

Editorial

As the SESAME project is completed, and new projects have started, time is due for some information about the NADIR data centre. In addition to delivering the same services as during EASOE several new features are now available, especially ECMWF data at higher resolution than the traditional $2.5^\circ \times 2.5^\circ$ grid. The purpose of this issue of NADIR NEWS is to provide information to SESAME PIs on data and software now available at NADIR. 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. The central computer, *zardoz*, is a Sun Sparcstation, and it is connected to other computers that act as file servers.

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*.

EASOE experimental data

The experimental data from the EASOE campaign has been issued on CD-ROM. The data are public domain, so the disk can be obtained by those who are interested. Just contact the NADIR team at NILU.

SESAME Experimental Data

Introduction

Many SESAME PIs have submitted the data that they acquired during the three active phases of SESAME. The final date for submission of data before we proceed with the CD-ROM production has been set to 30 Septem-

ber 1996. Below follows an update of the status in the various directories. So far (i.e. by June 1996) more than 6300 files have been submitted. The data can be found in `/nadir/sesame/data` on *zardoz*.

Aircraft data

Three different aircraft were in operation during SESAME. So far 500 data files have been submitted from the various aircraft.

Transall

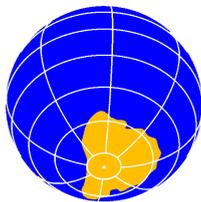
This German-operated aircraft carried these instruments:

- DOAS (UV and visible)
- FT-IR
- Lidar

The data can be found in `/nadir/sesame/data/aircraft/transall`.

CONTENTS

Editorial	1
Nomenclature	1
EASOE experimental data	1
SESAME Experimental Data	1
Potential vorticity maps from UKMO	3
ECMWF data on $2.5^\circ \times 2.5^\circ$ grid	3
Trajectories	4
PV at stations	4
ECMWF data on $1.125^\circ \times 1.125^\circ$ grid	4
Extraction of data on $1.125^\circ \times 1.125^\circ$ grid	5
Graphical presentation of data	7
Plotting of isentropic data on $2.5^\circ \times 2.5^\circ$ grid	8
Plotting of isobaric data at $2.5^\circ \times 2.5^\circ$ resolution	10
Plotting of trajectories	10
Plotting of T_{106} data	11
Plotting of TOMS data	12
Plotting of TOVS data	13
Plotting of ozonesonde data	14
Time series of data on $2.5^\circ \times 2.5^\circ$ grid	15
Time series of T_{106} data	16
Time series of PV at individual stations	17
Listing of data for single days	17
How to make XY diagrams	18
Other programs	18
A summary of all the programs	19
NADIR on the Web	20
Who to contact at NILU?	20
Access to ECMWF data	20
Acknowledgements	20



Falcon

This German-operated aircraft carried this instrument:

- Microwave measurements of ClO, HCl and ozone.

The data can be found in </nadir/sesame/data/aircraft/falcon>.

Fokker (ARAT)

This French-operated aircraft carried a lidar experiment called LEANDRE, and the data be found in

</nadir/sesame/data/aircraft/fokker>.

Balloon data

The balloon experiments involved many PIs, and one can find data for the following parameters:

- Chlorofluorocarbons
- Methane
- Nitrous oxide
- NO_x and NO_y
- Water vapour
- Particle number density
- Various gases as measured by FT-IR (HCl, HF, ClONO₂, HNO₃ etc.)
- ClO
- Ozone and NO₂ as measured by SAOZ

So far 50 files have been submitted from these experiments, and the data can be found in various subdirectories under </nadir/sesame/data/balloons>.

Ground-based data

The ground-based measurements involved a large number of stations in Europe, Asia and the Arctic and many different instruments, such as FT-IRs, lidars, UV-Vis instruments and microwave spectrometers. So far approx. 1160 files have been delivered from the ground-based instruments.

Dobson and Brewer data

Total ozone data from Dobson and Brewer instruments in the Northern Hemisphere have been collected by the University of Thessaloniki on a daily basis during the two winter periods. The data are stored in monthly files in </nadir/sesame/data/groundba/dobsbrew>.

FT-IR

Fourier-transform infrared spectrometers have been deployed at several stations and data have been received from these stations: Aberdeen, Harestua, Jungfraujoch, Kiruna, Ny-Ålesund and Søndre Strømfjord. Data from these instruments can be found in station directories under </nadir/sesame/data/groundba/ftir>.

SAOZ and other UV-Vis instruments

These stations have been equipped with UV-Vis instruments and delivered data to SESAME: Aberdeen, Aberystwyth, Bremen, Cimone, Harestua, Jungfraujoch, Kiruna, Ny-Ålesund, Observatoire de Haute Provence, Reykjavik, Scoresbysund, Sodankylä, Søndre Strømfjord, Thule, Zhigansk. Data from these stations can be found in station directories under </nadir/sesame/data/groundba/ftir>.

