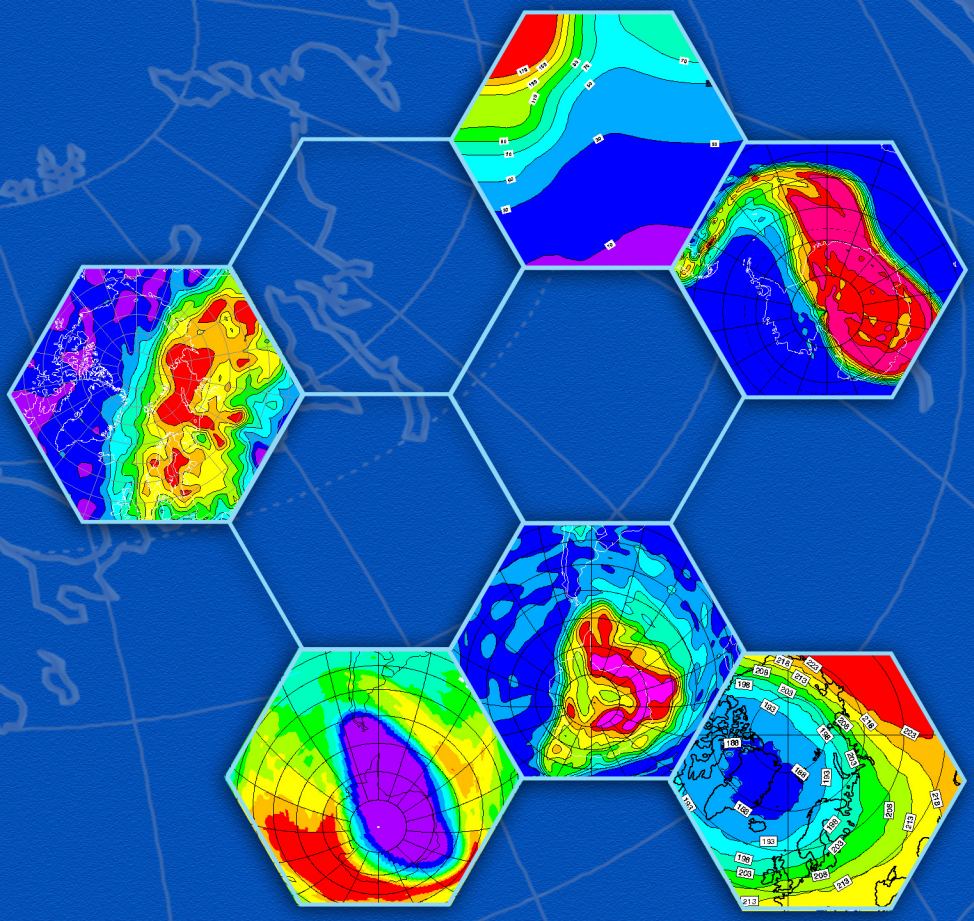
NADIR NEWS

No. 2 / 2003



NADIR

NILU: TR 11/2003
REFERENCE: U-103002
DATE: NOVEMBER 2003
ISBN: 82-425-1518-2
ISSN: 0807-7185

Contents

Editorial

This issue of NADIR NEWS is meant to give information on new developments and products at NADIR since the previous issue (December 1998) and in conjunction with the VINTERSOL campaign. Most of the information given in the previous issue has been kept in this issue so that it constitutes an independent source of information. For those who are not familiar with the NADIR data centre it can be mentioned that NADIR was put into operation in conjunction with the European Arctic Stratospheric Ozone Experiment in 1991-92. NADIR is an abbreviation for NILU's Atmospheric Database for Interactive Retrieval. NADIR now has approx. 500 users from all over Europe as well as USA, Canada, Japan and New Zealand. There are more than 300 login sessions per day during the most intensive winter periods. A first version of Nadir News 2003 was issued in early spring in connection with the startup of the ASSET project. The current version contains a few updates and corrections, and is prepared for printing.

Nomenclature

We use fonts of different colours and styles in order to improve the readability of the text. In the body text we use `this font` when we refer to directory names, file names and text lines in text files which are to be taken literally. *`This font`* is used for placeholders of text or file names. Such text should not be typed literally but replaced with text that applies to your case. Programs and scripts are referred to by **`this font`**. Commands that you type are shown in **`this font`**. If a command contains placeholders, they are given in ***`this font`***. Links to web pages and ftp sites are given in red colour, like this:
http://www.nilu.no
The PDF version of this document have hyperlinks to all referred web pages, so you can access them just by clicking on the link.

New developments

Since the previous issue of NADIR NEWS (December 1998) a number of new developments have taken place at NADIR. The most important new developement is the ENVISAT Cal-Val database. The following sections describe these new items in more detail. The information given in previous issues is also included, so this issue gives a complete description of the NADIR services.

Zardoz hardware

zardoz.nilu.no is a Sun clone with 2 Sparc II processors running at 400MHz. The IP address is 128.39.104.1. It runs the Solaris 7 operating system. zardoz is equipped with approx. 600GB of disk space.

Directory structure

A new directory structure has been implemented at NADIR. This has been done in order to make navigation easier for our customers and also to make the maintenance and back-up of the file systems easier. Most project related directories have been moved to directories located under `/nadir/projects`. Projects that are not directly linked to the coordinated European campaigns are found under `/nadir/projects/other`. Here one finds projects such as APE, GODIVA, Leewave, OSDOC, SAONAS, GOA and TOPOZ as well as several others.

For the ENVISAT Cal-Val and the ASSET databases, datafiles are located under `/nadir/esa/data` and `/nadir/eu/asset/data` respectively.

VINTERSOL directory tree

A directory tree has been set up for the VINTERSOL campaign. The VINTERSOL data will be stored under `/nadir/projects/vintersol`.

Ozonesonde data, which are collected mainly as a part of the Match campaign organised through the QUOBI project, will be stored in `/nadir/projects/vintersol/data/o3sondes`.

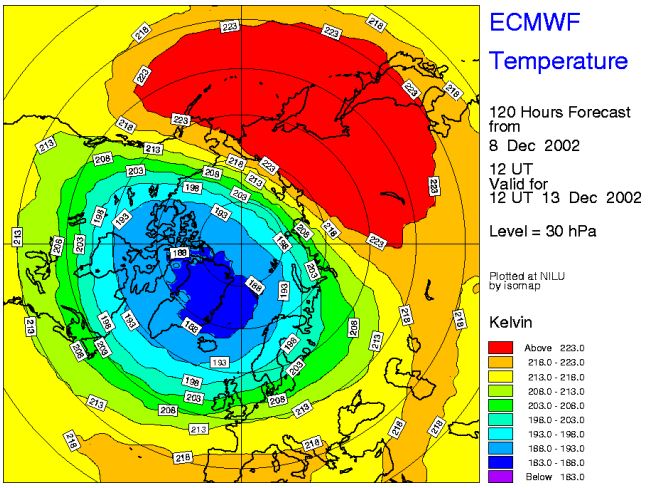


Figure 1. *120 hours forecast of temperature at 30 hPa valid for 12 UT on 13 December 2002.*

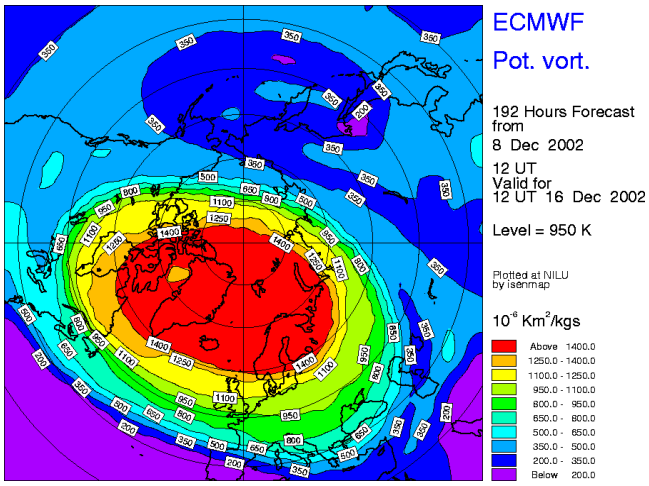


Figure 2. *A 192 hours potential vorticity forecast map valid for 16 December 2002 at the 950 K isentropic level (approx. 4-8 hPa).*

Under the main VINTERSOL directory, data from the related project will be stored in subdirectories such as `/nadir/projects/vintersol/euplex` and `/nadir/projects/vintersol/quilt`. Coordinators for those projects that have not yet arranged with directories should contact the NADIR team as soon as possible.

Daily updated plots

On zardoz you can find ready-made plots of a number of parameters that are updated on a daily basis. The plots are stored as GIF files. These products are found in various subdirectories under the directory `/nadir/plots`.

Maps of isobaric ECMWF fields

Analysis and forecast maps of temperature and geopotential height at the 14 standard isobaric levels from 1000 to 5 hPa are made every day. The maps are stored as colour GIF files in `/nadir/plots/isobaric_gif/yymmdd`. Figure 1 shows an example of such a map.

Maps of isentropic ECMWF fields

Analysis and forecast maps of temperature and potential vorticity at isentropic levels are stored as colour GIF files in `/nadir/plots/isentrop_gif/yymmdd`. Figure 2 shows an example of a potential vorticity map.

Maps of T_{106} data

Analysis maps of various parameters at T_{106} resolution (1.125 × 1.125 degrees are produced on a daily basis. These plots are available under `/nadir/plots/t106`. There are maps of T and GPH at isobaric levels and of PV and T at isentropic levels. The maps are stored in the GIF format. Figure 3 shows an example of such a map.

ECMWF products on the web

The maps of isobaric, isentropic and T_{106} data described above,

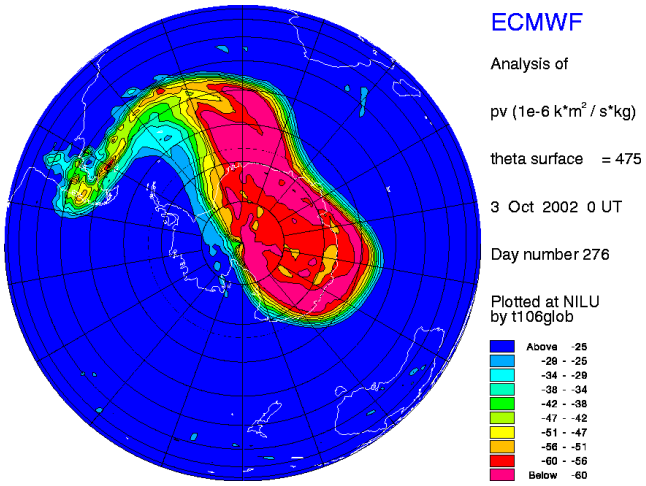


Figure 3. *Map of south polar potential vorticity for 3 October 2002, during the major warming that destroyed a large part of the vortex.*

are also available through the web site http://nadir.nilu.no/ecmwf. In addition to these, it is also possible to create trajectory plots similar to those made by the **`trajplo`** program described on page 22.

Through the web site, it is also possible to download preextracted T_{106} data in NASA-Ames format. As a part of the ENVISAT CalVal database project, a routine for extraction of met-data into HDF format was developed. This program is called **`hdfmars`** and is described in detail on page 18. It is possible to access this program through the web site and thereby extract met-data on demand - solely by the use of a web browser.

The web site is only available for those who have signed the ecmwf4 protocol. Use the same username and password as you do on zardoz.nilu.no to enter the site.

Maps of filaments

In conjunction with the former METRO project, the group at CNRS put into operation a service for daily maps with analyses and forecasts of potential vorticity. Plots of filaments in GIF

format are produced using a high horizontal resolution MIMOSA advection model (18 × 18km) of PV developed at Service d'Aéronomie du CNRS[1]. The model starts from ECMWF PV analysis on 1st November and computes the advection of PV using daily ECMWF analyses and forecasts available on NADIR. In order to follow the diabatic evolution of PV during the winter, a relaxation toward the large-scale ECMWF PV field is applied with a 10 days relaxation time. Daily plots of filaments are produced for 7 isentropic levels, 350, 380, 400, 435, 475, 550 and 675 K and for 00, 24, 48, 72, 96 and 120 hours forecast. Temperature maps at 475K are also produced on the same format for interpretation. Figure 4 shows one example of such a map. These maps are found as GIF files in http://www.aerov.jussieu.fr/~fgoutail/MIMOSA.html.

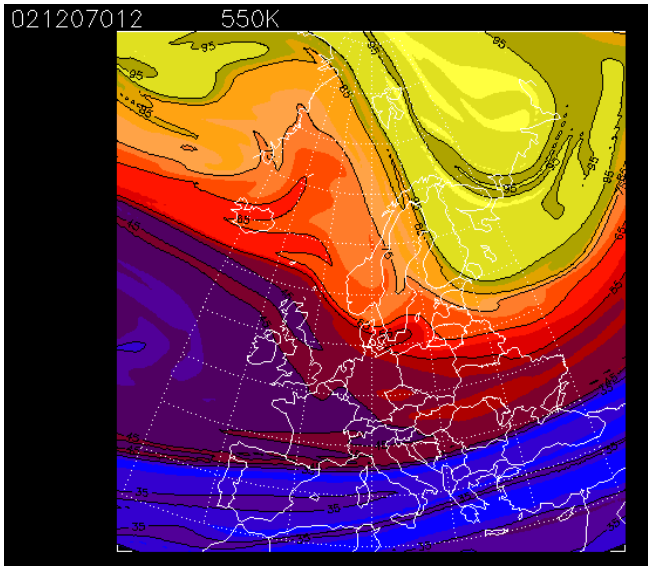


***Figure 4**. 24 hours forecast map of PV at 550K valid for 7 December 2002. This map has been made with a domain filling trajectory model running at CNRS.*

Total ozone maps

The WMO real time ozone mapping unit at the University of Thessaloniki produces daily maps of total ozone based on the GO_3OS, i.e. the Dobson and Brewer network of spectrophotometers. These map are found as postscript files in `/nadir/plots/wmo`. Figure 5 shows such a map.

The Antarctic vortex

During the south polar ozone hole season NILU runs a service for the WMO that calculates certain parameters on the development of the Antarctic vortex. Among these parameters are minimum temperatures, vortex area etc. Plots of these parameters are presented on the web. This service has been in operation since 2000 and will continue during the VINTERSOL period. The plots can be found here:
http://www.nilu.no/projects/nadir/o3hole

Figure 6 shows an example of a plot of the area of the vortex.

1. A. Hauchecorne, M. Marchand, S. Godin and C. Souprayen, A high resolution advection model for the interpretation of ozone filaments observed in lower stratospheric ozone lidar profiles at mid-latitudes, Proceedings of the European Workshop on Mesoscale Processes in the Stratosphere, Bad Tölz, Germany, 9-11 November 1998, pages 105 - 110.

