in recent years in broad agreement with the model, although there are differences in the detail of the comparison at different stations, which require further investigation.



FTIR observations of $ClONO_2$ (blue crosses), HCl (black triangle) and their sum (labelled Cl_y, red squares) at three sites. Also shown are 2D model calculations using prescribed trends of Cl source gases including $ClONO_2$ (blue line), HCl (black line) and HCl+$ClONO_2$ (red dashed line). From Rinsland et al. [2003].

Rinsland, C.P. et al., Long-term trends of inorganic chlorine from ground-based infrared solar spectra: Past increases and evidence for stabilization, J. Geophys. Res., 108(D8), 4252, doi: 10.1029/2002JD003001, 2003.

Lidar Working Group

Sophie Godin Beekmann[1] and Stuart McDermid[2]

[1]Centre National de la Recherche Scientifique, Service 'Aeronomie; [2]Jet Propulsion Laboratory

The last Lidar Working Group meeting took place at the Observatoire de Haute-Provence (OHP, France) on June 10-13, 2002 with 20 attendees and most lidar stations[1] represented. Long-term monitoring activities concerning the vertical distribution of stratospheric aerosols, stratospheric and tropospheric ozone, temperature and water vapour were reported.

Highlights

- Present stratospheric aerosol amounts are very close to background levels measured in 1979, which indicates that no long-term trend is detected by the lidar measurements over this period of time.
- The stratospheric ozone lidar time series are now long enough at various stations to provide a good evaluation of ozone long-term evolution and variability.
- The NDSC lidar measurements are, and will be in the near future, fully involved in the validation of the new satellite instruments scheduled for the monitoring of the stratosphere (SAGE III, ODIN, ENVISAT, Aura).
- Particular attention was given to the measurement of water vapour in relation to the large increasing trend measured in the stratosphere[2]. Lidar techniques include Raman scattering and differential absorption (DIAL). Raman lidars are the most widely used for the measurement of water vapour in the upper troposphere. The detection limit of these measurements is currently about 10 ppmv. One of the main technical issues concerns the calibration of the lidar signals. Lidar measurements of water vapour will be the focus of a special session at the SPIE conference in San Diego in August 2003.

Intercomparisons

Most recent intercomparison campaigns involving the NASA Goddard mobile lidar system:

- Lauder, New Zealand, April 2002, TOPAL (Temperature and Ozone Profiler Assessment at Lauder), Referee: Stuart McDermid.
- Mauna Loa, Hawaï, July-August 2002, Temperature and ozone profiles, Referee: Richard McPeters

Planned campaigns

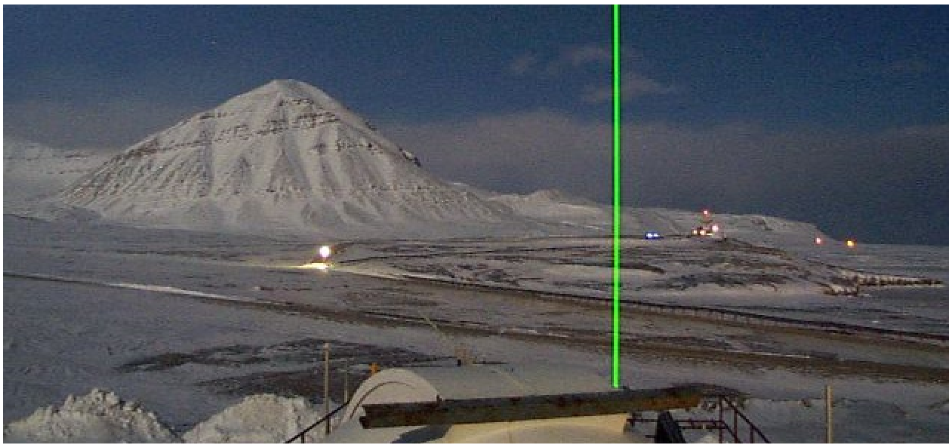
- La Réunion Island, TBD 2004, Referee : Thierry Leblanc
- OHP, Northern Summer 2004

New instruments

- Temperature lidar at Søndre Strømfjord (Greenland)
- DIAL stratospheric ozone lidar at La Réunion Island (France)

Next meeting

The LWG meeting will now take place every other year alternate to the International Laser Radar Conference (ILRC). The next meeting will be hosted by the CNR in Rome, Italy in October 2003.



Lidar measurements in Ny-Ålesund, Spitzbergen

Lidar measurements at the ALOMAR Observatory, Andøya, Norway

[1] Lidar stations : Alomar (Norway), Dumont d'Urville (Antarctica-France), Frascati (Italy), Garmisch (Germany), Hawaï, Mauna Loa (USA), Hohenpeissenberg (Germany), La Réunion (France), McMurdo (Antarctica-USA-Italy), Ny-Ålesund (Spitzbergen-Germany), OHP (France), Suwon (Korea), Table Mountain (USA), Tsukuba (Japan).

[2] Stratospheric Ozone Assessment, WMO 2002.

Microwave Working Group

Gerald Nedoluha[1] and Nik Kämpfer[2]

[1]Naval Research Laboratory; [2]University of Bern

The Microwave Working Group held a workshop on April 3-5 hosted by the University of Bern. 18 participants from 10 institutions were represented at the workshop, which was the first multi-day meeting organized by the Microwave Working Group. Despite the very different designs employed by microwave instruments measuring at different frequencies there was much common ground for discussion.

Much of the workshop involved the issue of accurate calibrations, specifically issues such as the accurate temperature measurement of hot and cold (generally liquid nitrogen) loads. The optimal elevation angle used for measurements, and the accurate determination of this angle also proved an interesting topic. Finally, there was much discussion on the reduction of instrumental baselines through the use of different materials, phase scramblers, etc. The location of the meeting also allowed the group to study some of the new microwave instruments at the University of Bern, including the MIAWARA water vapor instrument (see photo below).

Retrieval techniques were covered only briefly during the meeting. While most groups now use an optimal estimation technique for retrieval, there remain important differences, particularly in the modeling atmospheric parameters which are not directly measured. In order to obtain the temperature-pressure profiles required to obtain mixing ratio profiles, most retrievals now use a weather model (often NCEP) in the stratosphere, a climatology in the mesosphere, and some smoothing in between. The Working Group agreed that it would be desirable for all microwave measurements to use a common model to obtain temperature-pressure profiles.

Because of the success of this workshop the participants agreed to try and organize another meeting in 2004 in conjunction with the Quadrennial Ozone Symposium in Kos, Greece.

Most of the presentations from this meeting are available on the Microwave Group homepage at:
http://www.iapmw.unibe.ch/research/collaboration/ndsc-microwave/workshop/

Institutions present at the workshop:

Onsala Space Observatory, Sweden
Forschungszentrum Karlsruhe, Germany
Max-Planck-Institut für Aeronomie, Germany
National Institute of Water and Atmosphere, New Zealand
Meteoswiss, Switzerland
University of Massachusetts, US
University of Bremen, Germany
Sookmyung Women's University, South Korea
Naval Research Laboratory, US
University of Bern, Switzerland

The MIAWARA wtaer vapour instrument at the University of Bern.