Lidars

Both ozone and aerosol lidars have been used during SESAME, and the following stations have delivered data: Andøya, l'Aquila, Brasimone, Garmisch, Hohenpeissenberg, Ny-Ålesund, Observatoire de Haute Provence, Sodankylä and Thule. The data can be found in </nadir/sesame/data/groundba/lidars>.

Microwave spectrometers

Microwave spectrometers for measuring ozone and/or ClO have delivered data from Bern and Ny-Ålesund.

Figure 1 shows a map of the ground-based stations which have delivered data so far. More stations are expected to submit data within the next few months.

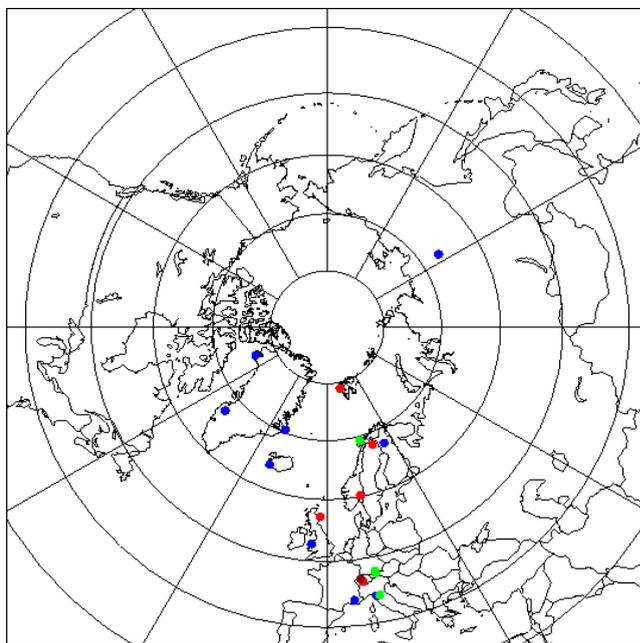


Figure 1. Ground-based SESAME stations. Blue dots are stations with UV-Vis instruments, red dots indicate FT-IR sites, green dots represent lidar sites and brown dots indicate the microwave stations. Several stations have more than one instrument.

Ozonesonde data

Ozonesondes have been launched from approx. 30 stations. Canadian data will also be included in the SESAME data base. Up to now more than 2270 ozonesonde profiles have been submitted to the data base. A program for conversion of raw data to geophysical data has been developed at NILU in order to ensure that the data are homogeneous. A new version of this program will soon be sent to the ozonesonde PIs. Figure 2 shows a map of all the ozonesonde stations that have submitted data to SESAME.

Modelling data

Data from NILU's trajectory model can be found in </nadir/sesame/data/modeling/nilu> and subdirectories under this one. This model uses backward trajectories as supplied by the Danish Meteorological Institute in order to get

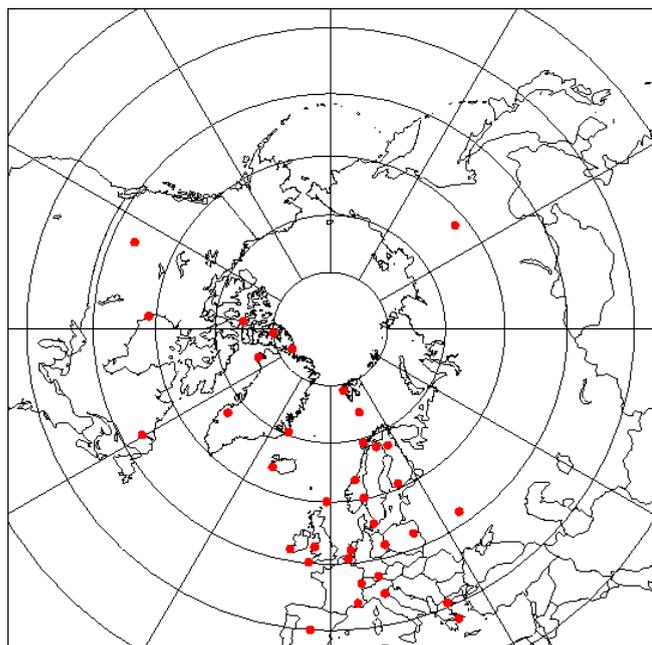
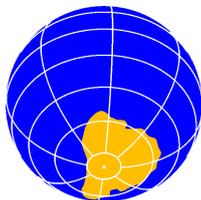


Figure 2. Ozonesonde stations participating in SESAME.

information on the movement of the air masses. The chemistry module includes a heterogeneous chemistry package for reactions on type I and type II PSCs. Figure 3 shows an example of results from this model. This plot was made with the program

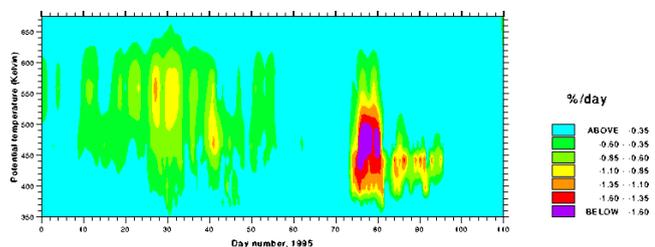


Figure 3. Results from NILU's trajectory model. The abscissa is the day of the year, and the ordinate is the isentropic level in the atmosphere. This plot shows the average chemical ozone destruction in percent per day in air parcels arriving at Yakutsk in Eastern Siberia during the time period from January to April 1995.