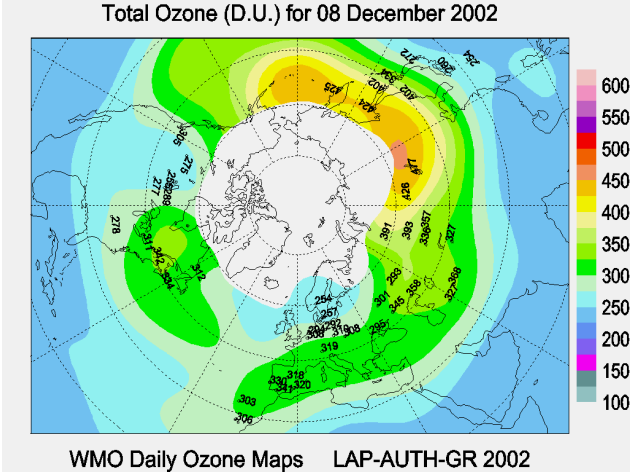


***Figure 5**. Total ozone for 8 December 2002 based on the GO_3OS and GOME.*

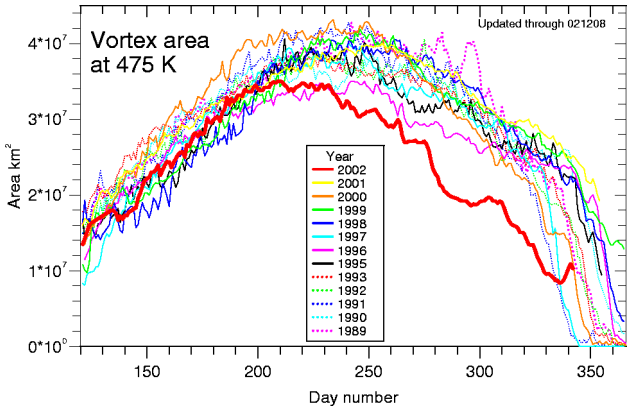


***Figure 6**. Area of the south polar vortex at 475K. The red curve shows the development during the unusual 2002 ozone hole season.*

Near-Real-Time processing of ozone sonde data for ECMWF

At the joint ECMWF/WMO expert meeting on realtime exchange of ground based ozone measurements, held at ECMWF in 1996, the requirements for ozone data for NWP (Numerical Weather Prediction) in realtime were outlined. ECMWF has developed the operational data assimilation system to include ozone retrieval from SBUV and GOME, and requires independent high quality profile data from ground-based systems. For daily validation, monitoring and troubleshooting, it was found that ozone sonde measurements should be available at the centre within 12-24 hours after the sounding.

NILU has collected ozone measurements from Arctic balloon flights through the Nadir database since 1988. Files are transferred and stored in the NASA-AMES 2160 format, and an automatic script has been set up to convert incoming data into the CREX format that is used at ECMWF. This script also performs a series of data quality checks, and can do simple corrections on

erroneous input files.

The CREX-converting routine is a modulised Perl script that automatically runs every 15 minutes on zardoz.nilu.no. On each run:

- The program recursively traverses a given directory.
- New incoming files since last run are identified, and for each file;
- A format check is done with dataex. Does it qualify as a proper NASA-AMES 2160 file?
- If so, the data values are loaded into a Perl object.
- Needed meta-data are retrieved from the header of the NASA-AMES file.
- At each pressure level of the sounding, the values are made sure to be legal and reasonable.
- Checks are made on pressure values, and temperatures inside and outside of the Styrofoam box.
- Errors are logged, and sometimes causes rejection of the file.
- The total ozone column is approximated
- A CREX file is made with ozone pressure, total pressure, outside temperature, relative humidity, time after launch, wind speed and wind direction for each pressure level.
- The final output is stored in a separate directory.

At the end of each run, a log file is updated to keep track of old and new files.

No qualitative changes are made to the sonde data, but the series of pressure levels are made monotonic if needed and bad data lines are skipped in the output. The latter is normally caused by negative pressure or negative time-after-launch values.

ECMWF downloads new CREX files from zardoz every 30 minutes. All ozone soundings that are uploaded to NADIR are therefore converted and transferred to the weather centre in Reading within a maximum of 45 minutes.

The script is currently used for ozone sonde stations that submit data through the VINTERSOL project. This near-real-time product is only available to ECMWF at the moment, but NILU is interested in contributing and developing this resource through future projects.

Current and recent projects

In this section we present some of the current stratospheric ozone projects that are part of the VINTERSOL campaign and other projects that are currently using the NADIR database. Some recent, but completed projects are also presented.

The VINTERSOL campaign

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 has 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 three main phases to VINTERSOL in which detailed studies of atmospheric processes will be made:

- 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.

More information on VINTERSOL and a planning document can be found on the web site of the European Ozone Research Coordinating Unit, http://www.ozone-sec.ch.cam.ac.uk/.

Overview of the VINTERSOL projects

The VINTERSOL campaign consists of a number of projects funded by the European Commission (DG Research) and by various national agencies. The table below lists these projects.

Projects participating in or linked to VINTERSOL

Acronym	Coordinator	URL
APE-Infra	Leopoldo Stefanutti, IROE/CNR	http://ape.iroe.fi.cnr.it/APE-Infra.htm
CIPA	Niels Larsen, DMI	http://web.dmi.dk/pub/CIPA/

Projects participating in or linked to VINTERSOL

Acronym	Coordinator	URL
EDUCE	Gunther Seckmeyer, Univ. of Hannover	http://www.muk.uni-hannover.de/EDUCE
EUPLEX	Fred Stroh, FZ Jülich	http://www.nilu.no/euplex
HIBISCUS	Jean-Pierre Pommereau, CNRS	http://www.aero.jussieu.fr/projet/HIBISCUS
MAPSCORE	John Remedios, Univ. of Leicester	http://www.leos.le.ac.uk/mapscore
POSTA	Ulrich Schurath, FZ Karsruhe	http://imk-aida.fzk.de/posta
QUILT	Geir Braathen, NILU	http://nadir.nilu.no/quilt
QUOBI	Peter von der Gathen, AWI	http://www.nilu.no/quobi
TROCCINOX	Ulrich Schumann, DLR	http://www.pa.op.dlr.de/troccinox
UFTIR	Martine de Mazière, IASB	http://www.nilu.no/uftir
AMIL2DA	Thomas von Clarmann, FZ Karlsruhe	http://www-imk.fzk.de/imk2/ame/amil2da
CANDIDOZ	Esko Kyrö, FMI	http://fmiarc.fmi.fi/candidoz
CARIBIC III	Carl Brenninkmeijer, Max Planch Institute, Mainz	http://www.caribic-atmospheric.com
EUROSPICE	J. Austin, UK Met Office	http://www.metoffice.com/research/stratosphere/processes/eurospice
GOA	Hennie Kelder, KNMI	http://www.knmi.nl/goa
MOZAIC III	Jean-Pierre Cammas, CNRS	http://www.aero.obs-mip.fr/mozaic
TOPOZ III	W. Kouker, DLR	http://www-imk.fzk.de/topoz-iii

More information on these projects can be found on the web pages of the Ozone Secretariat;
http://www.ozone-sec.ch.cam.ac.uk/

The GMES-GATO project

Global Monitoring for Environment and Security - Global Atmospheric Observations (GMES-GATO) is an EU funded conserted action, aiming to develope a strategy for global observations of atmospheric composition within GMES. Issues to be adressed include greenhouse gases, stratospheric ozone and urban pollution. The scope of the project is therefore to cover all aspects of atmospheric change on global, regional and local scale. Databases is one out of five topics in GMES-GATO, and issues like user needs and harmonisation between different databases will be addressed. The project is therefore expected to make a significant impact on the future developements of the NADIR data centre. GMES-GATO started 1st of February 2003 and will run for 24 months. More information can be found at the official web site: http://www.nilu.no/gmes-gato

Information of the cooperation between the European Union and the European Space Agency through GMES can be found at the official web site: http://www.gmes.info

The ASSET project

ASSET (Assimilation of ENVISAT Data) is a European (EU) initiative to exploit and develop earth observation data from Envisat using data assimilation. The project has two major activities and is aiming to exploit the satellite data in Numerical Weather Prediction (NWP) and investigate the distribution of chemical species. A third supporting activity covers data management, and the NADIR datacentre will be used to make these value-added data available to the scientific community. The project runs from January 1st 2003 until the end of 2005 and aims to (a) develop a European capability for chemical and UV forecasting and (b) provide analyses for coupled climate/chemistry studies. More information on the ASSET project can be found at the official web site: http://darc.nerc.ac.uk/asset/

The ASSET database builds on the system developed for the ENVISAT CalVal database, and the assimilated products are therefore accessible through a searchable web interface. The ASSET dataset will initially only be available to the project partners, but the idea is to make it public after completion. The ASSET database is found at: http://nadir.nilu.no/asset

The QUILT project

QUILT (Quantification and Interpretation of Long-Term UV-Visible Observations of the Stratosphere) started up in January 2001 and will last through December 2003. The EU project addresses stratospheric ozone depletion in particular, but is also focused on better exploitation of existing data, and development of new long-term observing capacites. QUILT uses the existing ground-based, satellite and balloon borne UV-visible data as well as 3D atmospheric modelling tools for quantifying ozone loss in the past, to monitor its development in the present and to investigate its relation to active halogen and nitrogen species.

The official QUILT web page is found at http://nadir.nilu.no/quilt and gives a general introduction to concepts, aims and achieved goals. Password protected pages are also available to project partners, and allows the consortium members to upload and download datafiles through the web interface.

The GOA project

GOME Assimilated and Validated Ozone and NO_2 Fields for Scientific Users and for Model Validation, GOA, was a two year long EU project completed in January 2003. Products such as a 7 year (August 1995- May 2003) dataset of assimilated total ozone, a one year dataset of assimilated and validated ozone profiles and a multi-year dataset of total NO_2 were produced by the consortium. A large amount (several thousands) of europe-

an ozone sonde data, collected at the NADIR data center, were used to validate the ozone profiles. The GOA datasets will be made available from KNMI in 2003. More information on the project can be found at the official web site: http://www.knmi.nl/goa

The UFTIR project

The consortium of the EU-project UFTIR is built around the European part of the NDSC FTIR community, complemented with some atmospheric modeling and related laboratory teams. "Time series of Upper Free Troposphere observations from a European ground-based FTIR network" (UFTIR) started in February 2003 and will last for 30 months. The main objective of the project is to provide trends and time-series of distinct tropospheric and stratospheric target gases such as N_2O, CH_4, HCFC-22, CO, C_2H_6 and O_3. All time-series will be archived at NADIR. More information on the project is found at: http://www.nilu.no/uftir

The MAPSCORE project

Mapping of Polar Stratospheric Clouds and Ozone Levels Relevant to the Region of Europe (MAPSCORE) is an EU-project focused around ozone depletion over Europe and its relation to the formation of polar stratospheric clouds (PSCs). MAPSCORE will provide data and tools which will advance the understanding of Polar Stratospheric Cloud (PSC) formation and their control of ozone depletion in the European region. Maps of ozone, related chemical species and PSCs will be delivered to the NADIR database. In this context, NILU is providing the partners with tools for quality assured file-generation and visualization, and a password protected web site has been set up to download project files and documents. These pages are found on http://nadir.nilu.no/mapscore, while the official mapscore site is located at: http://www.leos.le.ac.uk/mapscore/

The CANDIDOZ project and the ERA-40 data set

CANDIDOZ (Chemical and Dynamical Influences on Decadal Ozone Change) is a three year long EU project started up in May 2002. The main objective is to establish a scientific basis for the detection of the earliest signs of ozone recovery due to Montreal protocol and its amendments. This will be achieved by selecting the best long-term ozone and meteorological data sets available (by ECMWF and NCEP). In the context of CANDIDOZ, the NADIR data centre is collecting PV and pressure fields on five selected isentropic levels from the ERA-40 data set (ECMWF). A complete time-series from 1957 to 2001 is stored in ASCII format (not NASA-Ames) at zardoz.nilu.no. Access to these data are so far limited to internal use at NILU, but investigators interested in the data set should contact the NADIR team. More information on the CANDIDOZ project is found at: http://fmiarc.fmi.fi/candidoz

The EUPLEX project

The "European Polar Stratospheric Cload and Lee Wave Experiment" is an EU project started in May 2002 and ending in April 2004. EUPLEX will critically test current hypotheses for the three key processes of Arctic stratospheric ozone depletion chemistry: 1) PSC formation and properties in Lee-wave and synoptic scale PSC, 2) Halogen activation on PSC and 3) Chemical ozone loss. The use of stratospheric airplane measurements is central in the project, but the scientific problems are also approached with simulations from various models. The EUPLEX web site is located at: http://www.nilu.no/euplex

The QUOBI project

The EU funded project QUOBI (Quantitative Understanding of Ozone losses by Bipolar Investigations) started up in January 2002 and will last for 36 months. The main objective of the project is to test our quantitative understanding of the chemical mechanisms that destroy ozone in the wintertime Arctic stratosphere, and to improve the representation of these processes in chemical models of the atmosphere. The experimental basis of this project are two co-ordinated match-campaigns of measurements of ozone loss rates, one in the Antarctic polar vortex and one in the Arctic polar vortex. This will be the first time such a campaign takes place in the southern hemisphere. The NADIR data center collectes all ozone-sonde measurements on a near-real time basis, and provides forecasts and analyses of the needed meteorological parameters. The QUOBI web pages are located at: http://www.nilu.no/quobi

The PVC project and the ERA-15 data set

PVC (Polar Vortex Change) was an EU project aiming at studying the climatology of the north Polar vortex. For this project we acquired parts of the ERA-15 reanalysis data set from ECMWF. This data set dates from January 1979 through February 1994, and we can provide the complete set of daily (noon) temperature and wind data for all these years. The horisontal resolution is 1.125x1.125 degrees (T106), and the upper level is 10 HPa or 700K. Access to this data set is limited to the PVC partners, but investigators interested in this data set should contact the NADIR team.

The COSE project

Compilation of ground based measurements in support of Satellite measurements over Europe (COSE) was an EU project under Theme 3.3 (Centre for Earth Observation) of the Environ-

ment and Climate work programme. This project was the successor of the previous ESMOS project and could be considered as EU's contribution to the NDSC network. This project encompassed many of the ground based measurements carried out in Europe with UV-Vis spectrometers, lidars, FT-IRs and microwave instruments. Further information on the completed project is available at http://www.nilu.no/projects/nadir/cose/cose.html

The COZUV and AerOzClim projects

COZUV (Coordinated Ozone and UV project) was a joint Norwegian project within stratospheric ozone and UV research. It started in January 1999 and ran through 2002. The main objectives were to gain increased understanding of the processes that lead to ozone loss in the Arctic and at middle latitudes and to understand how changes in the ozone layer affects the amount of UV radiation that hits the ground. More details can be found at: http://www.nilu.no/projects/cozuv/

AerOzClim (Aerosols, Ozone and Climate) is a natural continuation of the work laid down in COZUV. The main objective of AerOzClim is to improve our understanding of aerosol- climate and ozone-climate interactions, by developing and applying global models in combination with analysis of data, to study processes involved, and to provide improved parameterisations for climate models. More information at: http://www.geofysikk.uio.no/forskning/atmosfare/prosjekter/AEROZCLIM

Network for the Detection of Stratospheric Change (NDSC)

What is the NDSC?

The Network for the Detection for Stratospheric Change (NDSC) is a set of high-quality remote-sensing research stations for observing and understanding the physical and chemical state of the stratosphere and assessing the impact of any stratospheric changes on the underlying troposphere and on global climate. The measurement priorities concern ozone and key ozone related parameters such as temperature, aerosols and tracers of chemistry and atmospheric motion. The current NDSC network of approx. 50 stations are supported by other existing ground-based monitoring networks, by ozonesondes and by measurements from satellites. Over 100 scientists from 15 countries are involved with NDSC research activities world wide. The NDSC is a major component of the international upper atmosphere research effort and has been endorsed by national and international scientific agencies, including the International Ozone Commission, the United Nations Environment Programme (UNEP), and the World Meteorological Organization (WMO).

Following five years of planning, instrument design and implementation, the NDSC began network operations in January 1991. For more information on the NDSC one can look up the following web sites:
http://climon.wwb.noaa.gov
http://www.ndsc.ws
http://www.nilu.no/projects/ndsc

Several European scientists participate in the NDSC and the former ESMOS projects, funded by the European Commission, have constituted an essential part of Europe's contribution to this network. Scientists with an interest in the stratospheric ozone problem are invited to participate in the network. The following open letter to the scientific community has been published by the NDSC Steering Committee:

Open letter to all those interested in acquiring access to public NDSC data

The NDSC Data Protocol states:

Since the nature of detection of small changes requires an extremely high level of measurement confidence, the Data Protocol recognizes that multiple seasonal analyses may be required for validation of observations from both individual and multiple sites. ***It is expected that such a procedure shall yield the verifiable product referred to as "NDSC data" within a two-year period after acquisition.*** *Co-authorship shall be offered on publications resulting from the verification procedure to those investigators participating in the process.* ***After the above verification period, NDSC data will be available to anyone through centralized scientific data archiving and distribution facilities.***

In this spirit, data that has been so verified and given the status of 'NDSC data', and is more than two years old, are available to the general public. NDSC datasets are outlined in the NDSC Measurements and Analyses Directory (link to the appropriate web page). Access to this data is through an account on the NDSC database computer. To receive such an account, complete the following application:
http://climon.wwb.noaa.gov/www/invite.html

As with any raw data, additional material is usually required to convert raw data into meaningful information.