The University of Bremen RAM instrument in Ny-Ålesund.

Satellite Working Group

Jean-Christopher Lambert[1], Alvin James Miller[2], and Yasuhiro Sasano[3]

[1]Belgian Institute for Space Aeronomy; [2]National Oceanic and Atmospheric Administration; [3]National Institute for Environmental Science, Tsukuba, Japan

Objectives

A major goal of the NDSC is to provide independent calibration and validation of orbiting atmospheric sensors. Ground-based and satellite remote sensing also offer complementary views of the atmosphere. The role of the NDSC Satellite Working Group is to foster synergy between the NDSC and satellite communities. Among its activities are addressed the geophysical validation of satellite data, development of comparison techniques, exchange of experience in atmospheric remote sensing, and advisory support to the design of validation programmes.

Ongoing satellite missions

NASA Instruments

Long-term validation relying on NDSC data records is ongoing for ERBS SAGE-II, UARS HALOE and MLS vertical profiles and TOMS O_3 columns. The new version 6.1 of the SAGE-II algorithms is an improvement for the O_3 and NO_2 profiles. The new version 8 of TOMS time series is under evaluation.

NOAA Polar Satellites

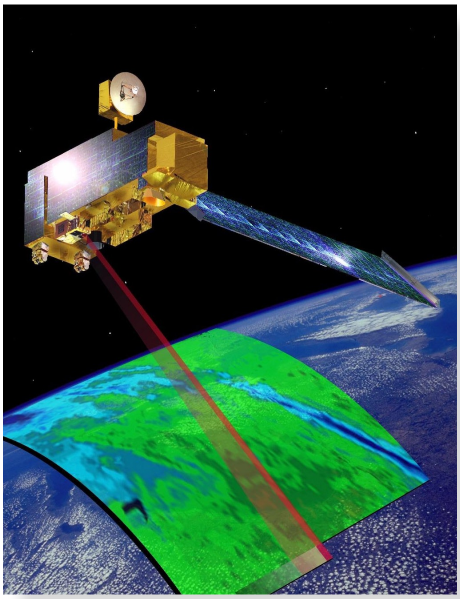
NOAA utilises NDSC data to validate the SBUV/2 ozone sensor as well as the temperature retrieval instruments that are on-board its operational afternoon polar orbiting satellite series. The combination of lidars, microwave instruments and balloonsondes contribute a unique database that allows to validate the absolute values as well as the long-term trends.

GOME

ESA's ERS-2 Global Ozone Monitoring Experiment (GOME) is entering its ninth year of global mapping of O_3, NO_2, BrO, OClO, CH_2O and SO_2. Recent upgrade of GOME O_3 and NO_2 data to version 3.0 has been assessed and published in an ESA technical report. NDSC groups continue the long-term validation of vertical columns and lead the validation effort within the GOME-1 Ozone Profile WG.

POAM-III

The Polar Ozone and Aerosol Measurement (POAM) Science Team has conducted an extensive validation on SPOT-4 POAM-III and has already a number of papers either published or in press on O_3, NO_2, aerosol extinction, and water vapour profiles. POAM-III is providing important information on the dehydration of the Antarctic stratosphere and on how bo-real forest fire smoke is injected into the stratosphere by intense convection in thunderstorms. An effort is under way to compare solar occultation instruments like POAM-III and SAGE-III with modelling results.



An artist's impression of the MOPITT instrument on board the EOS-Terra satellite

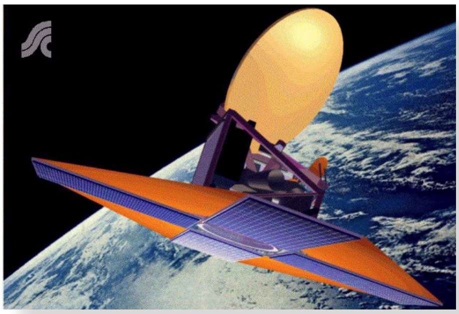
MOPITT

Launched on board of EOS-Terra in December 1999, Measurements Of Pollution In The Troposphere (MOPITT) provides CO vertical profiles and columns that are being validated by the FTIR community through comparisons with correlative measurements and independent retrievals. Retrieval of CH_4 columns is under way. Several papers are in preparation.

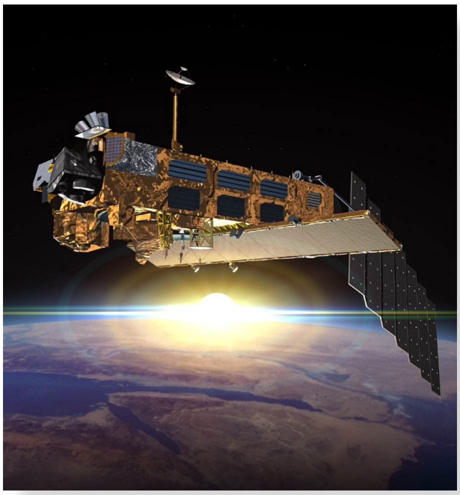
New satellites

Odin

Odin is in orbit since February 2001 and the two instruments SMR and OSIRIS are operational. First results of the validation campaign were discussed in a recent meeting. O_3 profiles provided by OSIRIS were validated by comparison with ozonesonde, POAM-III and SAGE-III profiles. SMR O_3 profiles still need further improvement. ClO measure-



The Odin satellite in orbit



An artist's impression of the ENVISAT satellite in orbit

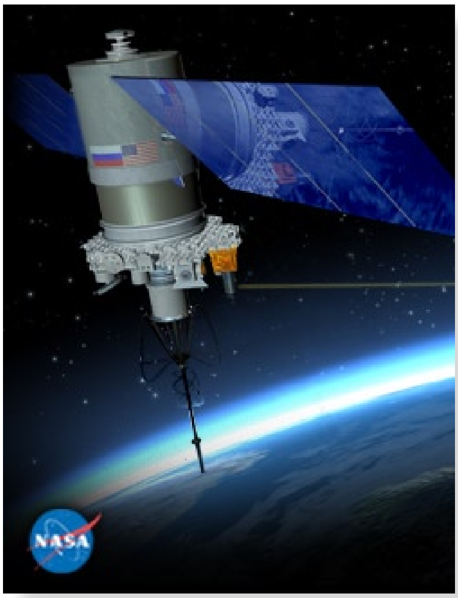
ments were positively compared with REPROBUS modelling results and H_2O measurements with a hygrosonde rocket-borne profile. Papers are in preparation.

ENVISAT

In orbit since March 2002, ESA's third Earth observation satellite ENVISAT and its ten instruments work fine. Due to the large number of measured species and parameters, validation activities are coordinated in a large-scale campaign involving massively the NDSC as well as balloons, airplanes, other satellites and models. First validation of early atmospheric chemistry data from GOMOS, MERIS, MIPAS and SCIAMACHY demonstrates the great potential of the instruments. Among first scientific results, ENVISAT gave a detailed picture of the separation of the Antarctic polar vortex in September 2002. Preliminary validation is reported in an ESA Scientific Publication and further validation is ongoing.