`modplot`. If you want information on how to use this plotting program, please contact the NADIR team.

Satellite data

TOMS

Data from TOMS (Nimbus-7 and Meteor-3) can be found in `/nadir/data/satellit/toms/nimbus7` and in `/nadir/data/satellit/toms/meteor3`. There are data from Nimbus-7 until May 1993 and from Meteor-3 until December 1994. Software for plotting of TOMS data is described in the chapter on plotting software. Altogether 1820 files are stored in these directories.

TOVS

TOVS data have been provided by CNRM in Toulouse, and

these data can be found in `/nadir/sesame/data/satellit/tovs`. More than 2400 files were submitted during the SESAME project period. Software for plotting is described on page 13. 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`.

Conclusion

Many PIs have submitted their experimental data, and more will do so over the next few months. In June 1996 approx. 6300 files were available on `zardoz`. This number includes approx. 2400 files of TOVS data leaving approx. 3900 files with experimental SESAME data. Meteorological data and TOMS data are not included in these numbers.

Potential vorticity maps from UKMO

Richard Swinbank of the United Kingdom Meteorological Office (UKMO) has provided NADIR with postscript maps of potential vorticity. The maps are located in subdirectories under `/nadir/data/ukmo`. Here follows an excerpt from the `read.me` file provided by UKMO:

The maps contained within this directory are postscript potential vorticity maps generated in two ways from UK Met Office assimilated data:

Files labelled `pv` are PV maps made from a single days assimilated data on an isentropic surface. For example the file `pv465k2.1.1994_nh.ps` would contain the PV map on the 465 Kelvin surface for 2nd January 1994.

The files named `ashoe` are made using the method of backward trajectories. For all these files five days of winds on an isentropic surface were used to make a hopefully higher resolution PV map of the final day. The parcels are initialised on an isentropic surface and then advected back in time using the winds of the previous days. The parcels are then labelled with the PV from the first day (as above), and assuming PV conservation, are plotted in their final position on the last day.

ECMWF data on $2.5^\circ \times 2.5^\circ$ grid

These are the data that have been available throughout EASOE and SESAME, and which have also been published on three CD-ROM volumes so far. CD-ROMs with data for the two winters 1993-94 and 1994-95 are under preparation.

Isentropic data

Analyses for 12 UT on the levels 350, 380, 400, 435, 475, 550 and 675K 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 were available.



During the 1995-96 winter 12, 36 and 60 hours forecasts based on the 0 UT analysis were also available. These forecasts were available somewhat later in the morning but still early enough to be useful for that same day. These forecasts are valid for the same times as the 24, 48 and 72 hours forecasts, but the advantage is that they are 12 hours “younger” and hence more accurate. These data normally cover the time interval from 1 November to 30 April. We have recently changed the directory structure so that both analyses and forecasts are found in the directory `/nadir/data/ecmwf/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.

Isobaric data

Analyses for 12 UT on the 13 standard levels 1000,850,700,500,400,300,200,150,100,70,50,30 and 10hPa 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/data/ecmwf/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 SESAME 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 seven 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 19. The trajectory data are found in `/nadir/data/ecmwf/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 $1.125^\circ \times 1.125^\circ$ grid. This gives more exact data than one obtains by extraction from the $2.5^\circ \times 2.5^\circ$ data. Software for extraction of data for stations of interest is described on page 17. These data are found in `/nadir/data/ecmwf/pvatstat/yyyy/mm`

As a novelty PV, temperature and geopotential height on the different isentropic levels are stored for each station for both 0 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 `pvyyymmdd.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. Work is under way, however, to convert these files to the NASA Ames format.

ECMWF data on $1.125^\circ \times 1.125^\circ$ grid

The demand for meteorological data has been increasing during EASOE and SESAME. At NILU we have 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 $1.125^\circ \times 1.125^\circ$. 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. We have chosen a PV map over Antarctica as the logo for this issue of NADIR NEWS.

Daily data

These data originate from ECMWF and are stored in spectral form, so-called T_{106} . These are model analyses that contain 31 model levels, with model level 31 being the ground or sea surface. The upper four levels are pure pressure levels, and the lower three are pure sigma levels, whereas the other levels are a mixture of the two. 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 (LN_{SP}) (LN_{SP} is only present at level 1 (level 0 for 19 level files, prior to 1992)). 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: 10, 30, 50, 70, 90, 100, 110, 130, 150, 180, 200, 225, 250, 275, 300, 325, 350, 400, 450, 500, 550, 600, 650, 700, 750, 800, 850, 900, 925, 960, 980, 1000 hPa; available theta surfaces are all levels from 200 to 700K in 5K steps, the only exception being that for potential vorticity the available levels are: 700, 675, 625, 550, 500, 475, 450, 435, 425, 400, 380, 365, 350, 340, 330, 325, 320, 315, 310, 305, 300, 295, 290, 285, 280, 275, 270, 265, 260, 255, 250, 245, 240, 235, 230, 225 K. Work is under way to increase the number of available levels for PV.