Therefore it is strongly recommended that data users 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 strongly encouraged to directly contact the NDSC Principal Investigator listed in the data documentation to insure the proper use of specific datasets and ensure the latest and most relevant information relating to the particular data set is being used to help with the interpretation.

The ENVISAT Cal-Val Database

NILU operates the database for correlative data that will be used for validation of five of the instruments on ENVISAT, namely AATSR, GOMOS, MERIS, MIPAS and SCIAMACHY. The development of this database started in the spring of 2000, but the work builds on the experience gained through the work on the GOME validation database hosted by NILU since 1995. The database is still undergoing new development, in particular when it comes to graphical tools. The cal-val database represents a new development of NADIR. The access is now through your web browser rather than telnet and ftp. The data format is HDF 4.1r3, rather than the NASA Ames format that we traditionally have used in NADIR.

Introduction

NILU has designed and implemented a system for organizing ground based measurement data, and for retrieval of the same data by scientists that perform comparisons with measurements from the ENVISAT satellite. The work has been performed in close co-operation with ESA and with representatives of the user community. The system is complex since it entails co-operation between wide spread scientific communities that have separate and different cultures and methods. In the ESA ENVISAT Calibration/Validation effort the measurements of stratosphere physicists, modellers and mathematicians, marine biologists, and space scientists need to be described within one common frame of reference.

Web access

Access to the database is via this URL:
http://nadir.nilu.no/calval

You need a user name and a password in order to log in. If you need an account, please contact Rita Larsen at NILU (mailto:ril@nilu.no)

Data formats

ESA selected the HDF 4.1r3 file format for the file exchange, based on the established use of this format within ESA and some of the user groups. Main software tools have been developed in FORTRAN, IDL, PHP, SQL and UNIX shell-scripts. The system uses Red Hat Linux, Apache web-server with PHP server-side scripting, and a MySQL database.

Through extensive co-operation with the ESA project Official **Dr. Rob Koopman**, the system design has been extended and adapted according to the growing awareness of the user requirements. The final product has evolved considerably compared to what was envisioned when the Work Statement was created, and may be subject to further evolution.

System description

The system components are here described in a logical order when we follow a data file as it passes from the originator into the storage and forward to an end user. The DS (Data Supplier) needs to sign a data protocol and be registered in the system metadata. This allows the user access to the Cal/Val web site, and gives permission to upload data for one or more projects (AOs).

At the Cal/Val website (http://nadir.nilu.no/calval/secure/) the user will find Metadata Guidelines, file templates and other documents that help with formatting original data into an HDF file. A software tool named **ASC2HDF** is available for Windows, Linux, Solaris and HPUX users. This tool accepts data and metadata in two simple text files, and will generate an HDF file after extensively testing the input according to predefined rules and values in `table.dat`. This file contains up-to-date information on all legal values in each metadata field. Whenever metadata are updated at the central site, a new version of `table.dat` is posted on the web.

Short descriptions of the metadata elements are displayed on a set of web pages under the "Browse Metadata" item. These pages are linked to the index database, and will always show the latest updated legal metadata values.

When the HDF file has been successfully tested at the local site by **ASC2HDF**, it may be uploaded to the Cal/Val site (`/nadir/esa/incoming`) by ftp, or through a web upload page (http://nadir.nilu.no/calval/secure/upload.php). A set of UNIX shell scripts is started every 5 minutes. These scripts check for new files in the `/nadir/esa/incoming` directory, and process each file by launching a FORTRAN program named **HDF2ASC**. The program verifies data and metadata according to the predefined rules in the `table.dat` – the same file that was used by **ASC2HDF**.

Even files that have been successfully tested by the originator, may be rejected at NILU, mostly due to inconsistencies in the file name (which reflects a subset of the metadata content), or due to duplicate file names or out-of-sequence version numbers. If the data supplier is not accredited for the AOID listed in the file, the file will also be rejected. An error report will automatically be emailed to the data supplier and the owner of the logon name that was used, and the file will be moved to a hidden directory.

If everything checks out correctly, the received HDF file will be moved to a storage file tree starting at /nadir/esa/data, and the file name, upload details and central metadata elements are stored in an **index database.** The system enforces consistent naming of variables and other metadata elements, and consistent spelling of names for people, organisations and sites.

The nadir index database contains the official list of allowed metadata values in the Cal/Val HDF data files, in addition to logs of uploaded/downloaded files, an overview of metadata contents, and the variable list of all accepted HDF data files. All this information is available to dynamic web pages at the Cal/Val web site. The main end user tool on this site is the "Search Data" page (http://nadir.nilu.no/calval/secure/getdata4.php), which allows the user to sort through the data files with advanced criteria selections. Filtering by data supplier, project, location, data source, data type, component and other metadata elements is supported. Data files may also be filtered by a "4-D box algorithm" (any file with data relevant for a given geographical location and time). Furthermore, files can be filtered by submission date and update status.

All data files that match the search criteria are listed in a new web page, with links to HDF data file download, to comments, and to a variable list. In the variable list page the user may select variables and generate an on-line plot. In the file list the user may also select multiple files for download as a tar-ball. The user may save the search criteria in the index database for convenient re-use at a later time.

Users that have an IDL license may download IDL scripts for HDF data file formatting (excluding the detailed error checking available in the FORTRAN version) and for plotting of data sets from HDF files (http://nadir.nilu.no/calval/secure/idltools.php).

Users that have signed an additional protocol for access to ECMWF data will find pre-computed T_{106} ASCII extractions and plots for the last 30 days, as well as plots of isentropic and isobaric forecasts. There is an on-line tool for extracting T_{106} data into HDF files. There is also an on-line facility for plotting 10-day back trajectories (based on data calculated at DMI by Dr. B. Knudsen).

Plots

While logged on to Cal/Val database one can generate plots of datafiles. Below follow two examples of data plots. When you are logged in at the restricted pages you click on the line that says "Search Data". This gives you a table with search criteria that you fill in. In the first example below we have chosen Location = ALOMAR, Data source type = LIDAR.DIAL and Variable name = O3.CONCENTRATION. Clicking on **Create file list** at the bottom of the page will produce a list of files that satisfy these criteria. In this file list click the column that says Variables for the file you wish to plot. You then get a table of contents for that file and you can select which parameters you wish to plot along the axes. We chose to plot temperature and ozone vs. altitude. Clicking on the **Create plot** button will give you the plot in Figure 7 visualised on the screen. In the second example we have chosen PI = Vik and Data Source = Hy2TH. The search returns a list of files, and we choose to plot the file submitted July 18, 2002. This file contains a 3-dimensional field of northward wind-velocity, and we choose to plot this versus longitude and latitude. Clicking on the **Create plot** button, gives you a plot at 3000K. At the bottom of the page, a drop-down menu appears and you are able to replot the figure at other Theta levels. Figure 8 shows the northward wind-speed at 400K. Please note that this plotting tool is developed for on-line web browsing and to give users a brief overview of what the datafiles contains. The quality of the plots are therefore not optimised for printing.

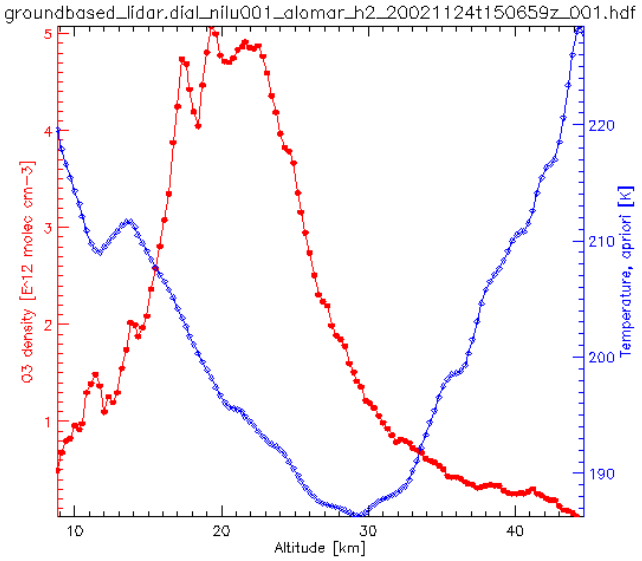


***Figure 7**. Example of an on-line plot created at the ENVISAT Cal/Val database. The figure shows temperature and ozone density as a function of altitude, measured by the DIAL system at Alomar.*

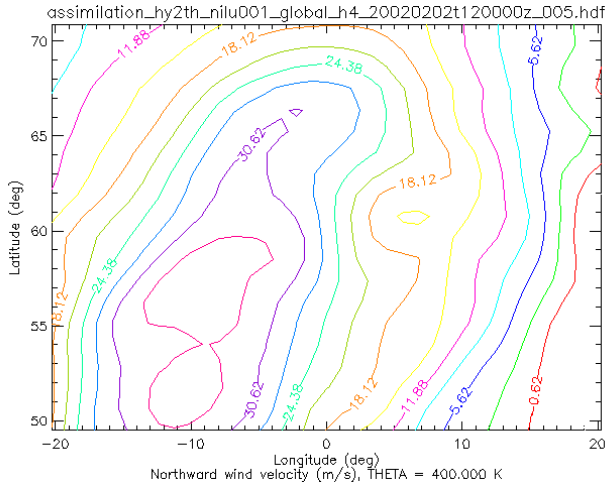


***Figure 8**. Example of an on-line plot created at the ENVISAT Cal/Val database. The figure shows northward wind velocity as a function of longitude and altitude at 400K. The datafile has been made with the program **hdf-mars**, described on page 18.*

The NILU team

The development and operation of the ENVISAT Cal/Val database is the result of a joint effort by a large team.

The NILU project leader from the start in the spring of 2000 until the spring of 2001 was **Dr. Bojan Bojkov**. He left NILU April 2001.

The Nguyen Thanh took over as the administrative project manager after Bojan Bojkov.

Dr. Aasmund Fahre Vik has joined the team to assist with the scientific part of the project management and takes part in IDL and FORTRAN programming.

Terje Krognes took part in working out data definitions, database structures and metadata guidelines, and has done a major part of the web development in PHP and SQL. He laid out the fundamentals of the system architecture, and interacted extensively in the detailed system design. He is also responsible for the user support, and handles updates of metadata in co-operation with the Metadata Board.

Sam-Erik Walker has programmed the main software tools in FORTRAN (ASC2HDF), and supported users with analysis of HDF file formatting problems.

Trygve Bårde has programmed the HDF file processing system in UNIX shell scripts, and assisted with hardware and OS installation.

Roland Paltiel has performed the the hardware and software installation.

Bjørn Gloslie has assisted with database configuration and administration.

Rita Larsen created the initial design of the Cal/Val web site, and has assisted with communication with the user group in administrative matters, such as data protocol administration.

Dr. Kjersti Karlsen Tørnkvist has joined the team as an IDL programmer.

Dr. Geir Ole Braathen has contributed as a scientific advisor.

The information given in this chapter is adapted from a technical report (NILU OR 54/2002, ISBN 82-425-1399-6)

Existing data and software

The rest of the document describes data and software that were described in previous issues of NADIR NEWS, but there have been some updates and changes. The section on extraction of T106 met-data has been updated with new developements as part of the ENVISAT CalVal project. The section furthermore contains additional information on efficient use of programs. Datasets of isentropic analyses and forecasts are available all the year and now also for the southern hemisphere. Minor changes and bugfixes are commented where appropriate.

THESEO and THESEO 2000 Experimental Data

The directory tree for the old THESEO data are found under `/nadir/projects/theseo`. Under this directory there are subdirectories for each of the THESEO related projects, such as Halomax, Metro, O_3loss, PSC-analysis, PVC, Stratospheric BrO and Wave. Real time PTU soundings from various stations in the European Arctic and Greenland are to be found in `/nadir/projects/theseo/misc/ptu`. In addition there are PSC alerts provided by the SAOZ network. Those are to be found in `/nadir/projects/theseo/misc/psc_alert`.

SESAME Experimental Data

Experimental data from the SESAME campaign can be found in `/nadir/sesame/data` on zardoz. A detailed description of these data was given in the June 1996 issue of NADIR NEWS.

EASOE Experimental data

The experimental data from the EASOE campaign was issued on CD-ROM in 1995. The data are public domain, so the disk can be obtained by contacting the NADIR team at NILU. The data can also be found under `/nadir/projects/easoe/data`.

Satellite data

TOMS

Data from TOMS (Nimbus-7, Meteor-3, ADEOS and Earth Probe) can be found in subdirectories located under `/nadir/satellit/toms`. There are data from Nimbus-7 until May 1993 and from Meteor-3 until December 1994. Data from ADEOS go from September 1996 until late June 1997. Data from the Earth Probe started in July 1996 and the instrument is still in operation. Software for plotting of TOMS data is described in the chapter on plotting software. More than 10000

files are stored in these directories.

TOVS

TOVS data were provided for the SESAME campaign by CNRM in Toulouse, and these data can be found in /nadir/sesame/data/satellit/tovs. More than 5600 files were submitted through September 1997, when the service was discontinued. Software for plotting is described on page 25. The data files are compressed, but you can copy the files you need to /nadir/tmp and uncompress them if you want to plot them with the plotting program on zardoz.

ECMWF data on 2.5° × 2.5° grid

These are the data that have been available throughout EASOE, SESAME and THESEO and which have also been published on three CD-ROM volumes so far. CD-ROMs are not produced anymore.

Isentropic data

Analyses for 12 UT on the levels 350, 380, 400, 435, 475, 550, 675 and 950K are made available by the Danish Meteorological Institute for the geographical area from the North Pole to 30°N. Pressure and PV are given, and it is possible to calculate temperature. This is done by several of the programs developed at NILU, such as the Uniras plotting programs. During the campaign phases 1, 2, 3, 4, 5 and 8 days forecasts are available. These data normally cover the time interval from 1 November to 30 April, but due to the activities around the ENVISAT Cal/val database the isentropic data were available throughout 2002. Analyses and forecasts are found in the directory /nadir/isentrop/*yyyy/mm*
where *yyyy/mm* designate the year and month. In this way we limit the number of files in each directory. Forecasts will be deleted when they are a few days old in order to limit the number of files.

During the Antarctic test-campaign of the QUOBI project in 2002, isentropic data were also made available for the southern hemisphere. These data will also be produced for the real match campaign in 2003, and they are expected to be available in May. These files are stored in the same directory as those for the northern hemisphere. Arctic files are named at*yymmdd.hhh*, and Antarctic files are named as*yymmdd.hhh*, where *hhh* is the forecast time.

Isobaric data

Analyses for 12 UT on the 14 standard levels 1000, 850, 700, 500, 400, 300, 200, 150, 100, 70, 50, 30, 10 and 5hPa are made by the Norwegian Meteorological Institute. Available parameters are temperature, geopotential height, zonal wind and meridional wind. The geographical area is from the North Pole to 30°N. These data are collected daily around the year. There are also 1, 2, 3, 4 and 5 days forecasts. The analyses and forecasts are now found in /nadir/isobaric/*yyyy/mm*.

Trajectories

Ten days backward trajectories arriving at a large number of end points are provided by the Danish Meteorological Institute. All measurement sites participating in VINTERSOL are included as well as a grid net of 118 end points covering the area from the North Pole to 30°N. There are data for the same eight levels as for the isentropic fields. To begin with, trajectory data were stored in two ways: a) as large collective files (4.5 MBytes) with data for all the end points and b) as a number of small files (approx. 40 kBytes) with data for each end point. This means that the same data was stored twice. As the amount of data accumulated this started to take considerable disk space. We now store the trajectory data only as large collective files. If you want to extract data for a single station, you can use a program called **traj**, which is described on page 31. The trajectory data are found in /nadir/trajecto/*yyyy/mm*.