SAGE-III

The second SAGE-III Ozone Loss and Validation Experiment (SOLVE-II) was a measurement campaign between January 12 - February 6, 2003 designed to examine the processes controlling ozone levels at mid- to



The SAGE-III satellite in orbit

high latitudes. Measurements were made in the Arctic in winter using the NASA DC-8 aircraft, as well as balloon platforms and ground-based instruments. The mission also acquired correlative data needed to validate the Stratospheric Aerosol and Gas Experiment (SAGE) III satellite measurements that will be used to quantitatively assess high-latitude ozone loss. NDSC data played an important role in the campaign.

ILAS-II

Improved Limb Atmospheric Spectrometer (ILAS) II aboard ADEOS-II was successfully launched by NASDA in December 2002. ILAS-II started routine operation in April 2003 after initial checkout of the satellite and sensors. Like its predecessor ILAS, ILAS-II is going to provide vertical profiles of many stratospheric species and aerosol extinction coefficients, all active in the infrared. Planned validation activities include, among others: several ozonesonde measurements from Kiruna (Sweden) and Syowa (Antarctica); an ILAS-II validation campaign using large balloons, scheduled in late 2003 at Kiruna; ground-based data acquired by FTIR spectrometers, lidars, and millimeter-wave radiometers at several NDSC stations; and other satellites and modelling results.

Concerted Programmes

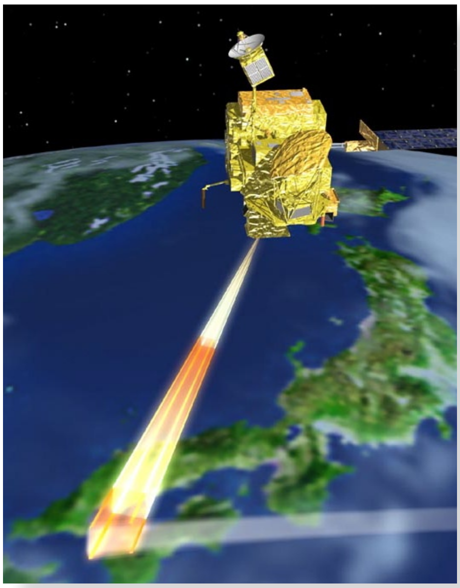
VINTERSOL (Validation of International Satellites and Study of Ozone Loss) is a major European field campaign involving the validation of ENVISAT, GOME, ODIN, and POAM-III satellite missions. Validation efforts within VINTERSOL are conducted in close collaboration with NASA SAGE-III, NASDA ILAS-II and CSA SCISAT-1 validation campaigns.

Future missions

The NDSC is involved in the planning of validation campaigns for several upcoming missions, namely: ACE and MAESTRO aboard SCISAT-1; HIRDLS, MLS, OMI and TES aboard EOS-Aura; SOFIS aboard GOSAT; Orbiting Carbon Observatory; and SMILES aboard ISS/JEM.

Further info

Lists of relevant publications, contact persons and Internet links for every atmospheric chemistry satellite mission are regularly updated on the NDSC web page.



The ADEOS-II satellite with ILAS-II on board

New stations

The NDSC consists of more than 70 stations. New stations are added every year. Here we bring information on stations adopted at the 2002 NDSC Steering Committee meeting. Background information on the stations has been provided by Zenobia Litynska (IMWM), Valery Dorokhov (CAO) and Signe Bech Andersen (DMI).

Legionowo, Poland

The upper air station at Legionowo (52.40°N, 20.97°E, 96 m a.s.l) of the Institute of Meteorology and Water Management, Centre of Aerology, Poland, has a long tradition in radiosoundings. Since 1992 LORAN Digicora/RS80(90) radiosounding system has been in use. Earlier measurements, since 1948, were taken with different radiosounding systems, latest, 1971-1991, with METEORIT/RKZ-MARZ.

Ozone profiles have been measured since 1979, beginning with the OSE ozone sensor and since 1993, with the ECC ozone sensor, regularly once weekly on Wednesdays. One to two additional ozone soundings per week have been performed since 1994, during MATCH campaigns during winter and spring months. The ozone data are regularly submitted to the WOUDC and to the NILU databases. Since July 1993 a network consisting of three UV Biometers SL 501 located at Legionowo, Leba (54.75°N, 17.53°E, 2m a.s.l) and Zakopane (49.30°N, 19.97°E, 855m a.s.l) has been established. Since July 2000, installation of a NILU-UV instrument at Legionowo has extended the monitoring of UV solar radiation.

The Legionowo complementary NDSC station is located at 52.40°N, 20.97°E and 96 m asl.

Yakutsk, Russia

Yakutsk station (62°N, 130°E) is located in eastern Siberia in the region of ozone maximum of Northern hemisphere. Balloon-borne ozone sounding using 2ZECC ozone sondes are carried out at Yakutsk since 1995 and daily total ozone measurements are conducted since 1992 using a Brewer spectrophotometer. Standard pre-flight preparation procedures recommended for the NDSC stations has been used since the beginning of the ozone sounding programme. In 1995 – 2002 a 1% KI cathode solution was used and since November 2002 a 0.5% KI cathode solution has been applied. At present, more than 180 ECC ozone sounding have been performed at Yakutsk station.

From the roof of the Yakutsk aerological station.

Salekhard, Russia

Salekhard (67°N, 67°E) is located in western Siberia in the northern Ural region. The importance of this site is that the station is often located inside the Arctic polar vortex during the winter/spring time. Balloon-borne ozone soundings using 2ZECC ozonesondes and daily total ozone measurements with a SAOZ spectrometer have been carried out at Salekhard since 1998. Standard pre-flight preparation procedures recommended for the NDSC stations have been used since the beginning of the ozone sounding programme. From 1998 to 2002 a 1% KI cathode solution was used and since November 2002 a 0.5% KI cathode solution has been applied. At present more than 100 ECC ozone sounding have been performed at the Salekhard station. Long data series have made it possible to perform many ozone observations inside the polar vortex. Severe springtime ozone loss has been detected several times over Siberia in the 1990's when the polar vortex was located over the region and temperatures in the lower stratosphere were cold enough to form polar stratospheric clouds.

The aerological station in Salekhard at 67°N and 67°E.

Scoresbysund

Illoqqortoormiut (Scoresbysund) is a small town on the east coast of Greenland located at 70.5°N and 22.0°W. The Danish Meteorological Institute runs a meteorological station there with help from Tele Greenland. The station has been operating since 1980 with radio soundings twice a day. The first ozone soundings were launched in 1989 and since 1991 ozone soundings have been launched on a regular basis once a week. The station is also equipped with a SAOZ UV-visible spectrometer owned by the CNRS, measuring total column nitrogen dioxide and ozone, since 1991. The station has been an NDSC site for UV-Vis spectroscopy for several years. Since 2003 the ozonesonde programme of the Danish Meteorological Institute is adopted as part of the NDSC ozone and aerosol sonde activity.