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 form, 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 loga-

rithm of the surface pressure (LNSP). Specific humidity is available until 4 April 1995, after when this parameter is only stored on a Gaussian grid. Work is under way to implement software that can extract this parameter also when it is 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 1991 to 7 January 1995, after when the daily data take over. Because of the large data volume, it has, until recently, not been possible to have all the archive data on-line at the same time. Now this problem has been solved through the installation of a high-capacity CD-ROM jukebox. These data can also be shared with those who have signed the ECMWF protocol for SESAME. We have also acquired data for the winter 1988-89, 89-90 and 90-91. If you are interested in access to these data, please contact NILU.

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 $1.125^\circ \times 1.125^\circ$ for the T_{106} data. A lower resolution can be specified to the [sp211](#) program described below. This will produce an output file with fewer grid points.

Extraction of data on $1.125^\circ \times 1.125^\circ$ 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 $2.5^\circ \times 2.5^\circ$ grid, except that there will be only one parameter and data for only one level. You can extract either the whole globe or a portion of it.

Daily data at model levels

sp211

For extraction of data at model levels, only one program has to be used: [sp211](#) (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 [sp211](#) program takes the arguments from the command line.

• Syntax

`sp211 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 $1.125^\circ \times 1.125^\circ$, so normally you would give 1.125 here, but you can also specify poor-



er 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, `sp211` prints out a usage list. This is helpful when trying to remember the syntax.

The `sp211` program reads the contents of the environment variable `MARSPATH`. This variable must be set by the user before `sp211` is used. `MARSPATH` must be set to:

```
/nadir/data/ecmwf/t106/yyyy/mm
```

This done with the command:

```
setenv MARSPATH /nadir/data/ecmwf/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/data/ecmwf/t106/1995/02
sp211 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/data/ecmwf/t106/1995/01
sp211 95 01 30 06 U 31 1.125 -50 50 90 30 eu-
rope.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 at the moment). *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 4 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 `sp211` 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 `sp211`, `hy2pv`, `hy2th`, `hy2p`, `hy2z` and 19 level versions of these. 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 Bojan R. Bojkov at NILU.



Graphical presentation of data

New 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 new plotting programs for plotting of T_{106} data, which are described below. If you experience any problems using these the 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 ECMWF_PATH /nadir/data/ecmwf
```

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 or from one of the CD-ROMs that will appear soon, 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*. The program codes will also be available on the CD-ROMs with ECMWF data from the SESAME campaign. 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 ECMWF_PATH /nadir/data/ecmwf` to the corresponding path for your site. If you read the data directly from one of the CD-ROMs provided by NILU you should set this path to `/cdrom/data/ecmwf`. 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 ECMWF_PATH $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 program called *ps2epsi* before importing it into the word processor. Some of the plots have been made with the driver *hcoposteps*. This driver produces an *eps* file (Encapsulated Postscript), which can be imported directly into many word processors.

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*.

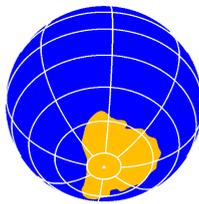
isenplo

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 `htp3a4` 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 12UT analysis and 12, 36 and 60 if you want forecasts based on the 0UT analysis (see the chapter on isentropic data on page 3).

• Example 1

```
isenplo pv 950125 0 475 htp3a4
```

This will give a plot of potential vorticity for 25 January 1995 at 475K as a postscript file. Figure 4 shows the resulting plot.

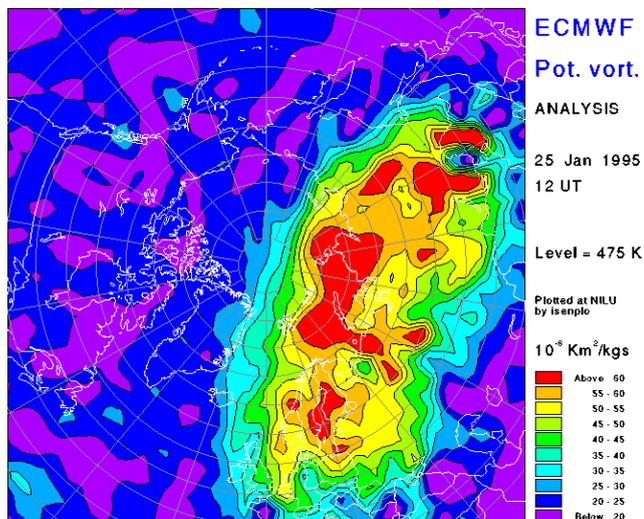


Figure 4. Potential vorticity at 475K on 25 January 1995.

• 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.

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 `htp3a4` for colour postscript.