PV at stations

Potential vorticity at the seven standard levels is calculated for a number of stations by the Danish Meteorological Institute by bilinear interpolation in a 1.125° × 1.125° grid. This gives more exact data than one obtains by extraction from the 2.5° × 2.5° data. Software for extraction of data for stations of interest is described on page 29. These data are found in /nadir/isentrop/pvatstat/*yyyy/mm*

As a novelty PV, temperature and geopotential height on the different isentropic levels are stored for each station for both 00 and 12 UT. This makes it easy to extract PV, temperature or geopotential height for a given level above a station for the whole winter. The data are stored in files named pv*yymmdd.tt*
where *tt* is the analysis time (00 or 12). The files are not in the NASA Ames format, but they are simple and self-explanatory.

ECMWF data on 1.125° × 1.125° grid

The demand for meteorological data increased during the EASOE and SESAME campaigns, and NILU therefore implemented a routine for daily transfer of global fields at so-called T_{106} resolution. This corresponds to a maximum latitude/longitude resolution of 1.125° × 1.125°. This routine became operational in early January 1995. We have also acquired data from previous winters (the EASOE winter, the 1992-93 winter and the first SESAME winter) on tape, and these data are also available. The latter data are referred to as archive data in the following. We have developed and implemented programs for extraction of the data and for interpolation of data from model levels to either isobaric or isentropic levels. It is also possible to obtain potential vorticity at isentropic levels.

Daily data

These data originate from ECMWF and are stored in spectral form, so-called T_{106}. These are model analyses that currently contain 60 model levels, with model level 60 being the ground or sea surface. The upper levels are pure pressure levels, and the lower are pure sigma levels, whereas the other levels are a mixture of the two. Older data contain less levels, and they do not cover the upper stratosphere. At each level several parameters are stored. At present the available parameters are: temperature (T), zonal wind (U), meridional wind (V), vertical wind (W) and the natural logarithm of the surface pressure (LNSP) (LNSP is only present at level 60). Programs to extract these model level data are available on zardoz, and routines for interpolation of data to isobaric and isentropic levels are also offered. Software routines are described later.

Data are available from 00 UT on 8 January 1995 onwards, with 6 hours intervals, giving data at 00, 06, 12 and 18 hours. Usually the data are received at NILU one or two days after calculation at ECMWF. Some longer delays have been encountered.

A set of interpolating routines have been written to convert data from model levels to more natural units like pressure or theta surfaces. These programs will interpolate to a wide range of surfaces. Available pressure surfaces are: 0.1, 0.14, 0.2, 0.3, 0.5, 0.7, 1, 1.4, 2, 3, 5, 7, 10, 14, 20, 30, 50, 70, 90, 100, 140, 200, 300, 500, 700, 850, 1000, 1013.25 hPa; available theta surfaces are all levels from 200 to 700 K in 5 K steps, from 700 to 1000 K in 25 K steps and from 1000 to 3000 in 250 K steps.

All the parameters contained in the model file can be extracted and interpolated, except for LNSP, which is the logarithm of the surface pressure.

Archive data

These data also originate from ECMWF and are also stored in spectral from, so-called T_{106}. These are model analyses that contain 31 model levels (19 levels before 1992), with model level 31 (19) being the ground or sea surface. The upper four levels are pure pressure levels and the lower three levels are pure sigma levels. At each level several parameters are stored. At the present time the available parameters are: temperature (T), specific humidity (Q), zonal wind (U), meridional wind (V), vertical wind (W) and the natural logarithm of the surface pressure (LNSP). Specific humidity is available until 4 April 1995, after when this parameter is only stored on a Gaussian grid.

Programs to extract these model level data exist on zardoz, and extraction of data to isobaric and isentropic levels is also offered (see following chapter).

Data are available from 1 October 1988 to 7 January 1995, after when the daily data take over. Please note that access to ECMWF data from the various years, are restricted by several protocols.

For converting data from model levels to more natural units like pressure or theta surfaces, a set of interpolating programs have been written. These routines will interpolate to a wide range of surfaces. Available pressure surfaces are the same as for the daily data (see above).

All the parameters contained in the model level data can be extracted and interpolated, except for LNSP, which is the logarithm of the surface pressure.

The maximum resolution is 1.125° × 1.125° for the T_{106} data. A lower resolution can be specified to the `sp2ll` program described below. This will produce an output file with fewer grid points.

Extraction of data on 1.125° × 1.125° grid

At NILU we have developed programs to extract portions of the T_{106} data. These programs are based on software provided by ECMWF, but considerable effort has been put into the implementation of these programs and in the development of programs for interpolation of model level data onto isobaric and isentropic levels. We have also developed a code to calculate potential vorticity on isentropic levels. The data are in so-called grib format and in spectral form. In order to get useful data from these files one has to convert to ascii numbers on a latitude longitude grid. We have chosen the NASA Ames format for the ascii files. Thus, a file that you extract from the T_{106} data will be very similar to the other meteorological data on 2.5° x 2.5° grid. You can extract either the whole globe or a portion of it.

Daily data at model levels

sp2ll

For extraction of data at model levels, only one program has to be used: **sp2ll** (spectral to lat./lon.). This is a program that uses the **gribex** routines provided by ECMWF to "degrib" and extract the T_{106} spectral coefficients and produce data on a regular latitude and longitude grid. The output from this program is an ascii file in NASA Ames format 3010, a plain 7-bit ASCII file. The **sp2ll** program takes the arguments from the command line.

• Syntax

sp2ll *yy mm dd hh Var Level Resolution West East North South Outfile*

yy mm dd and ***hh*** are year, month, day and hour, respectively. ***Var*** is the meteorological parameter you want. ***Level*** is the model level number, and it has to be in the range 1 to 31. ***Resolution*** is the geographical resolution in degrees. The best resolution you can obtain from T_{106} is 1.125° × 1.125°, so normally you would give 1.125 here, but you can also specify poorer resolutions, such as 2.5. ***West*** is the western limit. It has to be in the range -180 to 180. ***East*** is the eastern limit. It has to be in range -180 to 180, and it has to be larger than ***West***. ***North*** is the northern limit. It has to be in the range 90 to -90. ***South*** is the southern limit. It has to be in the range 90 to -90, and it has to be smaller than ***North***. ***Outfile*** is the name of the file to contain the resulting data.

Invoked without command line parameters, **sp2ll** prints out a usage list. This is helpful when trying to remember the syntax.

The **sp2ll** program reads the contents of the environment variable MARSPATH. This variable must be set by the user before **sp2ll** is used. MARSPATH must be set to:

```
/nadir/t106/yyyy/mm
```

This done with the command:

```
setenv MARSPATH /nadir/t106/yyyy/mm
```

This command can be put in your .login file if you plan to extract much model level data.

• Example 1

```
setenv MARSPATH /nadir/t106/1995/02
sp2ll 95 02 25 18 T 18 1.125 -180 180 90 -90
global.T.dat
```

This command extracts temperature from 18 UT on 25 February 1995 for the whole globe at model level 18. The output is stored in the file global.T.dat.

• Example 2

```
setenv MARSPATH /nadir/t106/1995/01
sp2ll 95 01 30 06 U 31 1.125 -50 50 90 30
europe.U.dat
```

This command produces zonal wind from 06 UT on 30 January 1995 for a region stretching from 50°W to 50°E and 90°N to 30°N, and the result is stored in the file europe.U.dat.

Archive data at model levels

For archive data (i.e. data which has been acquired on tape from ECMWF) the process of extracting data on model levels is identical to the one for daily data.

Daily & Archive data at pressure and theta levels

met-mars

In order to obtain T_{106} data at pressure and theta levels an additional set of programs have to be used. These are the interpolating programs **hy2p**, **hy2th** etc. A normal user will not need to be concerned about the usage of these programs, since a script called **met-mars** in most cases performs the task of extracting and interpolating by calling the necessary programs. The script **met-mars** is invoked by the user and will extract and interpolate. It will automatically set MARSPATH, so the user does not need to set this environment variable.

• Syntax

met-mars *yy mm dd hh West East North South Resolution Surface Level Variable Outfile*

where ***yy***, ***mm***, ***dd***, ***hh***, ***West***, ***East***, ***North***, ***South*** and ***Resolution*** have the same meaning as above. The latter should be 1.125 (only this resolution works). ***Surface*** is the type of surface and can be either **th** or **p**. ***Level*** is the numerical value of the level (see the chapter describing the data on page 15 for allowed levels). ***Variable*** is the name of the meteorological parameter and can be one of the following: **T**, **U**, **V**, **W**, **Z**, **PV** and, in addition for archive data, **Q**. All of these variables can be interpolated to any of the available surfaces. The *outfile* from this script is in NASA Ames format number 3010.

This is a plain 7 bit-ASCII file that can be transferred by ftp or e-mail.

• Example 1

```
met-mars 90 11 10 12 -180 180 90 30 1.125 th 475
T t901110.12.475
```

This will extract temperature on a theta surface at 475 Kelvin for the 10 November 12 UT producing a NASA Ames output file named `t901110.12.475`. The geographical area is from the North Pole to 30˚N.

• Example 2

```
met-mars 95 8 10 12 -180 180 90 30 1.125 th 435 PV
pv950810.12.435
```

This will give potential vorticity at 435 Kelvin over the Northern Hemisphere down to 30˚N.

• Example 3

Potential Vorticity over the south polar area at a theta surface:

```
met-mars 95 9 20 18 -180 180 -50 -90 1.125 th 650
PV pv950920.18.650
```

This gives PV between 50˚S and 90˚S at 650K.

• Example 4

```
met-mars 95 9 23 06 -180 180 -60 -90 1.125 p 100
T t950923.06.100
```

This gives temperature over the south polar area (60˚S to 90˚S) at the 100hPa pressure surface.

• Example 5

```
met-mars 95 9 26 12 -180 180 90 -90 1.125 th 500
PV pv950926.12.500
```

This gives a global field of PV at 500K for 26 September 1995.

At present *only* the 1.125 degree resolution can be used in the **met-mars** script, although the **sp2ll** program can accept any resolution.

The script **met-mars** is resident in `/nadir/bin` and can be copied and changed by the experienced user. The script is written in the Bourne shell. This script utilizes the programs **sp2ll**, **hy2pv**, **hy2th**, **hy2p**, **hy2z_th** and **hy2z_p**. 4 versions are available for each of the **hy2xx** programs since input data contain 19, 31, 50 or 60 model levels. Not all kinds of variations are covered by this script, and some users may have to change the script to fit the individual needs.

Any problems that you might have using these programs should be reported to Aasmund F. Vik at NILU.

HDF-mars

hdf-mars is very similar to met-mars, but the output is returned as an HDF file insted of ASCII. The HDF format is similar to that used in the ENVISAT Cal/Val database system. When using **hdf-mars**, you are not supposed to indicate any ***Outfile***, since the file-name is automatically generated according to the CalVal metadata definitions. The output from the program is written to the users home directory.

• Syntax

```
hdf-mars yy mm dd hh West East North South
Resolution Surface Level Variable
```

The arguments are similar to those in **met-mars**.

Making extractions more time-efficient

Both **met-mars** and **hdf-mars** are able to extract all available isentropic or isobaric levels into one file. This is done by giving -1 (minus one) instead of a level. For **met-mars**, the time consumption is almost the same when extracting all levels compared to extraction of a single level. For **hdf-mars**, the time consumption is somewhat larger when all levels are extracted at once, but significantly less than the time needed to extract all levels separatly.

If you are planning to download data on several levels, it is strongly adviced to use the multi-level option. This will surely save you a lot of time.

Pre-extracted T_{106} data

In connection with the daily updated production of T_{106} maps described on page 6, a selection of data on 8 isentropic and 20 isobaric levels are premade and stored on zardoz on a daily basis. Data are always available for the last 30 days. The files are located at `/nadir/met/extractions/isobaric/yymmdd/` and `/nadir/met/extractions/isentropic/yymmdd/`. The same files are furthermore available for download through the web page http://nadir.nilu.no/ecmwf

Graphical presentation of data

Uniras programs have been developed to plot data at T_{106} resolution. Some of the old Uniras programs have been rewritten, so that they are easier to install, modify and maintain. All programs described in the following can either be run on zardoz, where they have been installed, or you can transfer the source code to your local computer and install it there. The syntax of the old programs is as before, but the number of necessary input files has been drastically reduced. In order to plot data at T_{106} resolution, you first have to extract the data you want to plot, and then start the plotting program.

Introduction

The Uniras plotting programs **isenplot**, **isencol**, **isenbw**, **isocol** and **isobw** have been rewritten so that they no longer depend on the Unix shell scripts that were used to run the first versions of these programs. The number of input files needed to customize these programs is also drastically reduced, making this suite of programs easier to use. **isenplot** has been renamed to **isenplo**, but **isencol** and **isenbw** have been replaced by one program, **isenmap**, which can plot both colour and black and white maps. **isobw** and **isocol** have likewise been replaced by **isomap**. There are also plotting programs for plotting of T_{106} data, which are described below. If you experience any problems using these plotting programs, or if you have any ideas for improvements, please contact Geir Braathen at NILU.

Structure of programs and input files

The old programs had to be run by complicated shell scripts (in fact the programs **isenplot**, **isenbw** etc. are scripts that call the necessary fortran programs). The new programs are run without such scripts since they can take the input directly from the command line. The Sun Fortran specific function `iargc` and the subroutine `getarg` are used for this purpose. Program lines with these command must be replaced if you want to port these programs to your site and your compiler does not support these functions. The old programs needed a large number of input files, which had to reside in different directories depending on the program. The new programs run with just a very limited number of input files, and they are all supposed to reside in `~/.uniras`, where "~" symbolizes your home directory. Most plotting parameters can be varied by editing the file `~/.uniras/Uniras.inp`. The programs can run without this file, because default values for all variables are defined within the programs. The only two input files which are mandatory are `mclass.inp` and `colour.inp`. If you, through editing of `Uniras.inp`, choose to plot just isolines and no colour shaded map, you also need a file with data on the thickness of isolines (e.g. `mdash.inp`). All these input files are available in `/nadir/src/uniras/metplot_input`. If you run the command **metplot_install** on zardoz, the directory `~/.uniras` will be created, and the necessary input files will be copied to this directory. This command will also add the following line to your `.cshrc` file:

```
setenv ECMWFPATH /nadir
```

The plotting programs read this environment variable in order to find the ECMWF data. If you plan to use the programs on your local site, reading data from a local disk, you can set this environment variable according to your local installation. You have to use the same directory structure as we do below this point, since the rest of the path to the file name is calculated by the plotting programs as a function of date and data type. The plots can be customized by editing the file `Uniras.inp`. Each line in this file has this structure:

program.subroutine.parameter_name=value

where *program* is the name of plotting program that you invoke, such as **isenplo**, **isenmap** etc., and where *subroutine* is the name of the subroutine for which you want to provide a parameter. These subroutines are called by the programs: **mapsiz** to determine the size of the plot and the geographical coverage, **mclass** to determine the class limits, **colour** to specify the colour scale, **mdash** to specify the thickness of individual isolines, **ugplot** to plot the shaded map and isolines (**isenplo** only). The program **t106glob**, which is fundamentally different from the other programs, also calls a subroutine called **ortparam**. In `Uniras.inp`, it is possible to replace the program name with an asterisk. A parameter specified this way will be valid for all the plotting programs unless it is overruled by a program specific line.

• Example 1

```
*.mapsiz.x_size=180
*.mapsiz.y_size=180
*.mapsiz.lower_left_latitude=30.0D0
*.mapsiz.upper_right_latitude=30.0D0
*.mapsiz.lower_left_longitude=-45.0D0
*.mapsiz.upper_right_longitude=135.0D0
```

These lines specify that the map will be 180mm by 180mm, that the geographical coverage will be so that the lower left corner is at 30˚N, 45˚W and the upper right corner at 30˚N, 135˚E. Since the program name is replaced by an asterisk, these settings will be valid for all the plotting programs that use the **mapsiz** subroutine, unless the same parameters are also defined with a specific program name, such as in the example below.