The NDSC station at Scoresbysund.

Polar stratospheric clouds over Scoresbysund on 10 December 2002.

Planned stations

Several new stations and instrument deployments are planned for the next few years. Stations that have reached an advanced level of planning are described below.

The High Altitude Tropical Atmospheric Observatory at Mérida, Venezuela

Otto Schrems, AWI Alfred Wegener Institute,
Foundation for Polar and Marine Research, Bremerhaven

The Observatorio Nacional de Llano del Hato (3600 masl)

The city of Mérida (8°N, 71°W) in Venezuela is located at an elevation of 1600-1800 m and is surrounded by mountains up to 5000 m asl. Hence it constitutes an excellent site for a tropical high-altitude atmospheric observatory. The city can be reached from European airports within a day.

The city of Mérida is home of the Universidad de los Andes (ULA) and the Centro de Investigaciones de Astronomia (CIDA). Both institutions have agreed to cooperate with the Alfred Wegener Institute for Polar and Marine Research (AWI) in Bremerhaven, the University of Bremen and the Forschungszentrum Karlsruhe. It is the explicit goal of all involved institutions to get faculty members and students from ULA involved in the projects. The provision of instruments has so far been secured by national funding in Germany. However, there is further demand for financial support for carrying out the measurements and the scientific data analysis.

Two locations in the Mérida surroundings have been chosen: The Observatorio Nacional de Llano del Hato at 3600 masl and the Pico Espejo at 4765 masl.

The table shows the instruments that will be installed at these two sites. The shipment of the instruments was planned for early 2002 but has been delayed due to the political situation in Venezuela. AWI also plans to install a Vaisala ozonesonde system.

The astronomical observatory is easily accessible by car since a paved road leads to the site. The necessary infrastructure (electricity, telephone, lodging for scientists, etc.) already exists. All instruments provided by AWI will be installed at this observatory in transportable laboratory containers.

At the summit of Pico Espejo the microwave sensors as well as a DOAS instrument from the University of Bremen will be installed.

Principal investigator are Otto Schrems (AWI), Klaus Künzi and John Burrows (UBremen) and Gerd Hochschild (FZK). The local principal investigators are Prof. Dr. Pedro Hoffmann from ULA and Dr. Jürgen Stock from CIDA.

Site	Instrument
Obs. Nacional de Llano del Hato 3600 m	Mobile Aerosol Raman Lidar (MARL) – AWI design
	UV spectral radiometer - AWI design & isitec GmbH
	Mobile FTIR spectrometer - Bruker 120 M
	Sun photometer – Dr. Schulz & Partner GmbH, model SP1A)
	UV-Biometer - Solar Light Co., model 501
	Sky imager - Yankee Environmental Systems, model TSI-880
Pico Espejo 4765 m	Microwave instrument MIRA-2
	Microwave Radiometer WARAM
	UV-Vis Spectrometer DOAS

A longer version of this article can be found at ftp://ftp.nilu.no/pub/NDSC/newsletter/2003-1/merida.pdf

RAMAS, A New Radiometer for Atmospheric Measurements At Summit

by
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Introduction

Microwave measurements are severely attenuated by tropospheric water vapour, so high altitude stations are best suited for such observations.

RAMAS (Radiometer for Atmospheric Measurements at Summit) is a new microwave sensor developed for deployment at the Arctic research station Summit (72° N, 38° W) in the interior of Greenland at an altitude of 3200 m.

The project is supported by the European Commission (Fifth framework programme) and the US National Science Foundation (NSF). The instrument will be tested in Bremen during the winter of 2002/03 before installation at Summit. Operation will start at Summit early in the summer of 2003. After an appropriate validation and test phase we will propose to make the RAMAS instrument part of the primary Arctic NDSC station.

Instrument

RAMAS will measure in the 265 – 282 GHz frequency range and collect data of different trace gases (O_3, ClO, N_2O, HNO_3) nearly simultaneously. Table 1 gives an overview of species to be measured.

The instrument will retrieve constituent profiles over the 12-55 km altitude range with a vertical resolution of 6-8 km in the lower and 8-12 km in the upper stratosphere.

Summit Station

The Summit station is operated by the US National Science Foundation. Figure 1 shows a map of the North Atlantic region with Greenland and the position of Summit shown as a red dot. It was first used for the ice core drilling projects (GISP, GRIP) in 1997, and since then, has attracted different groups carrying out Arctic research. In summer (May – August), about 30 people (researchers and engineers) work at Summit for temporary observations or instrument maintenance and upgrades. From September to April, about 5 people are wintering over at Summit to take care of continuously measuring instruments. Figure 2 shows a photo of the station.

For more information on Summit see:

http://www.summitcamp.org/

http://www.hwr.arizona.edu/geosummit

A longer version of this article with more technical details on the RAMAS instrument can be found here:

ftp://ftp.nilu.no/pub/NDSC/newsletter/2003-1/ramas.pdf

Table 1. Expected performance of RAMAS

Species	Alt. range [km]	Accuracy
O_3	12 – 55	0.2 ppm
ClO	15 – 45	0.3 ppb
HNO_3	15 – 45	0.3 ppb
N_2O	15 – 45	10...30 ppb
HO_2	15 – 45	0.1 ppb
H_2O_2	15 – 45	0.05 ppb
NO_2	25 - 45	2 ppb
HCN	15 – 45	0.05 ppb
SO_2	15 – 45	2 ppb

Figure 1. The North Atlantic region with Greenland and with the position of Summit (red dot).

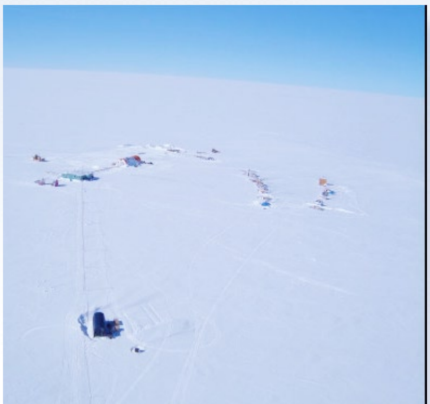

Figure 2. The Summit station seen from the meteorological tower.

BREDOM: Bremian DOAS Network for Atmospheric Measurements

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Introduction

UV-visible spectroscopy combined with the DOAS analysis technique is now an established measurement method and many NDSC stations are equipped with this type of instrumentation.

The classical UV-Vis instrument collects light scattered from the zenith. This gives information on slant column abundances that can be converted to vertical columns with the help of radiative transfer modelling.

A novel technique, the so-called Multiaxis DOAS technique, consists of pointing the instrument at different elevation angles close to the horizon. Such measurements, combined with radiative transfer modelling will give information on the vertical distribution of the species we wish to measure. Figure 1 illustrates the difference between the zenith sky technique and the multiaxis technique.