• Example

```
isenmap pv 950225 0 550 htp3a4
```

This will give a plot of potential vorticity for 25 February 1995 at 550K to a postscript file. Figure 5 shows the resulting plot.

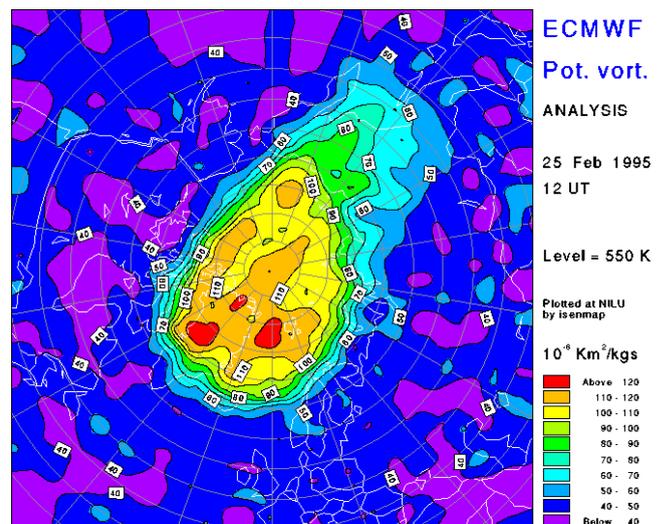


Figure 5. Potential vorticity at 475K on 25 February 1995.

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.

• Example 1

```
isenvert pv 960212 180 htp3a4
```

This will produce a plot of PV along the International Date Line for 12 February 1996. The resulting plot is shown in Figure 6.

• Example 2

```
isenvert ps 960112 20 mx11
```

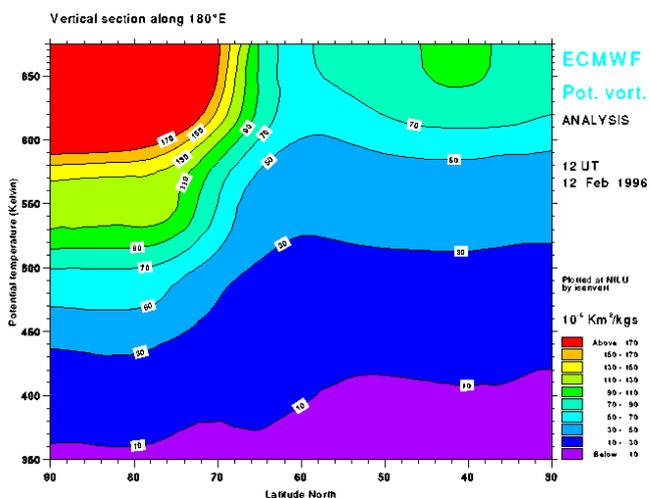
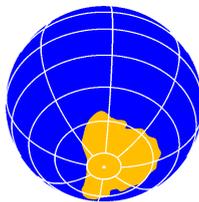


Figure 6. Potential vorticity along 180°E on 12 February 1996.

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 7.

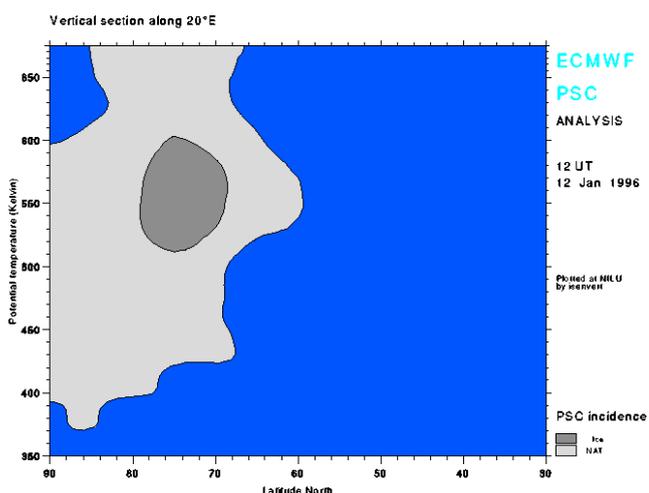


Figure 7. Vertical PSC distribution along 20°E on 12 January 1996.

Plotting of isobaric data at 2.5° × 2.5° resolution

isomap

There is now only one program for plotting of low resolution 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 htp3a4
```

This will produce a map of total wind (the vector sum of `u` and `v`) for 12 UT on 30 January 1995 at 30hPa. Figure 8 shows the plot.

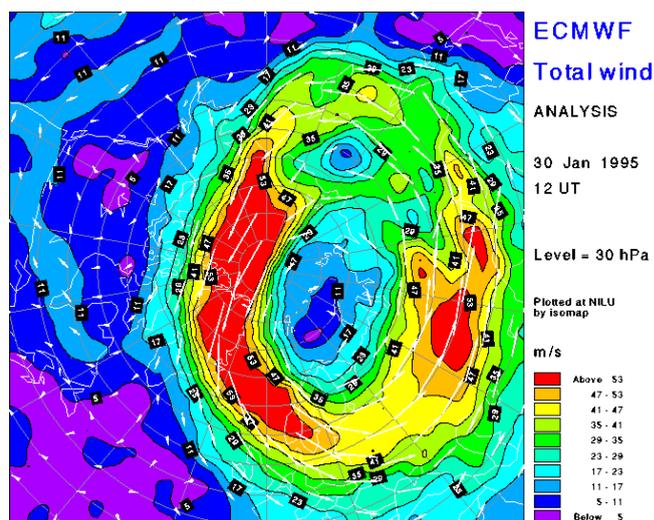


Figure 8. Total wind for 12 UT on 30 January 1995.

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:

```
gridpoint,lat,lon
```

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

• 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 9 shows the result.

- **Example 2**

```
trajplo 950205 gridpoin, 40,0 550 htp3a4
```

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

- **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 475K ending at the given stations.

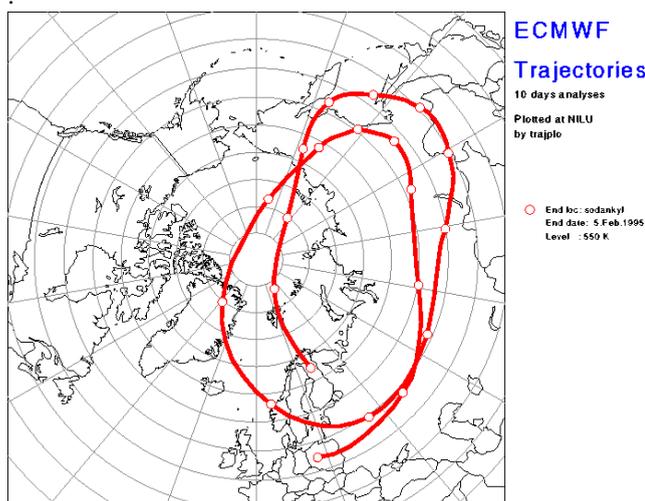


Figure 9. Trajectory ending at 550K above Sodankylä on 5 February 1995.

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, temper-

ature 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` described above, 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 550K. 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 10.

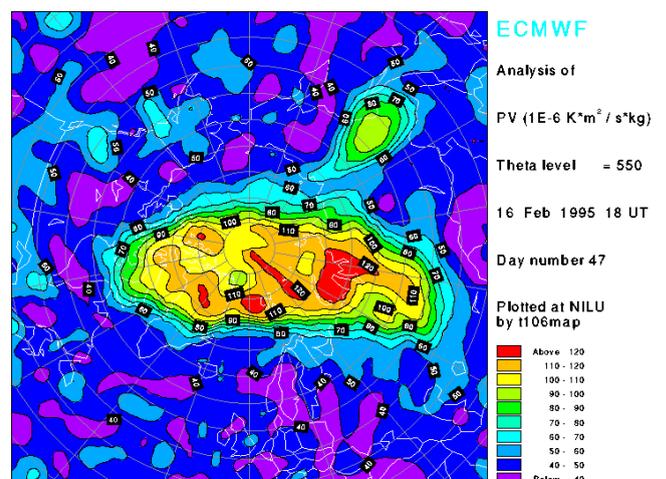
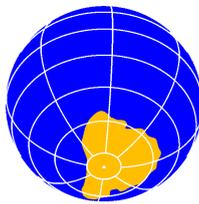


Figure 10. Potential vorticity at 550K on 16 February 1995 18 UT over the Northern Hemisphere.

t106glob

Use this program if you want to plot a map of any arbitrary portion of the globe. This program uses the orthographic projec-



tion (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 have extracted using `met-mars` described above, 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 475 K over the Northern Hemisphere for 12 UT on 10 January 1995, centred over Kiruna.

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

```
met-mars 95 1 10 12 -180 180 90 -90 1.125 th
475 T t95011012.475
```

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