• Example 2

```
isenmap.mapsiz.lower_left_latitude=20.0D0
isenmap.mapsiz.upper_right_latitude=20.0D0
```

In this case these two lines will overrule the lines in Example 1, where the program name was replaced with an asterisk. The other parameters, though, will be as determined in Example 1. The order of lines with and without asterisks is immaterial, since the subroutines that read these lines read all lines with asterisks first and then the program specific lines next. This means that a program specific line will overrule the asterisk lines.

Installing the plotting programs at your own site

If Uniras is available at your site you can copy the source codes, header files and sample input files from zardoz. If you transfer the source files from zardoz you have to fetch the files in these four directories:

`/nadir/src/uniras/metplot` for the `Makefile` and the Fortran code for the main programs (`isenmap.f`, `isomap.f` etc.), `/nadir/src/uniras/lib` for the include files (`*.h`) and the subroutines (such as `mclass2.f`, `mapsiz2.f` etc.), from `/nadir/src/uniras/geomaps` for the country maps, and from `/nadir/src/uniras/metplot_inp` for sample input files. The files from the latter directory have to be put in `~/.uniras`. In order to simplify the installation, we have also put all these files together with the script **metplot_install** in a tar file named `/nadir/src/uniras/metplot.tar`. Copy this file with ftp to your local computer. Make sure that the tar file resides in the directory under which you want the programs installed. In the following we call this directory *$sourcetop*. Then carry out the following steps:

1. **tar xvf metplot.tar**. The files will now be found in

$sourcetop*/metplot, *$sourcetop/lib, *$sourcetop*/geomaps and *$sourcetop*/metplot_inp.

2. **cd *$sourcetop*/metplot**
3. Open Makefile in a text editor and edit the line that says INSTALLTOP=/nadir/bin to something which is suitable for your site.
4. Open the metplot_install script file in a text editor and edit the line that says INPUTDIR=/nadir/src/uniras/metplot_input to *$sourcetop*/metplot_inp. Then edit the line that says setenv ECMWFPATH /nadir/data/ecmwf to the corresponding path for your site. We refer to this path as *$datapath* in the following.
5. Make sure that you are still in *$sourcetop*/metplot and issue this command: **make install**. This will compile and link all the programs and move the Uniras executables and metplot_install to $INSTALLTOP.
6. Make sure that the access rights of the Uniras executables and metplot_install are so that you and your colleagues can access them.
7. Make sure that your PATH variable points to $INSTALLTOP. If it doesn't, edit your .cshrc file accordingly. Type **source ~/.cshrc** or open a new window. Also type **rehash**.
8. Go to your home directory. Issue this command: **metplot_install**. The necessary input files are now in ~/.uniras, and the line setenv ECMWFPATH $datapath has been appended to your .cshrc file.
9. Issue this command: **source ~/.cshrc**
10. Run any of the plotting programs following the instructions in the sections below.
11. If the look and size of the plot don't correspond to what you want, go to ~/.uniras and edit the file Uniras.inp.

A note on device drivers

In the Uniras plotting examples used throughout this document we use either mx11 or htp3a4 as the device driver. The mx11 driver is the general driver for plotting on the screen if your computer runs an X-11 windows system. The htp3a4 device driver has been chosen as an example of a driver that produces colour postscript output. Most of the Uniras plots shown in this newsletter have been made with the htp3a4 driver. The postscript file has then been converted to epsi (Encapsulated Postscript Interchange) format with a shareware program called **ps2epsi** before importing it into the word processor. Some of the plots have been made with the driver hcposteps. This driver produces an eps file (Encapsulated Postscript), which can be imported directly into many word processors. In version 7 of Uniras we have had problems with the htp3a4 driver since it only produced black and white output. We have therefore switched to the driver called hcposta4, which works fine.

Plotting of isentropic data on 2.5° × 2.5° grid

There are two programs available for plotting of isentropic data on the 2.5° × 2.5° grid: **isenplo** and **isenmap**. There is also a program for plotting of vertical sections of isentropic data, **isenvert**.

isenplo

This program uses the Uniras routines **gcnw2s** and **gcnw2v** for the plotting of the colour shaded map and isolines, respectively. These routines do not support annotated isolines, which make them useless for b/w isoline plots. However, these routines can plot the gridded data directly without calling any interpolation routines, which means that **isenplo** runs faster than the other programs. This program is ideal for colour plots. Alternatively, one can plot a grey tone map.

• Syntax

isenplo *type date fc_hours level device*

where ***type*** is either **te**, **pv**, **pr** or **ps** depending on whether you want temperature, PV, pressure or PSCs, respectively, where ***date*** is the date on the form yymmdd, ***fc_hours*** is the number of forecast hours relative to 0 or 12 UT on ***date***, where ***level*** is the isentropic level you want the plot for, and where ***device*** is the name of the Uniras device you want the output on. Typical devices are: **mx11** for X windows (screen) and **hcposta4** for colour postscript. You should set ***fc_hour*** to 0 if you want the analysis. The permitted values for ***fc_hour*** are 24, 48, 72, 96, 120 and 192 if you want forecasts based on the 12 UT analysis and 12, 36 and 60 if you want forecasts based on the 0 UT analysis (see the chapter on isentropic data on page 15).

• Example 1

isenplo pv 950125 0 475 hcposta4

This will give a plot of potential vorticity for 25 January 1995 at 475 K as a postscript file. Figure 9 shows the resulting plot.

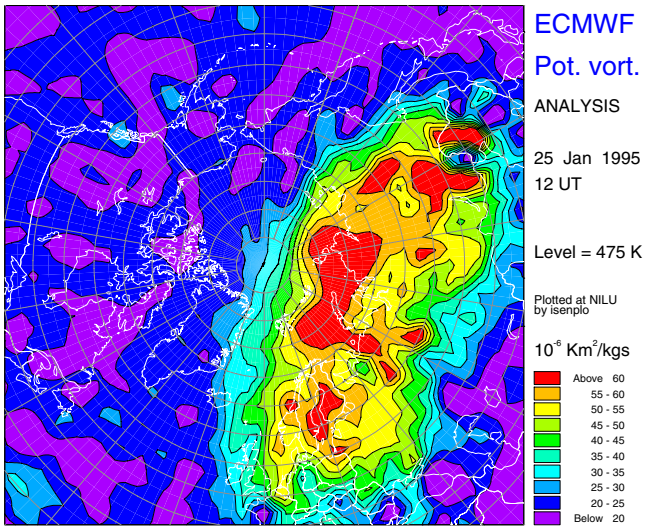


Figure 9. *Potential vorticity at 475 K on 25 January 1995.*

• Example 2

```
isenplo te 960114 0 550 mx11
```

This will give a plot of temperature at 550K for 12 UT on 14 January 1996. The picture will be sent to your X11 screen.

• Example 3

```
isenplo pv 950205 192 475 mx11
```

This will give a plot of a 192 hours forecast of potential vorticity relative to 5 February 1995. The level is 475K.

isenplo_min

This program is identical to isenplo, but it marks the minimum and maximum values of the temperature and pressure fields and the maximum for the PV field.

Isenmap

This program uses the Uniras routines **gcnr2s** and **gcnr2v** for the plotting of the colour shaded map and isolines, respectively. These routines do support annotated isolines, which make them useful for b/w isoline plots. However, these routines need the data on a rectangular grid, which means that the data have to go through an interpolation routine. Thus, this program takes some more time to execute than **isenplo**.

• Syntax

```
isenmap type date fc_hours level device
```

where ***type*** is either **te**, **pv**, **pr** or **ps** depending on whether you want temperature, PV, pressure or PSCs, respectively, where ***date*** is the date on the form yymmdd, ***fc_hours*** is the number of forecast hours relative to 0 or 12UT on ***date*** (see explanation above in section on **isenplo**), where ***level*** is the isentropic level you want the plot for, and where ***device*** is the name of the Uniras device you want the output on. Typical devices are: **mx11** for X windows (screen) and **hcposta4** for colour postscript.

• Example

```
isenmap pv 950225 0 550 hcposta4
```

This will give a plot of potential vorticity for 25 February 1995 at 550K to a postscript file. Figure 10 shows the resulting plot.

Isenvert

This program plots a vertical section of potential vorticity, pressure, temperature or PSC incidence along a meridian. This program is useful for investigating the vertical distribution of these parameters.

• Syntax

```
isenvert type date longitude device
```

where ***type*** is either **te**, **pv**, **pr** or **ps** depending on whether you want temperature, PV, pressure or PSCs, respectively, where ***date*** is the date on the form yymmdd, where ***longitude*** should be in the range 0 to 357.5, and where ***device*** is the name of the Uniras device you want the output on.

The following two examples show how this program can be used to localize the vortex edge as a function of altitude and the vertical extent of a PSC cloud, respectively.

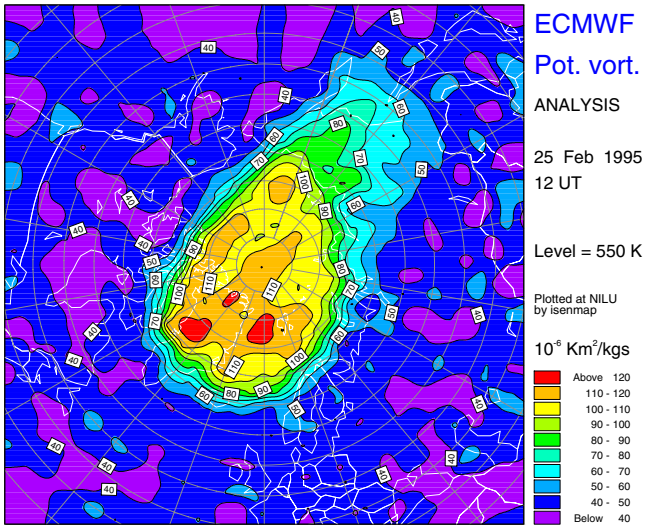


Figure 10. *Potential vorticity at 550K on 25 February 1995.*

• Example 1

```
isenvert pv 960212 180 hcposta4
```

This will produce a plot of PV along the International Date Line for 12 February 1996. The resulting plot is shown in Figure 11.

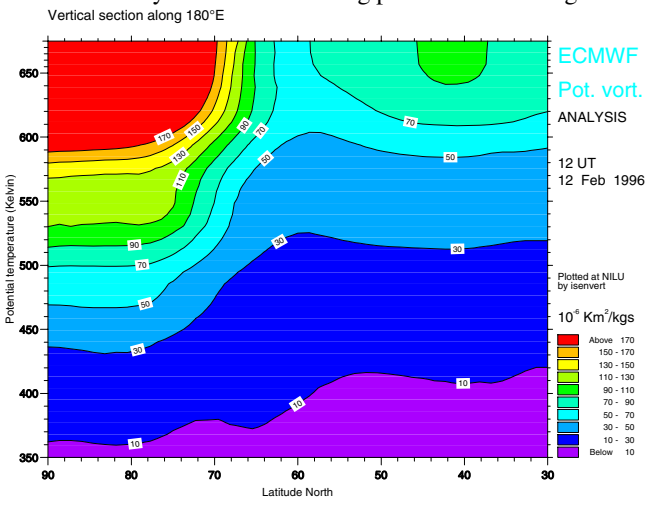


Figure 11. *Potential vorticity along 180˚E on 12 February 1996.*

• Example 2

```
isenvert ps 960112 20 mx11
```

This command will give a plot of the vertical extent of PSCs along 20˚E on 12 January 1996. The resulting plot is shown in Figure 12.

Plotting of isobaric data at 2.5˚ × 2.5˚ resolution

isomap

There is now only one program for plotting of low resolution

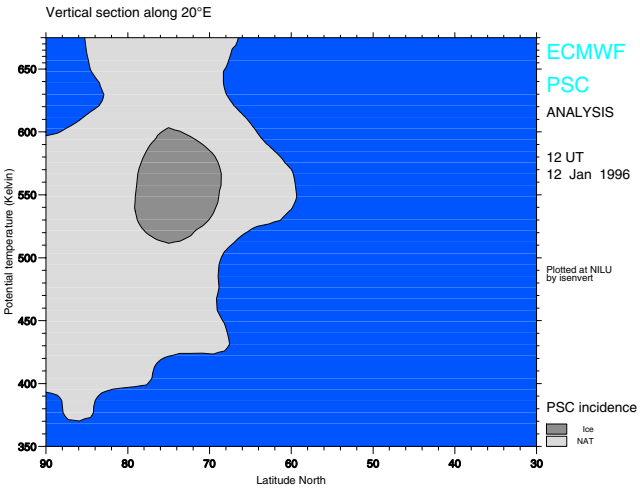


Figure 12. *Vertical PSC distribution along 20˚E on 12 January 1996.*

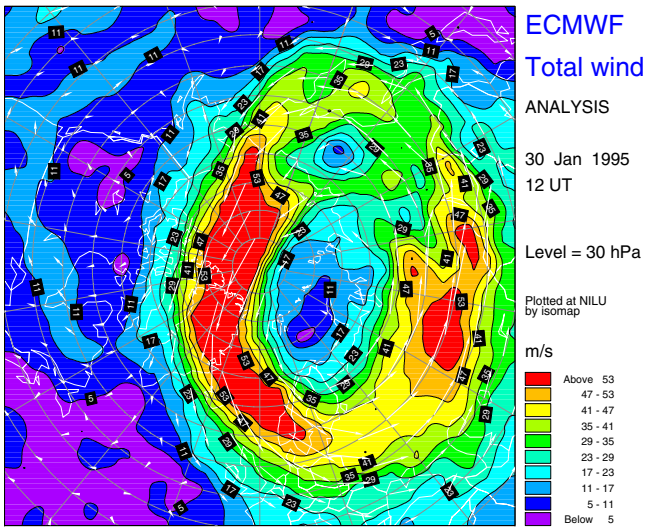


Figure 13. *Total wind for 12 UT on 30 January 1995.*

isobaric data; **isomap**.

• Syntax

isomap *type date fc_hour level device*

The input parameters are as described above for isenmap, except that ***type*** can be one of **gp** (geopotential height), **te** (temperature), **mw** (meridional wind), **zw** (zonal wind), **tw** (total wind) or **ps** (PSC). ***level*** now has to be one of the 13 standard isobaric levels.

• Example

isomap tw 950130 0 30 hcposta4

This will produce a map of total wind (the vector sum of u and v) for 12 UT on 30 January 1995 at 30 hPa. Figure 13 shows the plot.

isoplo

This program plots isobaric data using the same plotting technique as the program isenplo (see above). The advantage of this program over isomap is that the plotting is quicker since there is no need for interpolation to a rectangular grid. This program also marks on the map the position of the maximum and the minimum temperatures in the field.

• Syntax

isoplo *type date fc_hour level device*

The input parameters are as described above for isomap.

• Example

isoplo te 981211 0 30 hcposta4

This will produce a map of temperature for 11 December (12 UT) at 30 hPa. The resulting plot is shown in Figure 14. Here the geographical limits in `Uniras.inp` have been set so that the whole field from 30˚N is included.

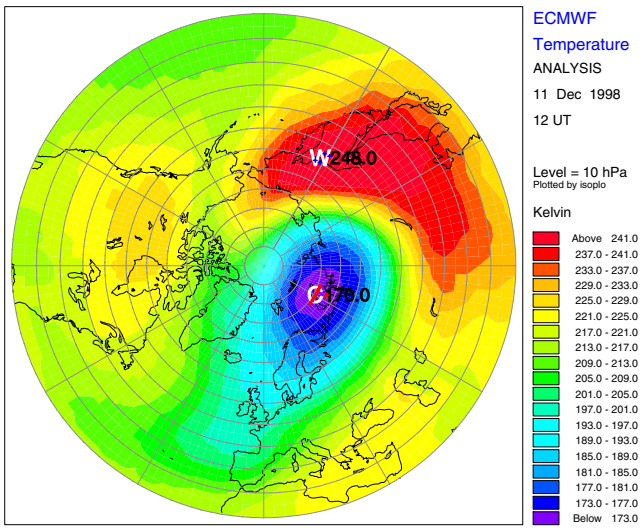


Figure 14. *Temperature at 10hPa on 11 December 1998. A minimum temperature of 170K was found over Novaya Zemlya.*

Plotting of trajectories

trajplo

The **trajplo** program is a modified version of the old program **trajplot**, and it now runs without the aid of a script. It plots isentropic trajectories at seven levels.