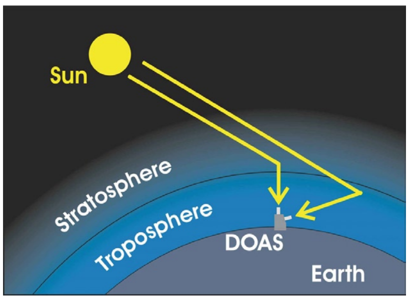

Figure 1. The lower yellow line shows the classical zenith sky measurement geometry where light is scattered from the zenith into the spectrometer. In this configuration the light travels a relatively long distance in the stratosphere and a relatively short distance in the troposphere. The upper line shows a different light path resulting from the instrument pointing at an angle away from the zenith. With this geometry the light travels a relatively longer path through the troposphere.

Instrument

The instrument consists of a spectrograph with a focal length of 257 mm and the grating has 1200 l/mm. The spectral resolution (FWHM) is 0.6 nm. The instrument will observe in five different directions, to the zenith plus four directions between 0 and 30° above horizon. The detector is a CCD with 2048 x 512 pixels. The integration time for a spectrum will typically be 5 minutes in each direction.

Data retrieval

Slant columns will be derived with the Univ, of Bremen DOAS algorithm, which is NDSC qualified. The Sciatran radiative transfer model will be used to combine the slant column abundances from the different directions in order to derive information about the vertical distribution of the measured species. The Sciatran model is a full spherical model that takes into consideration refraction and all orders of multiple scattering. An interface to a chemical model will be made to derive abundances of species that undergo rapid photochemistry. One expects to be able to measure the following compounds: O_3, NO_2, OClO, BrO, IO, H_2O and HCHO.

Deployment

The map in Figure 2 shows the NDSC UV-Vis network as well as the stations that will be equipped with multiaxis DOAS instruments. Currently the stations in Ny-Ålesund, Bremen and Nairobi are in operation with measurements in the UV. Spectrometers for the visible part of the spectrum are planned for 2003. Instruments are also planned for Merida (Oct. 2002), Summit (summer 2003), Zugspitze and Maldives (autumn 2003 or later).

The complete version of this article, with references, can be found at ftp://ftp.nilu.no/pub/NDSC/newsletter/2003-1/bredom.pdf

The project is supported by the BMBF, the University of Bremen and the European Commission (Fifth framework mme).

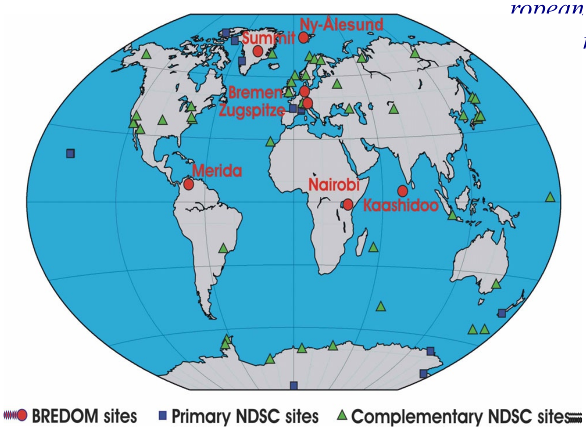

Figure 2. The map shows the primary NDSC sites (blue squares), complementary NDSC sites (green triangles) and existing or planned multiple axis DOAS deployments (red circles).

The stratospheric ozone monitoring radiometer SOMORA

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[1)]Institute of Applied Physics, University of Bern, Switzerland
[2)]MeteoSwiss, Aerological Station, Payerne, Switzerland

Figure 1. View of the microwave radiometer SOMORA located at the aerological station of Payerne.

In the frame of the WMO Global Atmosphere Watch programme, a new ground-based microwave radiometer dedicated to the long-term monitoring of stratospheric and mesospheric ozone has been developed at the Institute of Applied Physics (IAP) of the University of Bern in collaboration with MeteoSwiss (Figure 1).

The stratospheric ozone monitoring radiometer (SOMORA) detects the emission line of ozone at 142.175 GHz. Ozone profiles between 20 and 60 km and with 30 minutes time resolution are retrieved from the recorded spectra using C.D. Roger's optimal estimation method. The SOMORA instrument will complement the existing GROMOS instrument which has been measuring in Bern since 1994. The time series achieved with SOMORA since January 2000 is represented in Figure 2, together with values of the various contributions to the total retrieval error.

The instrument is currently under validation. A comparison of the SOMORA results with coincident measurements of the Hohenpeissenberg and the Observatoire de Haute Provence lidars, the Payerne ozonesondes and the IAP GROMOS microwave shows a very good agreement between the mean profiles. A significant discrepancy is observed only in the comparison with the OHP data, probably due to the larger meridional distance between the two sites. The system was moved from Bern to the Payerne aerological station in June 2002. There, it is operated automatically and complements the balloon-borne ozone soundings which are performed three times a week. After the validation of the SOMORA measurements, an application to the NDSC is planned. The full version of this article, which shows a comparison between SOMORA and other observations, can be found at ftp://ftp.nilu.no/pub/NDSC/newsletter/2003-1/somora.pdf

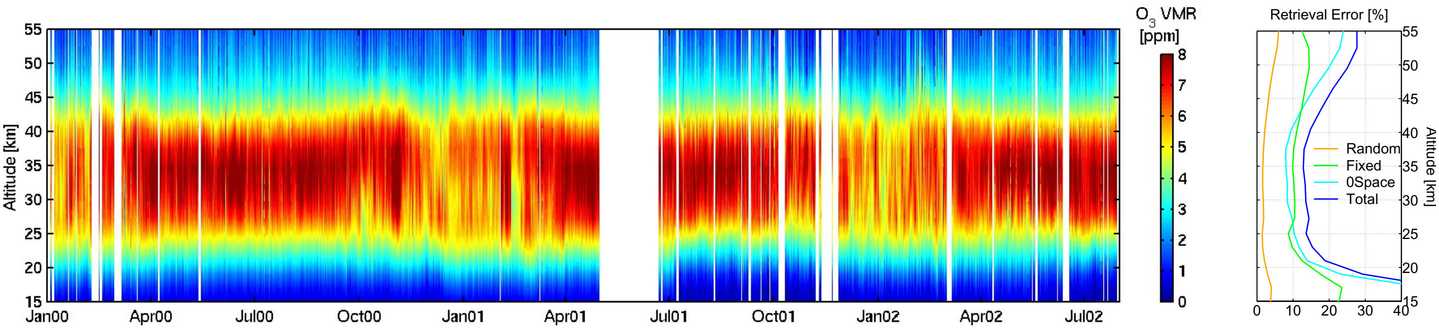

Figure 2. Time series of ozone profiles (left panel) measured with SOMORA, January 2000 – July 2002, together with the mean profiles of the various contributions to the total retrieval error (right panel)

Reports from meetings

The 2002 NDSC Steering Committee meeting

The Steering Committee meeting of 2002 took place in Toronto, Canada, from 11-13 September. The full report from this meeting will be made available on the NDSC web site (www.ndsc.ws).