```
t106glob t95011012.475 183 223 68 21 mx11
```

The plot will look like Figure 11.

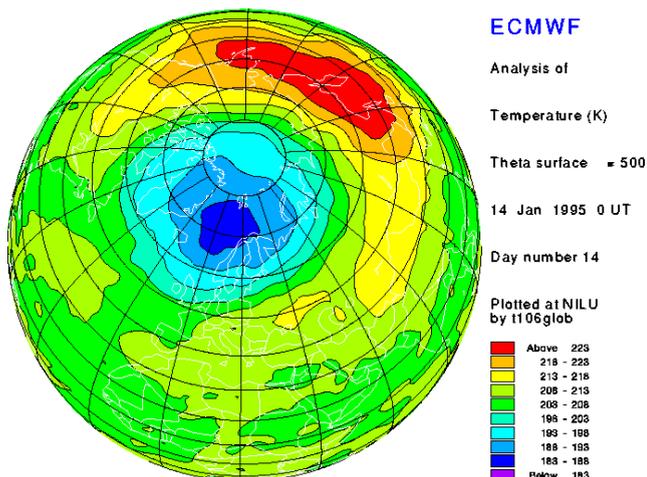


Figure 11. Orthographic plot of temperature at 475 K on 10 January 1995 at 12 UT. The map is centred over Kiruna.

• 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 12.

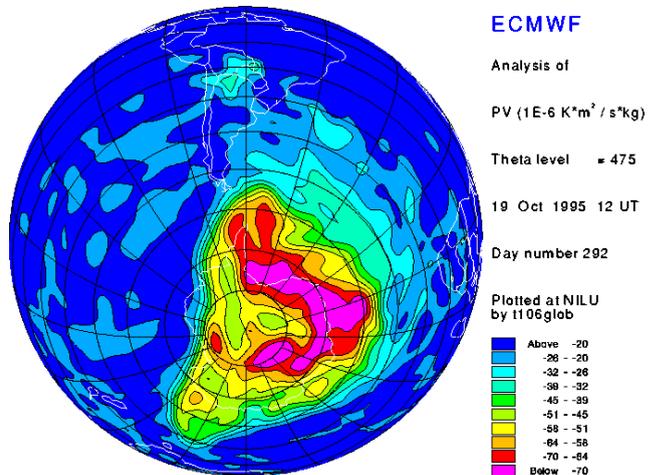


Figure 12. Orthographic plot of potential vorticity at 475 K on 19 October 1995 at 12 UT. The map is centred over the Antarctic Peninsula. Note that PV is negative in the Southern Hemisphere.

t106plot

This program can plot temperature, PV and PSC incidence (based on temperature data) from NASA Ames files with $1.125^\circ \times 1.125^\circ$ 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`.

• 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
```

Then you plot the PSC map using the temperature data:

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

The resulting plot is given in Figure 13.

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.

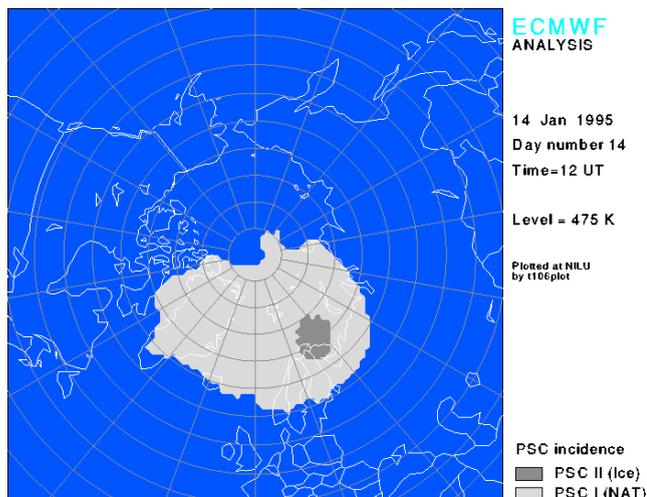
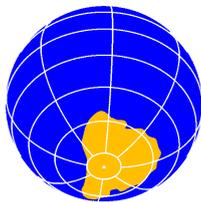


Figure 13. Stereographic plot of PSC incidence at 475K on 14 January 1995 at 12UT.

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/data/satellit/toms/nimbus7/
d930315.n7 250 450 mx11
```

Figure 14 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

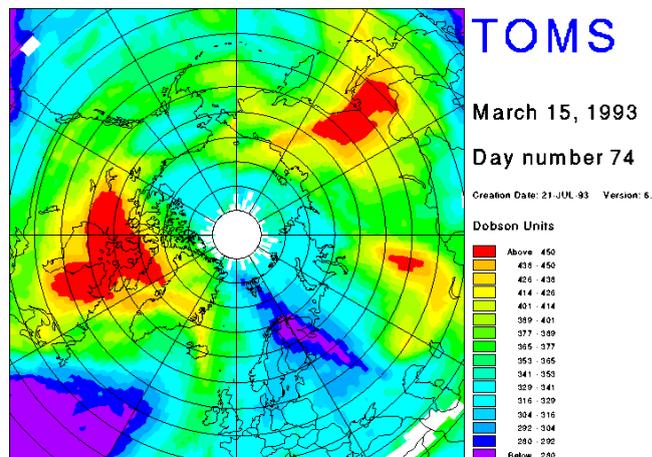


Figure 14. Stereographic plot of TOMS total ozone for 15 March 1993.

of the centre of the map, respectively, and where *device* is the Uniras device.

• Example

```
tomsglob /nadir/data/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 15.

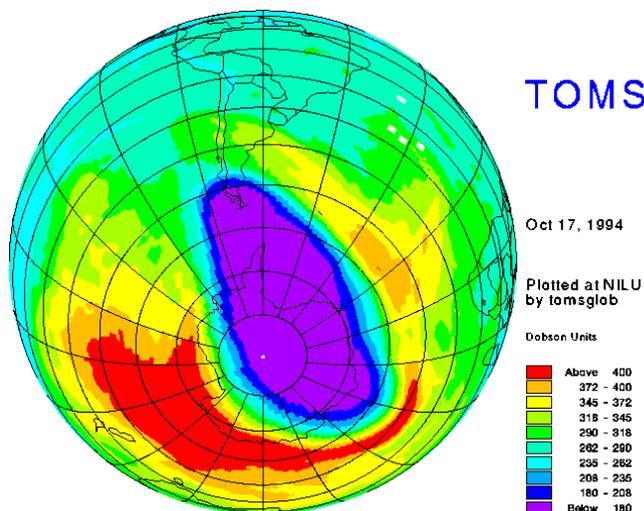
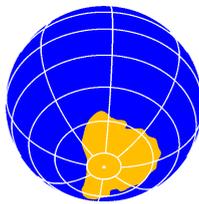


Figure 15. Orthographic plot of Meteor 3 TOMS total ozone for 17 October 1994. One can see how the ozone hole (the region with total ozone < 180 DU) touches the southern tip of South America.