• Syntax

trajplo *date_1 station_1 level_1 date_2 station_2 level_2 ... date_n station_n level_n device*

where ***n*** can be in the range 1-6. The station name can be either one of the measurement sites or one of the grid points. The measurement sites have eight character codes, which normally are the first eight characters of the stations name. The grid points should be referred to as:

gridpoin,*lat*,*lon*

Available stations have varied during the EASOE, SESAME, THESEO and VINTERSOL campaigns. In order to obtain a list of stations in a file you can run the program **statlist**.

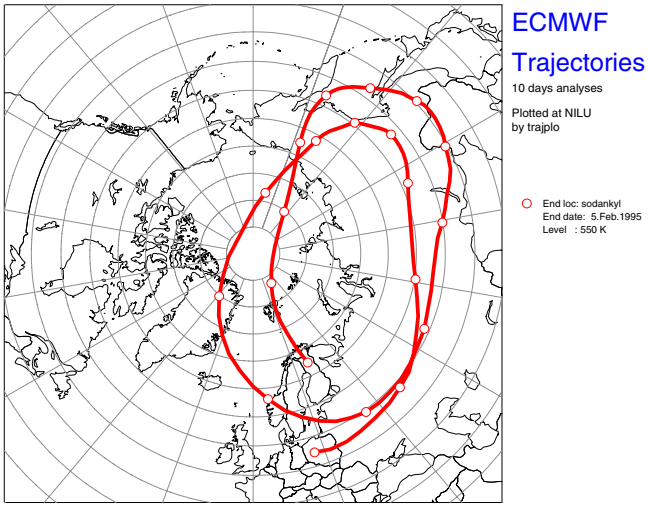


***Figure 15**. Trajectory ending at 550 K above Sodankylä on 5 February 1995.*

- **Syntax**

```
statlist date outfile
```

- **Example**

```
statlist 950205 stations.out
```

This produces a text file with all the stations names in it.

Here follow some examples of trajectory plotting commands:

- **Example 1**

```
trajplo 950205 sodankyl 550 mx11
```

This will give a plot of a trajectory ending at the 550 level above Sodankylä. The plot in Figure 15 shows the result.

- **Example 2**

```
trajplo 950205 gridpoin, 40,0 550 hcposta4
```

This will give a plot of a trajectory ending at a grid point located at 40 °N and 0 °E at 550 K.

- **Example 3**

```
trajplo 950101 sodankyl 475 950101 thule 475
950101 uccle 475 950101 aberystw 475 950101
nyalesun 475 950101 kiruna 475 mx11
```

This will produce a plot on the screen of six trajectories at 475 K ending at the given stations.

As described on page 6, it is possible to access **trajplo** through the web site http://nadir.nilu.no/ecmwf.

Plotting of T_{106} data

Introduction

Three programs are available for plotting of T_{106} data. One program, **t106map**, gives the same type of maps as **isenmap**, whereas the second program, **t106glob** plots data in an orthographic projection. The former is well suited for plots over the Northern Hemisphere, whereas the latter can be used to plot either hemisphere. Both these programs plot arbitrary files resulting from the extraction of T_{106} data described above. Since the programs don't know which parameter to plot, the lower and upper class limits have to be given on the command line. These programs hence don't use the **mclass** subroutine.

The third program, **t106plot**, follows the same syntax as **isenmap** and **isomap**. This program produces the same type of plot as **t106map**, but it is restricted to plotting PV, temperature and PSC incidence (calculated from the temperature). The instructions and examples below will make the use of these programs a bit clearer.

Common to all three programs is that the data have to be on $1.125^\circ \times 1.125^\circ$ grid, but the programs handle any geographical coverage. The data array is dimensioned to contain a global field at this resolution, but before data is read it is filled with missing values. The area covered by the data file is specified in the data file header, so that the data are put into the appropriate array elements.

t106map

Use this program if you want to plot a map over the Northern Hemisphere of any arbitrary parameter that you have extracted from the spectral T_{106} data.

- **Syntax**

```
t106map data_file min max device
```

where ***data_file*** is the name of a NASA Ames file that you have extracted using **met-mars** as described previously, where ***min*** and ***max*** are the lower and upper class limits, respectively, and where ***device*** is the name of a Uniras device.

- **Example**

Assume that you want to plot a PV map of the Northern Hemisphere from 30 °N to the Pole for 18 UT on 16 February 1995 at 550 K. First you have to extract the data with **met-mars**:

```
met-mars 95 2 16 18 -180 180 90 30 1.125 th 550 PV
pv95021618.550
```

Then you specify the output file from this command as the data input to the plotting program:

```
t106map pv95021618.550 40 120 mx11
```

The resulting plot is given in Figure 16.

t106glob

Use this program if you want to plot a map of any arbitrary portion of the globe. This program uses the orthographic projection (i.e. the globe looks like it does from space). You specify on the command line the latitude and longitude of the centre of the map. This way you can see the globe from any vantage point you want. This program is ideal if you want to plot a map over the Southern Hemisphere, such as Antarctica.

- **Syntax**

```
t106glob data_file min max centre_lat centre_lon
device
```

where ***data_file*** is the name of a NASA Ames file that you

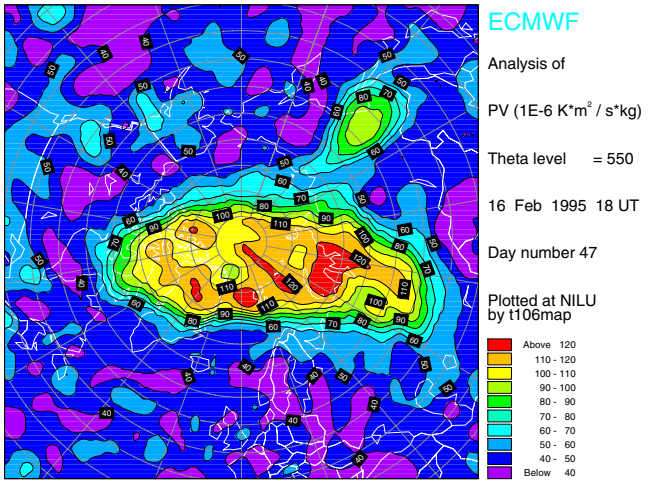


***Figure 16**. Potential vorticity at 550 K on 16 February 1995 18 UT over the Northern Hemisphere.*

have extracted using **met-mars** as described previously, where ***min*** and ***max*** are the lower and upper class limits, respectively, where ***centre_lat*** is the latitude of the map centre, where ***centre_lon*** is the longitude of the world centre, and where ***device*** is the name of a Uniras device. The lower and upper class values are determined by ***min*** and ***max***, and the number of classes will be determined by the number of colours in the colour file (e.g. `colour.inp`) pointed to in `Uniras.inp`.

• Example 1

Assume that you want to plot a temperature map at 500 K over the Northern Hemisphere for 0 UT on 14 January 1995, centred over Kiruna.

First, you extract the data with **met-mars**:

```
met-mars 95 1 14 0 -180 180 90 -90 1.125 th 500 T
t95011400.500
```

The output from this program is used as input for the plotting program:

```
t106glob t95011400.500 183 223 68 21 mx11
```

The plot will look like Figure 17.

• Example 2

Let us assume that you want to make a plot of PV at 475 K over the south polar region for 19 October 1995, 12 UT, centred over the Antarctic Peninsula. First, you extract the PV field:

```
met-mars 95 10 19 12 -180 180 90 -90 1.125 th 475
PV pv951019.12.475
```

Then make the plot:

```
t106glob pv951019.12.475 -70 -20 -68 -60 mx11
```

The plot is shown in Figure 18.

t106plot

This program can plot temperature, PV and PSC incidence (based on temperature data) from NASA Ames files with 1.125° × 1.125° resolution. This program reads the class values from `~/.uniras/mclass.inp` or any other file that you specify. In this sense it works in the same way as **isenmap**.

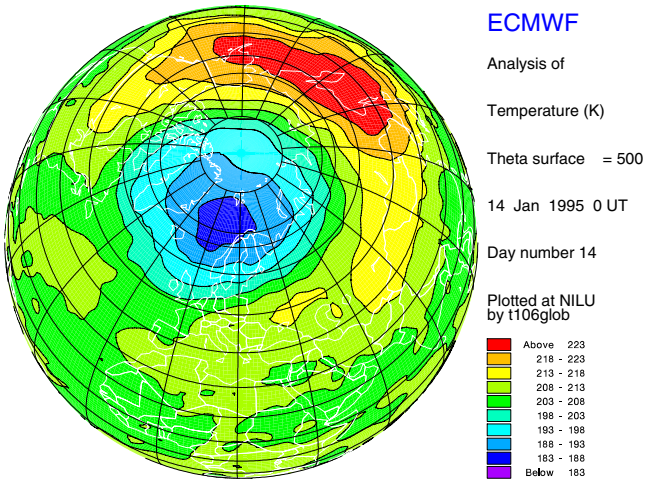


***Figure 17**. Orthographic plot of temperature at 500 K on 14 January 1995 at 0 UT. The map is centred over Kiruna.*

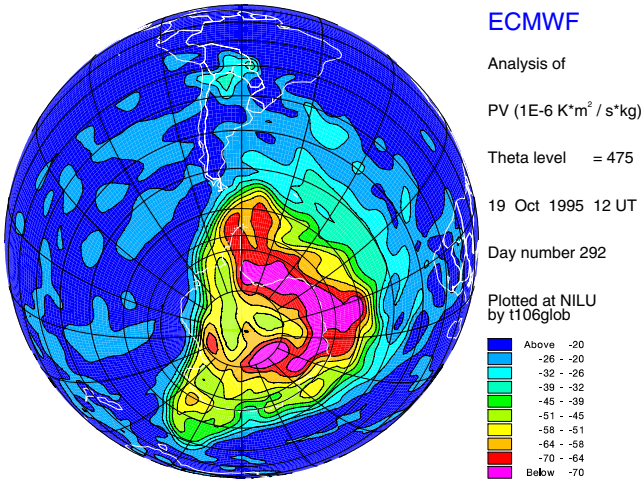


***Figure 18**. Orthographic plot of potential vorticity at 475 K on 19 October 1995 at 12 UT. The map is centred over the Antarctic Peninsula. Note that PV is negative in the Southern Hemisphere.*

• Syntax

```
t106plot data_file parameter device
```

where ***data_file*** is the full path to the file containing the data, where ***parameter*** is one of **te**, **pv** or **ps**, and where ***device*** is the Uniras device name.

• Example

Let us assume that you want a PSC map at 475 K for 12 UT on 14 January 1995. First, you extract temperature data for this date and time:

```
met-mars 95 1 14 12 -180 180 90 30 1.125 th 475 T
t95011412.475
```

The you plot the PSC map using the temperature data:

```
t106plot t95011412.475 ps mx11
```

The resulting plot is given in Figure 19.

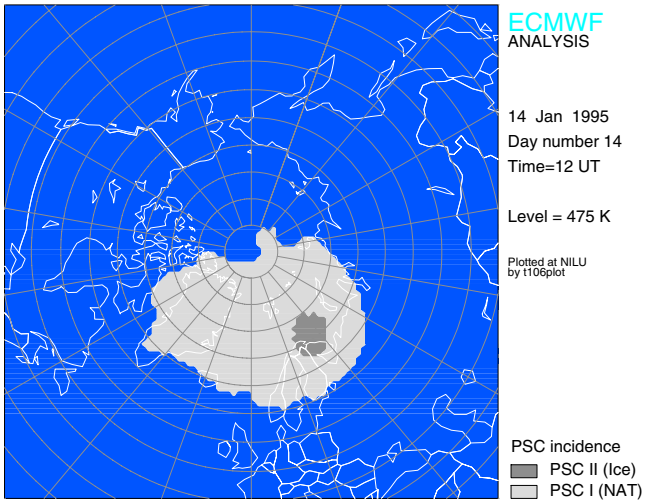


Figure 19. *Stereographic plot of PSC incidence at 475 K on 14 January 1995 at 12 UT.*

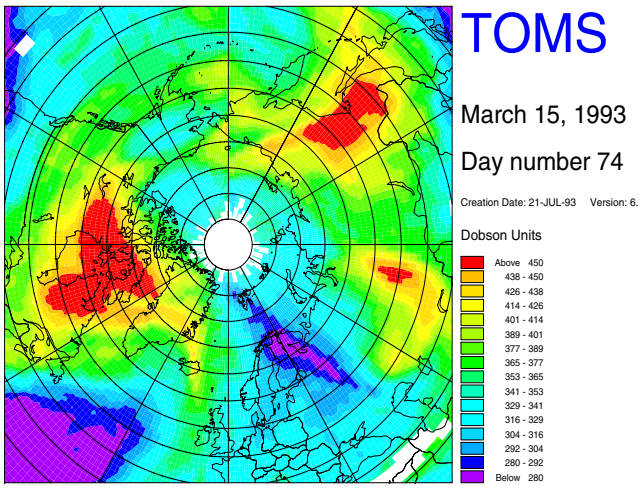


Figure 20. *Stereographic plot of TOMS total ozone for 15 March 1993.*

Plotting of TOMS data

There are two programs to plot TOMS data, one that plots a stereographic map of the Northern Hemisphere and one that plots an orthographic map of any part of the globe.

tomsplot

This program plots an azimuthal stereographic plot of TOMS data over the Northern Hemisphere.

- **Syntax**

```
tomsplot data_file min max device
```

where ***data_file*** is the full path to the TOMS data file (which should be in the normal NASA TOMS format (not NASA Ames format)), where ***min*** and ***max*** are the lower and upper class limits, respectively, and where ***device*** is the Uniras device.

- **Example**

```
tomsplot /nadir/satellit/toms/nimbus7/
d930315.n7 250 450 mx11
```

Figure 20 shows the resulting plot. We have used 16 colours, rather than the 10 normally used. This is done by editing the file `~/.uniras/Uniras.inp`. Go to the line which says: `tomsplot.colour.input_file_name`, and edit this line so it looks like this:

```
tomsplot.colour.input_file_name=
~/.uniras/colour16.inp
```

The file `colour16.inp` can be found in `/nadir/src/uniras/metplot_inp`.

tomsglob

This program is quite similar to **`t106glob`** since it can plot the globe from any vantage point.

- **Syntax**

```
tomsglob data_file min max centre_lat centre_lon
device
```

where ***data_file*** is the full path to the TOMS data file (which should be in the normal NASA TOMS format (not NASA Ames format), where ***min*** and ***max*** are the minimum and maximum class values in Dobson units, where ***centre_lat*** and ***centre_lon*** are the latitude and longitude of the centre of the map, respectively, and where ***device*** is the Uniras device.

- **Example**

```
tomsglob /nadir/satellit/toms/meteor3/
oz94/ga941017.m3t 180 400 -68 -60 mx11
```

This command will produce a total ozone plot on the screen with the Antarctic Peninsula in the centre of the map. The map is shown in Figure 21.