The first NDSC symposium, Sept. 2001

The first NDSC symposium was arranged in order to celebrate the first ten years of NDSC operation. The report from this symposium follows here.

The stratosphere plays a critical role in the Earth system. Its composition, chemistry, and circulation are affected by, and at the same time significantly influence, processes in the troposphere below and mesosphere above. Its susceptibility to human-induced change, exemplified by chlorofluorocarbon-induced ozone depletion, makes it imperative that we measure and understand the ongoing changes and their effects on Earth's climate and biosphere. Toward this end, the international Network for the Detection of Stratospheric Change (NDSC) was initiated eleven years ago. A landmark conference has recently recorded the remarkable accomplishments of the first decade of this global network.

At its annual meeting in 2000, the NDSC Steering Committee decided that it was timely to organize the first NDSC scientific symposium after ten years of careful and comprehensive worldwide observations of a large number of atmospheric parameters had been obtained, and when theoretical analyses of these data were yielding exciting new environmental insights. The main objectives of the NDSC 2001 Symposium, held at the Palais des Congrès 'Le Palatium' in Arcachon, near Bordeaux, France on 24-27 September 2001, were to: (a) assess the current state of activities and data products; (b) evaluate related data analyses in support of global change and climate; and (c) to emphasize scientific results obtained through the analysis of NDSC data acquired over the past decade, in relation with other data sources such as balloon-borne, aircraft, and satellite measurements, and with model computations. A further goal was to generate discussions and collaborations among the various NDSC working groups as well as among NDSC data producers and external users.

The NDSC began operations in January 1991 to observe ozone, ozone-related chemicals, and meteorological variables primarily at a globally distributed set of ground- based remote-sensing stations (see NDSC Site Map). The Network includes active lidars; passive ultraviolet, visible, infrared, and microwave instruments for total column and vertical profile measurements; and in situ balloon sounding instruments. The NDSC currently involves over 250 scientists from Europe, USA, Canada, Japan, Russia, New Zealand, Australia, and other countries (see http://www.ndsc.ws for details). The Symposium included presentations concerning all of the major Network activities.

Approximately 250 participants registered in advance for the Symposium; however, the tragic events of 11 September 2001 in New York and Washington, DC, USA, discouraged or prevented about 30 colleagues from making such a trip less than two weeks after the tragedy.

A special feature of the Symposium was the Poster Session, comprising 200 posters that were displayed for the entire duration of the Symposium in a room that was also used during breaks, allowing attendees to converse frequently on scientific issues with the poster authors. Another special feature was the interactive Plenary Sessions, which enabled all participants to actively discuss key measurements and conclusions.

At the onset of the Symposium, the Scientific Programme Committee and the Local Organizing Committee expressed their gratitude to the various institutions for their generous grants that made the organization of the NDSC 2001 Symposium possible on a worldwide basis: specifically, the European Commission, ESA, CNES, UNEP, NASA, Ministère de l'Environnement, SPARC/WRCP, CNRS/INSU, CNRS/PNCA, IPSL, and some local institutions. Thanks were also given for the support of SPARC/WRCP and NASA, which enabled researchers from Egypt, Kenya, and Brazil to attend.

The Symposium was organized into seven complementary sessions:

1. Coupling between Stratospheric Change and Surface UV
2. Polar Ozone Loss
3. Global Ozone: Trends and Variability
4. Ozone-Related Chemical Species: Distribution and Trends
5. Dynamics and Climate-Related Studies
6. Satellite Calibration and Validation
7. Prospects: New Algorithms and Analysis Methods, Instruments, and Sites.

Each session began with a review talk, followed by two or three additional short presentations selected from among the posters to illustrate the session, a long break around the posters related to the scientific theme of the session, and a discussion about the results presented in posters, lead by a chairman, a reviewer, and two discussion leaders, who were also in charge of reviewing and synthesizing the information in the various posters.

The following results highlighted during the sessions bear mention.

- Long-term trends of UV radiation in the Northern Hemisphere derived from ground-based measurements and satellite data are in the range of several percent per decade.
- The coupling of stratospheric change and surface UV was discussed for several future climatic scenarios, in both the troposphere and the stratosphere. It is evident that the combination of a warming troposphere and a cooling stratosphere, as expected from increasing greenhouse gases (GHGs), will affect ozone levels and surface UV fluxes in significant ways.
- Arctic ozone loss was extensively studied by different techniques showing good agreement among them. Satisfactory agreement was also seen in the Antarctic. The roles of polar stratospheric clouds and dynamics were emphasized, and a study of the polar vortex using aerosol and lidar measurements provided estimates of subsidence rates in good agreement with theory.
- Several important aspects of ozone variations were highlighted on time scales ranging from the transient appearance of polar vortex filaments over mid-latitude locations to long-term changes documented by both satellite and ground-based observations. New aircraft and NDSC ground-based observations now better define the ozone distribution all the way from the troposphere to the mesosphere. Atmospheric dynamics were shown to have played a significant role in long-term changes in the lower stratosphere.
- Our understanding of stratospheric ozone has improved remarkably using the detailed knowledge of the free radicals involved in catalytic ozone destruction, as well as their source gases and sinks or reservoir species, obtained from NDSC observations and analyses.

We are now at the point where the impressive NDSC database is being compared with theoretical models to answer fundamental scientific questions. The models generally agree qualitatively with observations, but there are differences that appear due (in part) to inaccuracies in model circulation. Nevertheless, the models whose circulations are based on observed meteorology are precise enough to interpret specific chemical events. An impressive array of observations of ozone-related chemical species (most of which are NDSC-targeted species) was reported, including ClO, OClO, $ClONO_2$, HCl, NO_2, BrO, HNO_3, and N_2O. Our knowledge of stratospheric water vapour is incomplete, despite the fact that it is a key constituent in chemical, dynamical, and radiative processes in the stratosphere and the upper troposphere. One of the discussion sessions stressed that more priority should be given to measurements of H_2O in all time and altitude ranges, particularly in the free and upper troposphere, as well as in the lower stratosphere.

Further study is needed on irreversible processes and their associated implications, such as ozone depletion due to rising GHGs (e.g., N_2O and H_2O). Another issue, which became clear in plenary discussions, was the need to increase the scope of the NDSC by including more tropospheric measurements. Several examples include: the use of global measurement networks for all major GHGs; for FTIR total and partial column measurements of tropospheric tracers such as COS, HCN, C_2H_6, and CO; and for cirrus clouds.

One of the major objectives identified at the inception of the NDSC was the role of ground-based measurements in the validation of satellite observations and, particularly, on the identification of and correction for their possible long-term drift. Many examples of such satellite validation activities using NDSC products were presented relevant to TOMS, ILAS, POAM, MOPITT, SBUV, SBUV/2, GOME, SAGE II, MSX/UVISI, CLAES, and HALOE. Looking to the future, there was a strong request dictated by the new generation of space borne instruments to extend NDSC observations toward lower altitudes including the lower stratosphere, upper troposphere, and even the free troposphere. Given the strong diurnal cycle of tropospheric chemical species, most useful tropospheric data for satellite validation would require the measurements to be performed at the precise time of the satellite overpass, which would be possible in some, but certainly not all, circumstances.