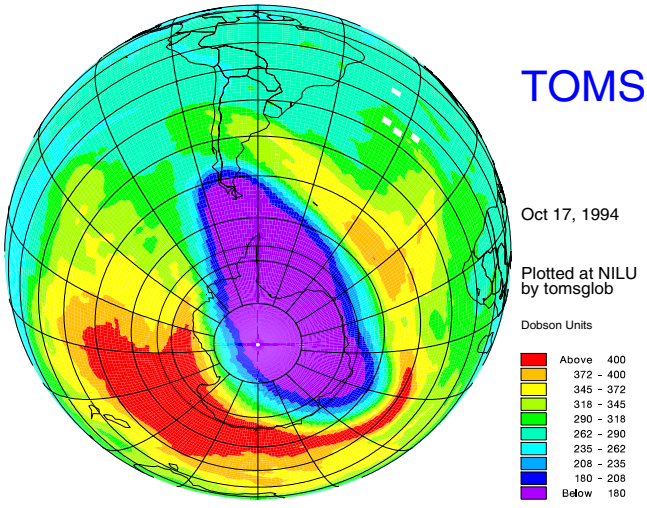


Figure 21. *Orthographic plot of Meteor 3 TOMS total ozone for 17 October 1994. One can see how the ozone hole (the region with total ozone < 180 DU) touches the southern tip of South America.*

Plotting of TOVS data

tovsplot

This program plots a stereographic map of total ozone from TOVS as provided by CNRM in Toulouse.

• Syntax

tovsplot *file_name device*

where ***file_name*** includes the full path of the file to plot and ***device*** is the Uniras device.

• Example

Let us assume that you want to plot a TOVS map for 27 February 1996. First you copy the compressed TOVS file to /nadir/tmp, so that you can uncompress it:

```
cp /nadir/sesame/data/satellit
/tovs/tv960227.oz2.Z /nadir/tmp
```

Then you uncompress it:

```
cd /nadir/tmp
uncompress tv960227.oz2.Z
```

Now the file can be plotted:

```
tovsplot tv960227.oz2 hcposta4
```

This gives a file called POST that you can ftp to your local computer and print on your local printer. The result is shown in Figure 22.

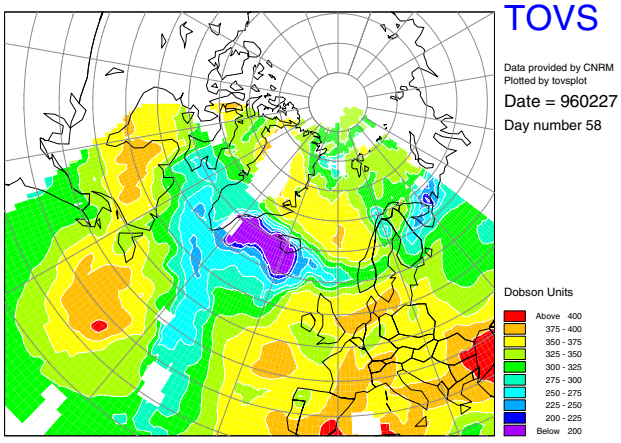


Figure 22. *Stereographic plot of TOVS total ozone for 27 February 1996.*

Plotting of ozonesonde data

sondeplo

This program is ideal for plotting individual ozone profiles from specific stations.

• Syntax

sondeplo *station date_hour device*

where ***station*** is the name of the launch site, ***date_hour*** is the date and hour of launch on the form yymmddhh and ***device*** is the Uniras device for the output.

• Example

sondeplo thule 95022314 hcposta4

The result is shown in Figure 23.

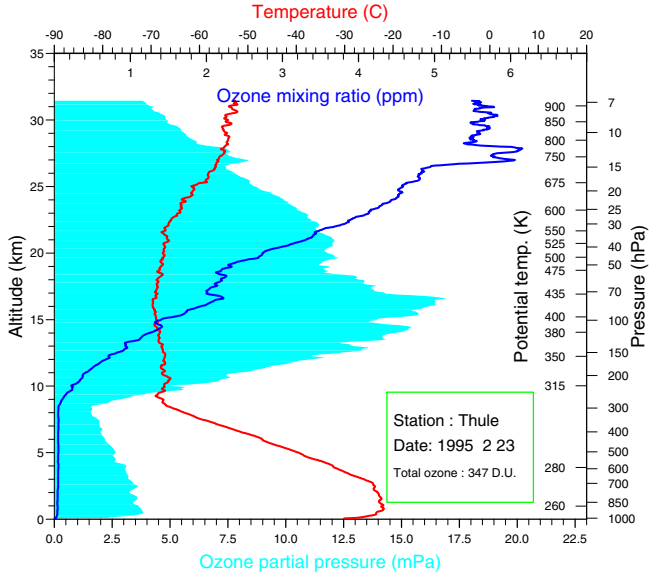


Figure 23. *Plot of an ozonesonde profile from Thule (Greenland) on 23 February 1995.*

meanprof

This program calculates and plots an average profile from any number of individual profiles. The program takes as input the name of a file that contains a list of ozonesonde data file names.

• Syntax

meanprof *file_list device*

where ***file_list*** is the name of the file that contains a list of sonde data files and ***device*** is as before.

• Example 1

meanprof iv9203.dir hcposta4

• Example 2

meanprof iv9503.dir hcposta4

The resulting plots from these two commands are shown in Figure 24 and Figure 25.

profile

This program can be used to inspect a large number of profiles on the computer screen. The program takes a file list as input, and one profile is displayed after the other by pressing the space bar or a mouse button.

• Syntax

profile *file_list*

where ***file_list*** is a file with a list of file names of

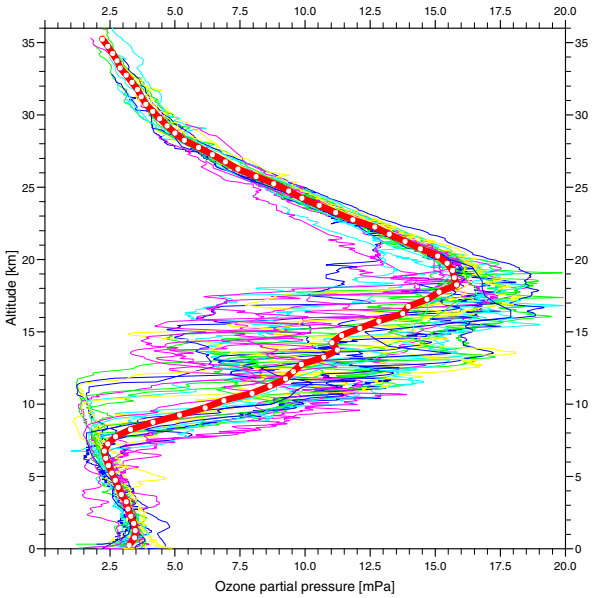


***Figure 24**. Plot of a mean ozone profile resulting from averaging approx. 30 ozone soundings carried out inside the polar vortex during March 1992. Each profile is plotted as a thin curve in different colours. The mean profile is plotted as a thick red curve with white dots marking every 500m.*

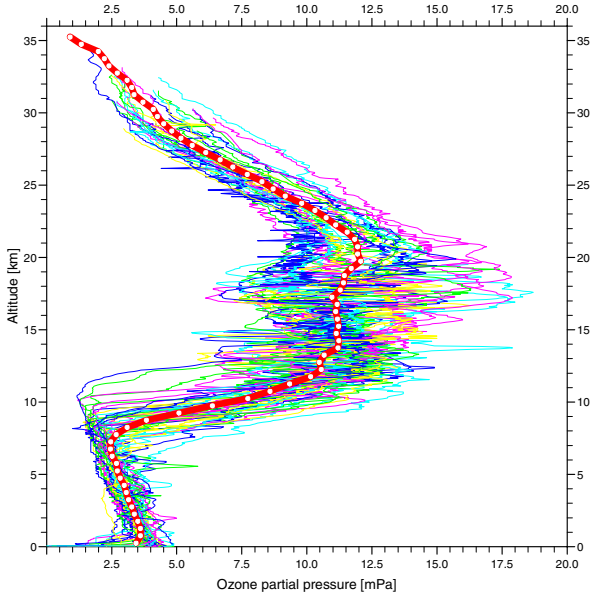


***Figure 25**. Plot of a mean ozone profile resulting from averaging approx. 40 ozone soundings carried out inside the polar vortex during March 1995. One can clearly see the ozone deficit in the 15-20km range which was caused by chemical destruction.*

ozonesonde data.

Time series of data on 2.5˚ × 2.5˚ grid

Isentropic data

isen_ts

The program **isen_ts** will make a time series of any of the parameters temperature, pressure, potential vorticity and PSC incidence for a given grid point. The output is to an ascii file. The program reads the necessary input parameters from the command line.

- **Syntax**

isen_ts *start_date end_date data_type level lat lon outfile*

where ***start_date*** and ***end_date*** are the start and end dates of the time series on the form yymmdd, where ***data_type*** can be **te**, **pv**, **pr** or **ps** for temperature, potential vorticity, pressure and psc incidence, respectively, where ***level*** is the isentropic level in the range 350 to 950K, where ***lat*** and ***lon*** are the latitude (multiple of 2.5 in the range 30 to 90) and longitude (multiple of 2.5 in the range -177.5 to 180) of the site you want data for, and where ***outfile*** is the name of the file to contain the output.

- **Example**

```
isen_ts 941201 950330 te 475 52.5 -5.0 te475.dat
```

Here are the first few lines of output:

```
Parmeter=te Level=475 Lat.= 52.5  Lon.=  -5.0
 Date   Jul     TEMP
941201  335    212.3
941202  336    212.4
941203  337    214.2
941204  338    214.5
941205  339    214.9
941206  340    215.7
941207  341    220.1
941208  342    214.1
941209  343    211.8
941210  344    207.3
```

The source code can be found on zardoz in
/nadir/src/nongraph/meteorol/isen_ts.f

isen_minmax

The program **isen_minmax** will make a time series of the maximum and minimum temperature anywhere north of 40 °N. The input parameters are taken from the command line.

• Syntax

isen_minmax *start_date end_date level outfile*

where the parameters have the same meaning as for the previous program.

• Example

isen_minmax 940101 940430 475 tmin.dat

The first few lines of the output file will look like this:

```
Level = 475.
Date   Julian   Min      Max      Mean
940101    1    191.3    228.8    212.9
940102    2    192.2    228.9    213.6
940103    3    194.8    231.4    213.3
940104    4    195.9    230.3    213.0
940105    5    194.3    231.4    212.8
940106    6    193.1    231.2    212.2
```

isen_mincoor

This program will make a time series of the minimum and maximum temperature in the same way as isen_minmax. In addition, isen_mincoor also gives the latitude and longitude of the minimum temperature points. The input parameters are taken from the command line.

• Syntax

isen_mincoor *start_date end_date level outfile*

where the parameters have the same meaning as for the previous program.

• Example

isen_mincoor 981201 981210 475 tmin.dat

The first few lines of the output file will look like this:

```
Level = 475
Date   Julian Min    Max    Mean   min_lat min_lon  max_lat max_lon
981201 335 192.6 226.4 209.6 70.0 22.5   62.5   70.0
981202 336 195.1 225.9 210.0 70.0 77.5   67.5   70.0
981203 337 197.0 229.1 210.0 72.5 70.0   55.0   72.5
981204 338 197.0 230.8 210.1 65.0 30.0   60.0   65.0
```

Isobaric data

iso_ts

The program **iso_ts** is analogous to **isen_ts**, and the syntax is the same. Running **iso_ts** without parameters gives a list of allowed parameters.

iso_minmax

This program is analogous to **isen_minmax** and the syntax is the same. Running **iso_minmax** without parameters gives a list of all the input parameters.

iso_mincoor

This program is analogous to isen_mincoor and the syntax is the same. Running **iso_mincoor** without parameters gives a list of all the input parameters.

Time series of T_{106} data

We will here show how you can use the **met-mars** script to extract time series from the T_{106} data. This will be shown through a couple of examples.

• Example 1

Let's assume that you want to make a time series of the possible PSC area at 475 K during the last four winters. By possible PSC area we mean the geographical area covered by PSCs. This means that we have to find the number of grid cells with temperatures lower than a certain threshold, determined by the partial pressures of water vapour and nitric acid, and then add the area of all these grid cells. In order to find this we have to extract a temperature field for each day of these four winters. In this chapter we will show how you can extract a time series of temperatures from the T_{106} data available at NADIR.

In order to extract the temperature fields we will use **met-mars**. Because of the large number of extractions (one per day) it will be best to do this with a script. Since the extraction and interpolation of T_{106} data is quite time consuming, we recommend that you do one month at a time. You can make one script for each month and then run these scripts individually. Here follows a script that will extract data for January 1993. We extract data for 12 UT only.

```
#!/bin/csh
foreach date ( 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 )
   met-mars 93 01 $date 12 -180 180 90 30 1.125 th 475 T t.93.01.$date.12.475
end
```

• Example 2

Let's assume that you want to see how the vortex has moved over a period of one month. The T_{106} data will give you a much better time resolution than the 2.5°×2.5° data, since we have analyses for every 6 hours. The time period of interest is February 1995. The following script will extract the data:

```
#!/bin/csh
foreach date ( 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 )
    foreach hour ( 00 06 12 18 )
       met-mars 95 02 $date $hour -180 180 90 30 1.125 th 475 PV pv.95.02.$date.$hour.475
    end
end
```

These data can then be plotted with **t106map** to give postscript files. These postscript files can then be converted to GIF files, so that they can be animated with **xanim**. On zardoz you find a routine called convert that converts postscript files to GIF files. The following script will plot the extracted data and convert the plot files to GIF format:

```
#!/bin/csh
foreach date ( 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 )
   foreach hour ( 00 06 12 18 )
      t106plot pv.95.02.$date.$hour.475 pv hcposta4
      mv POST pv.95.02.$date.$hour.ps
      convert pv.95.02.$date.$hour.ps pv.95.02.$date.$hour.gif
    end
end
```

Time series of PV at individual stations

The Danish Meteorological Institute provides more exact PV data for a number of stations. These files are not in the NASA Ames format, and we have written a special program, **pvatstat**, to read these files and make a time series of PV for an individual station. The program works on data files from before 1 November 1995. Files from after this date can be read with **pvatstat2**.

• Syntax

pvatstat *f_date l_date level outfile* m|*n*

where ***f_date*** and ***l_date*** are the first and last date, respectively, ***level*** is the isentropic level and ***outfile*** is the name of the file to contain the result. The last parameter should either be the letter **m** (literally) for manual interaction or a number (***n***) indicating which station number you want. If you are not sure what the number of your station is, you should type **m** in order to get a list of the stations' coordinates. From this list you can choose a station number. Beware that the station numbers can change between different time periods, since the number of stations included has changed during the years. Hence, the first time you run **pvatstat** for a given time period you should choose **m** as the last parameter.

• Example 1

pvatstat 941201 950331 475 pv475.dat m

This will give you a time series of PV at 475 K between the given dates. The output will be written to the file pv475.dat, and since we have typed **m** at the end, the program will list the sta-

tion coordinates and ask you to choose one of them.

- **Example 2**

```
pvatstat 941201 950331 475 pv475.dat 12
```

This will give you PV time series for station number 12 in the pvatstat data.

Here is an example of output from this program:

```
Latitude=66.80  Longitude=123.40   Level=475
Date    Julian     PV
941225    -6     55.31
941226    -5     61.41
941227    -4     69.23
941228    -3     60.03
941229    -2     48.48
941230    -1     52.86
941231     0     55.20
950101     1     52.19
950102     2     48.91
```

Listing of data for single days

Introduction

The NASA Ames files with ECMWF data are not easy to read manually. Because of this, we have made some programs that can read these files (or portions of them) and make a more readable output.

Isentropic data

isen_extr

The program **isen_extr** takes out a portion of the data for a given meteorological variable, date, level and within certain geographical limits. The output is directed to the screen.

- **Syntax**

```
isen_extr date forecast_hours type level lat lon
```

where ***lat*** and ***lon*** give the latitude and longitude of the upper right corner of the geographical area to extract.

- **Example**

```
isen_extr 941225 0 pv 550 80 20
```

Isobaric data

isolist

The program **isolist** makes a listing of the contents of an isobaric file where the four parameters temperature, GPH, u and v are listed on one line for each grid point.

- **Syntax**

```
isolist date forecast_hours level outfile
```

The meaning of the input parameters is as before.

- **Example**

```
isolist 950101 0 100 isodat.100
```

Here are some lines from the output file:

```
date=950101 forecast hours= 0    level=100 hPa
lat      lon      T[K]    Z[dam]    u[m/s]    v[m/s]
90.0       0.0     200      1483       9.4       7.4
87.5    -177.5     200      1489      15.8       9.3
87.5    -175.0     200      1489      16.3       8.7
87.5    -172.5     200      1489      16.8       8.0
...
...
52.5    -170.0     226      1585       8.1      12.6
52.5    -167.5     227      1588       5.7      15.4
52.5    -165.0     226      1592       2.6      16.3
```

isoprof

The program **isoprof** takes out data for all the 13 isobaric levels for a given date and a given location.

- **Syntax**

```
isoprof date forecast_hours lat lon outfile
```

where the input parameters are as before.

- **Example**

```
isoprof 950101 120 67.5 20.0 profile.dat
```

Here follows a listing of `profile.dat`:

```
date=950101 forec hours=120 lat=67.5 lon=  20.0
Pressure    T[K]    Z[dam]    u[m/s]    v[m/s]
1000         267        -4      -0.2      -4.3
 850         261       121      -6.0      -4.0
 700         253       267      -8.0      -3.8
 500         234       506       0.0      -5.3
 400         223       656      10.0       3.1
 300         210       837      20.3       9.1
 200         210      1085      14.5       5.3
 150         207      1261      12.1       3.1
 100         206      1505      20.6      -1.0
  70         199      1717      26.3       1.2
  50         198      1912      30.4       0.7
  30         197      2206      33.7       1.4
  10         196      2838      37.0       2.4
```

iso_extr

The program **iso_extr** takes out a portion of the data for a given meteorological variable, date, level and within certain geographical limits. The output is directed to the screen.

- **Syntax**

```
iso_extr date forecast_hours type level lat lon
```

where ***lat*** and ***lon*** give the latitude and longitude of the upper right corner of the geographical area to extract.

• **Example**

```
iso_extr 941225 0 T 50 80 20
```

How to make XY diagrams

xyplot

This is a Uniras program for making XY plots, for example of time series. The program takes two parameters on the command line; the device name and the orientation of the plot. The rest of the input comes from an input file, `xyplot.inp`, which has to reside in `~/.uniras`. The source code and a sample input file can be found on zardoz in `/nadir/src/uniras/xyplot`. With this program several curves can be plotted in different colours and/or line styles. It is also possible to specify text strings and their location on the plot in the input file. Let us assume that you want to plot a time series of minimum temperatures in the Northern Hemisphere for some of the first winters in the nienties. First, you run the program **`isen_minmax`**, which is described on page 27. From the output one can extract columns 2 and 3 with the **`awk`** command:

```
awk ´{print $2, $3}´ tmin.dat > tmin.jul
```

The file `tmin.jul` can then be used as input data for **`xyplot`**. Make one such data file per winter, e.g. `tmin92.jul`, `tmin93.jul`, `tmin94.jul` and `tmin95.jul`. Specify these files in the `xyplot.inp` input file. In this input file one can also decide on the width, line style and colour of each curve.

• **Syntax**

```
xyplot device orien [julopt]
```

where ***`device`*** is the Uniras device, ***`orien`*** is the orientation of the plot (1-4) and ***`julopt`*** is an optional parameter which should either be omitted or set equal to **`jul`**. If ***`julopt`*** is set to **`jul`**, day numbers larger than 250 will have 365 subtracted from them, so that one can make plots of time series covering the whole winter, and where dates before 1 January will get negative day numbers.

• **Example**

```
xyplot hcposteps 1 jul
```

The path to the data files must be given in the input file `~/.uniras/xyplot.inp`.

Figure 26 shows what the plot will look like.

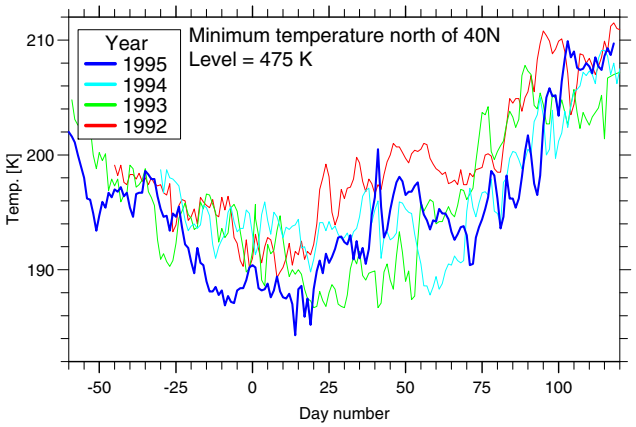


Figure 26. *Time series of Northern Hemisphere minimum temperatures for some of the first winters in the nienties. The 1994-95 winter has been enhanced with a thicker curve.*

Other programs

Picking out data inside the vortex

pvpick

If you have a large set of data files for a given station, such as spectrometer data, lidar data or ozonesonde data, it can be useful to pick out only those data files that represent measurements carried out inside the polar vortex. It might be tedious to make this selection manually. This can be done quite easily with the program **`pvpick`**. As input it needs a file with the file names of the data files and a file with PV data. This latter file will typically be the output file from the **`pvatstat`** program. The program picks out the date part of a file name by searching for a "/" followed by "8" or "9" three characters later. If your files names follow the convention adopted by NADIR, this should be a good criterion for picking out the date part of the file names. From the PV data file those dates that have PV above a certain threshold are picked. These dates are compared with the dates found from the file with data file names, and a list of file names satisfying the PV criterion are written to an output file. The PV limits for the most common levels are given in the source code, but these can be changed by copying the source code to your home directory or to your local computer. The program can be found in `/nadir/src/nongraph/meteorol`.

• **Syntax**

```
pvpick dirfile pvfile level outfile
```

where ***`dirfile`*** is the file containing the file names, ***`pvfile`*** is a file with a time series of PV data for the station, ***`level`*** is the isentropic level, and ***`outfile`*** will contain a list of files that satisfy the PV criterion defined in the program.

Extraction of trajectories for individual stations

Trajectory data used to be stored both as large collective files containing data for all stations, and as smaller files for each station. In order to save disk space these data are now only stored as large collective files. If you are interested in transferring trajectory data for only one or a small number of stations, you can extract data for single stations. The extraction program is called **`traj`**. This program will extract trajectories for all the isentropic levels ending at one station for a specific date. When logged on to zardoz, run

```
traj -help
```

to get instructions on how to use this program. To extract trajectories for dates after Desember 31 1999, use the program **`traj2000`**. Usage is similar to **`traj`**.

Listing of TOMS data

The program **tomslist** lists a portion of TOMS data on the screen.

- **Syntax**

tomslist *data_file lat lon*

where ***data_file*** is the name of the TOMS data file and ***lat*** and ***lon*** are the coordinates of the upper left corner of the window you want to list.

- **Example**

```
tomslist /nadir/data/satellit/toms/nimbus7/
d930315.n7 89.5 -178.75
```

This command will produce a listing of total ozone values on the screen (10 columns and 21 lines).

A summary of all the programs

Here follows an alphabetical list of all the programs described in this newsletter together with a short description of their purpose.

Table 1. Program summary.

Program name	Purpose	Page
asc2hdf	Converts an ASCII file into HDF.	12
hdf-mars	Extracts and interpolates gribbed spectral ECMWF data. The output is in HDF format.	18
isen_extr	Lists a lat./lon. portion of isentropic ECMWF data on the screen.	29
isenmap	Plots a map of isentropic ECMWF data at 2.5˚ × 2.5˚ resolution. Isolines can be annotated, so this program is useful for b/w plots.	20
isen_mincoor	Makes a time series of the maximum and minimum temperature anywhere north of 40˚N from the isentropic ECMWF data. Also gives the coordinates of the max and min points.	27
isen_minmax	Makes a time series of the maximum and minimum temperature anywhere north of 40˚N from the isentropic ECMWF data.	27
isenplo	Plots a map of isentropic ECMWF data at 2.5˚ × 2.5˚ resolution.	20
isenplo_min	Plots a map of isentropic ECMWF data at 2.5˚ × 2.5˚ resolution. Marks on the map the position and value of maximum and minimum values.	20
isen_ts	Extracts a time series of isentropic ECMWF data for a given grid point and level.	27
isenvert	Plots a vertical section of isentropic ECMWF data along a meridian	21
iso_extr	Extracts a portion of the isobaric ECMWF data. Output is written to the screen.	30
isolist	Writes out the contents of an isobaric ECMWF file with one line per grid point. The output is written to a file.	29

Table 1. *(Continued)* Program summary.

Program name	Purpose	Page
isomap	Plots a map of isobaric ECMWF data at 2.5˚ × 2.5˚ resolution.	21
iso_mincoor	Makes a time series of the maximum and minimum temperature anywhere north of 40˚N from the isobaric ECMWF data. Also gives the coordinates of the max and min points.	28
iso_minmax	Makes a time series of the maximum and minimum temperature anywhere north of 40˚N from the isobaric ECMWF data.	28
isoplo	Plots a map of isobaric ECMWF data at 2.5˚ × 2.5˚ resolution.	22
isoprof	Extracts the four parameters of an isobaric ECMWF file for all 13 levels at a specified grid point.	30
iso_ts	Extracts a time series of isobaric ECMWF data for a given grid point and level.	28
meanprof	Calculates and plots a mean ozone profile from a list of ozonesonde files.	26
met-mars	Extracts and interpolates gribbed spectral ECMWF data. This program must be run before you can use the plotting programs t106glob, t106map and t106plot.	17
profile	Interactive Uniras program that displays a list of ozonesonde profiles in succession.	26
pvatstat	Extracts time series of PV data for individual stations. Works on data through October 1995.	29
pvatstat2	Same as pvatstat, but works on data files starting 1 November 1995	29
pvpick	Picks out data files for a station according to certain PV criteria.	31
sondeplo	Plots individual ozonesonde profiles.	26
sp2ll	Extracts spectral ECMWF data onto a latitude/longitude grid. Data will be on model levels. We recommend the use of met-mars for extraction of spectral data.	17
statlist	Produces a list of end points in a trajectory data file.	22
t106glob	Plots T_{106} data in orthographic projection. met-mars must be run first to extract the data.	23
t106map	Plots T_{106} data (any parameter) in stereographic projection. met-mars must be run first to extract the data.	23
t106plot	Plots T_{106} data (T, PV or PSC) in stereographic projection. met-mars must be run first to extract the data.	24
tomsglob	Plots TOMS data in orthographic projection.	25
tomslist	Lists a lat./lon. portion of a TOMS file on the screen.	31
tomsplot	Plots TOMS data over the Northern Hemisphere in stereographic projection.	25
tovsplot	Plots TOVS data in stereographic projection.	25
traj	Extracts trajectory data for a single station from the large collective trajectory files.	31

Table 1. *(Continued)* **Program summary.**

Program name	Purpose	Page
traj2000	Same as traj, but works for data after 1999	31
trajplo	Plots up to six trajectories.	22
xyplot	Plots one or more curves in an XY diagram.	30

On-line services

A number of institutions and investigators have put in place web sites with near real-time data. Below follows a table of some services that we are aware of.

Description of service	URL
Day to day updated plots of Antarctic vortex size and other meteorological parameters	http://www.nilu.no/projects/nadir/o3hole
Preliminary model results from the SLIMCAT 3D model	http://www.env.leeds.ac.uk/~fengwh/winter03.html
Near-Real-Time plots from REPROBUS and forecast + analyses from MIMOSA	http://www.aerov.jussieu.fr/ ~fgoutail/
Preliminary results from simulations with the DLAPSE 3D model	http://www.env.leeds.ac.uk/~stewart/EUPLEX_WEB/-EUPLEX_NRT.html
Near-Real-Time service providing various GOME products such as total ozone, assimilated ozone, clear-sky UV index etc	http://www.knmi.nl/gome_fd
Annual NCEP data for the northern and the southern hemisphere	http://hyperion.gsfc.nasa.gov/Data_services/met/ann_data.html
Near-Real-Time plots of Ozone, NO_2, BrO, HCHO, OClO and SO_2 products from GOME	http://www.iup.physik.uni-bremen.de/gomenrt/
Links to various MAPSCORE related Near-Real-Time services	http://www.leos.le.ac.uk/mapscore/data/linkspage.html

NADIR on the Web

Information about NILU and NADIR is now available on the web and can be found at http://www.nilu.no/nadir. If you have any ideas about information that ought to be available on the Web server, please contact us.

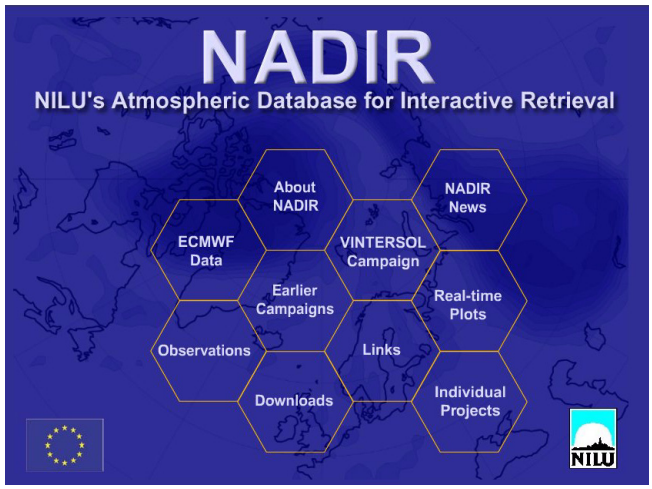


Figure 27 *Nadir on the web* - http://www.nilu.no/nadir

Who to contact at NILU?

If you have any questions regarding the NADIR services, please contact one of the following persons:

Rita Larsen (user accounts, data protocols).
Tel: +47 63 89 80 29
E-mail: ril@nilu.no

Aasmund Fahre Vik (general questions and meteorological data).
Tel: +47 63 89 81 78
E-mail: afv@nilu.no

Geir O. Braathen (Uniras programs).
Tel: +47 63 89 81 80
E-mail: geir@nilu.no

Roland Paltiel (technical questions regarding the computer system).
Tel: +47 63 89 80 37
E-mail: rpa@nilu.no

Terje Krognes (questions regarding use of the ENVISAT Cal/Val database)
Tel: +47 63 89 82 03
E-mail: tk@nilu.no

If you are in doubt about who to contact you can send an E-mail to nadirteam@nilu.no. The request will then be handled within a few days.

Access to ECMWF data

ECMWF data can be accessed by those who are affiliated with certain EU projects within atmospheric chemistry research and who have signed the ECMWF data protocol. An agreement has been made with ECMWF for the ENVISAT Cal/Val and the VINTERSOL time period, and a new protocol (ecmwf4) has been made. This protocol can be obtained by contacting Rita Larsen (ril@nilu.no).

Acknowledgements

The NADIR staff at NILU wish to thank all those who contribute to the data centre: The European Centre for Medium Range Weather Forecast (ECMWF), Reading, UK, for the provision of meteorological data. The European Commission (DG XII) and the Norwegian Research Council for funding 50% of the expenses related to the operation of the data centre. The European Space Agency (ESA) and The Norwegian Space Centre for financing the ENVISAT Cal/Val database. The Royal Norwegian Ministry of the Environment for financial support. Bjørn M. Knudsen at the Danish Meteorological Institute for the provision of isentropic fields, trajectories and PV at stations. The Norwegian Meteorological Institute, and especially Rebecca Rudsar, for setting up routines for on-line transfer of isobaric data and T_{106} data from ECMWF to NILU. CNRM, Toulouse for the provision of TOVS data. Julio Bacmeister, NRL, for provision of code for production of lee-wave plots. And last, but not least, all the PIs who submit their experimental data to NADIR.

NADIR NEWS

is a publication of the
Norwegian Institute for Air Research
NILU

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Validation of International Satellites and study of Ozone Loss
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