Given the importance of the climate issue, it was suggested that NDSC investigators widen their focus to include measurements that can improve the present-day uncertainties in the role of aerosols and clouds in climate change. For this to succeed, researchers involved in measurements and those involved in climate-change models need to have closer interactions. It was suggested that the NDSC convene a meeting to discuss measurement needs and the rationale for observations that will help answer climate-change questions. The "Prospects" discussion session stressed the need for new instrumentation, and the development of new remote-sensing algorithms with an objective assessment of errors in the retrieved products. The importance of refining publicly available data sets and databases, assimilating data into models, and conducting more instrument intercomparisons was emphasized. Finally, as evident from the NDSC sites map (see page 2), additional stations are needed in the Southern Hemisphere as well as at tropical latitudes to address many outstanding key questions of global relevance to ozone and climate-change research.

The presentations clearly demonstrated that the NDSC, in its first decade, has made major steps toward achieving its founding goals. It has made challenging observations through which key changes in the stratosphere have been determined and understood in a timely way. It has established key links between changes in stratospheric ozone, tropospheric chemistry, surface UV, and climate. The Network has provided independent calibrations of space-based instruments, and has produced accurate publicly available data sets for testing and improving atmospheric models. While much still remains to be done, the accomplishments of the first decade bode well for future successes.

Based on the opinions of a large majority of the participants, the NDSC Steering Committee has concluded that the NDSC Symposium was a "tremendous success as a celebration of the first ten years of scientific operations of NDSC. It provided a unique opportunity for the attendees to report and discuss scientific results obtained through the analysis of NDSC data in relation with other sources such as aircraft-, balloon- and satellite-borne measurements, and model computations. Through the oral and poster presentations and extensive discussion periods, the goal of fostering new collaborations among and with the various NDSC Working Groups was certainly advanced.

Participants also contributed to discussions aimed at identifying new opportunities and directions for the Network's activities during the next decade."

NDSC session at EGS/AGU/EUG

At the joint EGS/AGU/EUG conference in Nice in April 2003 there was a special session (AS 28) devoted to results from the NDSC. There were 15 oral presentations and 17 posters. A full overview of posters and talks with abstracts can be found here: http://www.cosis.net/members/meetings/programme/view.php?p_id=37

Upcoming NDSC meetings

NDSC Steering Committee meetings	**Place**	**Date**
2003 Steering Committee meeting	Wellington, New Zealand	December 2003
2004 Steering Committee meeting	Andøya, Norway	September 2004
2005 Steering Committee meeting		
2006 Steering Committee meeting	Mauna Loa, Hawaii	September 2006
Working group meetings		
FT-IR working group	Bremen, Germany	17-20 June 2003
Lidar working group	Rome, Italy	October 2003
Microwave working group	Kos, Greece	June 2004

Relevant projects

In this section you find information on ongoing and new projects that are relevant to the NDSC. These can be both national and international projects.

CANDIDOZ

Chemical and Dynamical Influences on Decadal Ozone Change (CANDIDOZ) is a 3-year EU project that started on 1.4.02. It is coordinated by Esko Kyrö, Finnish Meteorological Institute. The main objective is to establish a scientific basis for the detection of the earliest signs of ozone recovery due to the Montreal protocol and its amendments. The aim is to assess the development of the ozone layer and subsequent UV exposure and the possible consequences of climate-ozone interaction. More information is found here: http://fmiarc.fmi.fi/candidoz/

COSE

In the frame of the EU project COSE, Compilation of atmospheric Observations in support of Satellite measurements over Europe (1998-2000; coordinator: M. De Mazière, BIRA-IASB), a Data Consolidation Document was compiled. It was updated recently within QUILT. This document tabulates the most relevant characteristics of an important number of NDSC data products (*total column data for* O_3*,* NO_2*, HCl, HF,* $ClONO_2$*, OClO,* HNO_3*,* CH_4*, CO, and profile data for* O_3*, ClO, and aerosol),* as measured by European LIDAR, microwave radiometer, O_3 sondes, and FTIR and UV-Vis DOAS spectrometers. The characteristics include temporal and spatial resolution, accuracy and precision, and acquisition conditions. The document is meant to assist the user in further scientific data exploitation. It can be downloaded from http://www.nilu.no/projects/nadir/cose/DCdoc_Final_version.pdf .

COZUV

COZUV was a national Norwegian ozone and UV project funded by the Research Council of Norway. It started in 1999 and ran through 2002. The project involved chemical and dynamical modelling, observations of ozone and relevant trace gases and observations and modelling of UV radiation. More information can be found here: http://www.nilu.no/projects/cozuv

EDUCE

European Database for UV Climatology and Evaluation (EDUCE) is a 3-year EU project that started on 1.6.2000. The project is ccordinated by Günther Seckmayer, Univ. of Hannover. The objectives are:

- To establish a UV climatology for Europe in combination with investigations into potential long-term changes in the UV radiation environment,
- To continue the collection and storage of UV radiation and ancillary data in the European UV database, providing a comprehensive database of measurements together with the software tools needed for efficient search and retrieval of data,
- To control and assess the quality of the data in the database,
- To develop, test and implement radiative transfer models, which are the primary tools in both the study of the UV environment and the quality assurance of the measurements.

More information can be found here: http://www.muk.uni-hannover.de/~martin/

ESAC

Experimental Studies of Atmospheric Changes II (ESAC II) is a Belgian national project coordinated by Martine De Mazière, BIRA-IASB. It supports all Belgian NDSC activities related to the International Scientific Station of the Jungfraujoch, the Harestua and Uccle observatories and the Observatoire de Haute Provence. It also includes the initiation of the Belgian NDSC activities at Île de la Réunion: a first FTIR campaign took place in Sep-Oct 2002 with 2 instruments simultaneously at the Maido summit and the university campus in St. Denis; in 2003, a MAXDOAS instrument will be installed for long-term operation. More information: http://ww.oma.be/ESACII/Home.html.

GMES-GATO

GMES-GATO is an EU project that aims at defining the strategy for atmospheric observations within the joint European Union/European Space Agency initiative called GMES (Global Monitoring for Environment and Security). The project is funded as a concerted action and is coordinated by Geir Braathen, NILU. More information can be found here: http://www.nilu.no/gmes-gato

HIBISCUS

HIBISCUS is an EU project coordinated by Jean-Pierre Pommereau, CNRS. The aim is to study the impact of tropical dynamical, microphysical and chemical processes on the global stratosphere. The project uses a variety of instruments measuring a range of trace gases including ozone and water vapour borne by balloons which are launched from Brazil. Long duration balloons are used to circle the globe in flights lasting several weeks. The results are analysed using sophisticated computer models. More information is found here:

http://www.aero.jussieu.fr/projet/HIBISCUS/index.html

MAPSCORE

Mapping of Polar Stratospheric Clouds and Ozone Levels Relevant to the Region of Europe (MAPSCORE) is a 3-year EU project that started on 1.1.2001. It is coordinated by John Remedios of the Univ. of Leicester. Stratospheric ozone levels over the region of Europe are profoundly influenced by lower stratospheric temperatures and the stability of the polar vortex, as ozone loss is sensitive to the threshold nature of polar stratospheric cloud (PSC) formation and denitrification. In the MAPSCORE project European scientists are fully exploiting the available field and satellite measurements. By providing maps of PSC properties, denitrification and new observations, together with data assimilation analyses, existing datasets are enhanced. These datasets are being produced for four entire winter/spring periods. More information: http://www.leos.le.ac.uk/mapscore/

QUILT

Quantification and Interpretation of Long-Term UV-Vis Observations of the Stratosphere (QUILT) is a 3-year EU project that started on 1.1.2001. It is coordinated by Geir Braathen, NILU. The aim of the project is to optimise the exploitation of the existing European UV-visible monitoring systems by which O_3 and the related free radicals NO_2, BrO and OClO can be measured. These monitoring systems include ground-based, balloon and satellite observations. QUILT is providing an assessment of the chemical ozone loss over the last decade and through 2000-2003. This is achieved through analysis improvements, consolidation of existing datasets and near real time integrations with chemical transport models. More information is found here: http://nadir.nilu.no/quilt/

QUOBI

Quantitative Understanding of Ozone losses by Bipolar Investigations (QUOBI) is a 3-year EU project coordinated by Peter von der Gathen, AWI. The aim is to gain a quantitative understanding of chemical ozone loss in the polar regions by comparing models and observations under a broad spectrum of meteorological conditions. Estimates of chemical ozone loss are made in the Arctic and Antarctic by coordinated campaigns including ozonesonde and satellite measurements of ozone and other important species. The results are compared with chemical transport models to identify what deficiencies exist and to find possible explanations. More information is found here: http://www.nilu.no/quobi/

SOGE

System for Observation of halogenated greenhouse gases in Europe (SOGE) is an integrated system for observation of halogenated greenhouse gases in Europe. The project is funded by the European Commission and is coordinated by Frode Stordal, NILU. The project builds on a combination of observations and modelling. The observations are partly surface in situ data collected continuously at four background stations as a part of national or international measurement programs. More information can be found here: http://www.nilu.no/niluweb/services/soge/

UFTIR

Time series of Upper Free Troposphere observations from a European ground-based FTIR network (UFTIR) is an EU project coordinated by Martine De Mazière, BIRA-IASB. It started on 1.2.03 and will last for 30 months. The main objectives are a) to revise and homogenise the analyses of available experimental data using new inversion algorithms, for providing consistent time series of distict tropospheric and stratospheric abundances of the target gases (CO, C_2H_6, CH_4, N_2O, O_3, HCFC-22,), and b), to derive long-term trends of tropo- and stratospheric abundances. The consortium of the UFTIR project is built around the European part of the NDSC FTIR community, complemented with some atmospheric modeling teams and one dealing with laboratory spectroscopy relevant to atmospheric remote sensing. More information: http://www.nilu.no/uftir

Vintersol

VINTERSOL (Validation of INTERnational Satellites and study of Ozone Loss) is a major European field campaign studying stratospheric ozone. VINTERSOL ('Winter sun' in the Scandinavian languages) will take place from late 2002 until mid 2004. It is the latest major European field campaign to study ozone loss. There have been three previous European campaigns: the European Arctic Stratospheric Ozone Experiment (EASOE); the Second European Stratospheric Arctic and Mid-latitude Experiment (SESAME); and the Third European Stratospheric Experiment on Ozone (THESEO). Like them, VINTERSOL relies jointly on support from national funding agencies and from the Environment and Sustainable Development programme of EC DG Research.

An important dimension for VINTERSOL is the involvement of several new European satellite instruments. Measurements from the ERS-2 GOME satellite instrument (operational since 1995) and from the POAM III instrument on the SPOT IV satellite (operational since 1998) will continue to be used. However, in addition, measurements from the ODIN satellite (launched in February 2001) and ESA's new ENVISAT satellite (launched in March 2002) will be validated and, in time, analysed. VINTERSOL is thus being mounted in conjunction with the validation campaign for ENVISAT satellite, and it will significantly extend the scope and duration of the validation activities, so enhancing the quality of the measurements made by these satellite instruments. The increasing international dimension to earth observation studies is also evident, as there will be cooperation with the validation campaigns for the NASA SAGE III (SOLVE-2) and the NASDA ILAS-2 satellite instruments.

There are four main phases to VINTERSOL in which detailed studies of atmospheric processes will be made:

- a small balloon campaign in the tropics in late 2002;
- intensive Arctic ozone loss studies in the 2002/03 winter/spring;
- ozone loss studies in the Antarctic winter and spring 2003; and
- balloon and aircraft studies in the tropics in early 2004.

In addition a number of measurement and modelling projects will run continuously through this period yielding information on the longer time-scale processes in the stratosphere.

The international Network for the Detection of Stratospheric Change (NDSC) was formed to provide a consistent, standardised set of long-term measurements of atmospheric trace gases, particles, and physical parameters via a suite of globally distributed sites.

The principal goals of the network are:

- To study the temporal and spatial variability of atmospheric composition and structure in order to provide early detection and subsequent long-term monitoring of changes in the physical and chemical state of the stratosphere and upper troposphere; in particular to provide the means to discern and understand the causes of such changes.
- To establish the links between changes in stratospheric ozone, UV radiation at the ground, tropospheric chemistry, and climate.
- To provide independent calibrations and validations of space-based sensors of the atmosphere and to make complementary measurements.
- To support field campaigns focusing on specific processes occurring at various latitudes and seasons.
- To produce verified data sets for testing and improving multidimensional models of both the stratosphere and the troposphere.

The primary instruments and measurements of the NDSC are:

- Ozone lidar (vertical profiles of ozone from the tropopause to at least 40 km altitude; in some cases tropospheric ozone will also be measured)
- Temperature lidar (vertical profiles of temperature from about 30 to 80 km)
- Aerosol lidar (vertical profiles of aerosol optical depth in the lower stratosphere)
- Water vapour lidar (vertical profiles of water vapour in the lower stratosphere)
- Ozone microwave (vertical profiles of stratospheric ozone from 20 to 70 km)
- H_2O microwave (vertical profiles water vapour from about 20 to 80 km)
- ClO microwave (vertical profiles of ClO from about 25 to 45 km, depending on latitude)
- Ultraviolet/Visible spectrograph (column abundance of ozone, NO, and, at some latitudes, OClO and BrO)
- Fourier Transform Infrared spectrometer (column abundances of a broad range of species including ozone, HCl, NO, NO_2, $ClONO_2$, and HNO_3)
- Ozone and aerosol sondes (vertical profiles of ozone concentration and aerosol backcatter ratio)
- UV spectroradiometers (absolutely calibrated measurements of UV radiance and irradiance)

Contacts

For more information, please go to the NDSC web site (*www.ndsc.ws*) or contact the co-chairs:

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