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 htp3a4
```

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 16.

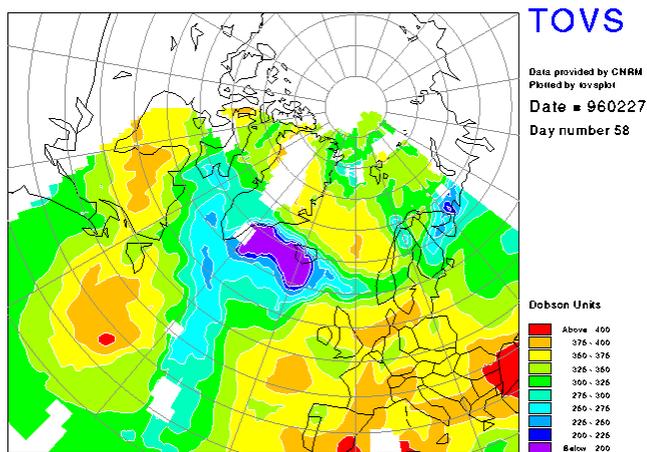


Figure 16. Stereographic plot of TOVS total ozone for 27 February 1996.

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 htp3a4
```

The result is shown in Figure 17.

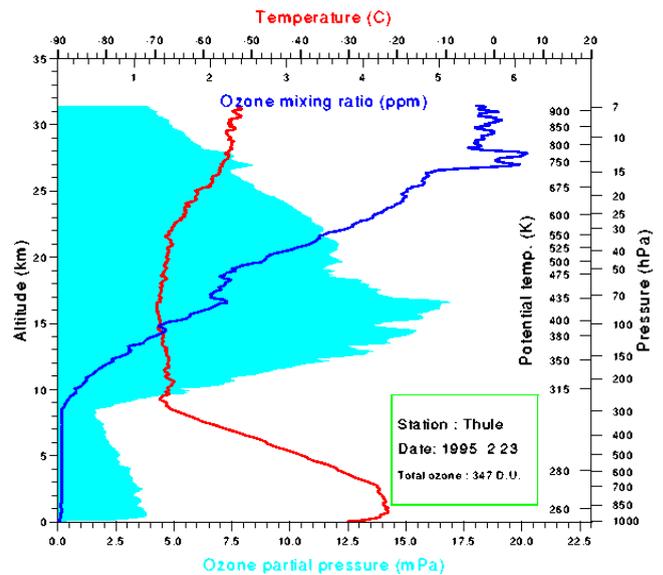


Figure 17. Plot of an ozonesonde profile from Thule (Greenland) on 23 February 1995.

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 htp3a4
```

• Example 2

```
meanprof iv9503.dir htp3a4
```

The resulting plots from these two commands are shown in Figure 18 and Figure 19.

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 ozonesonde data.

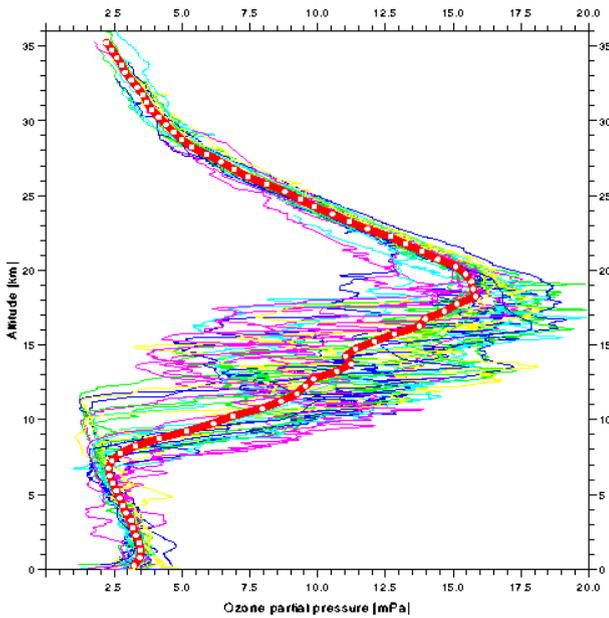


Figure 18. Plot of a mean ozone profile resulting from averaging approx. 30 ozone soundings carried out inside the polar vortex during March 1992. Each profile is plotted as a thin curve in different colours. The mean profile is plotted as a thick red curve with white dots marking every 500m.

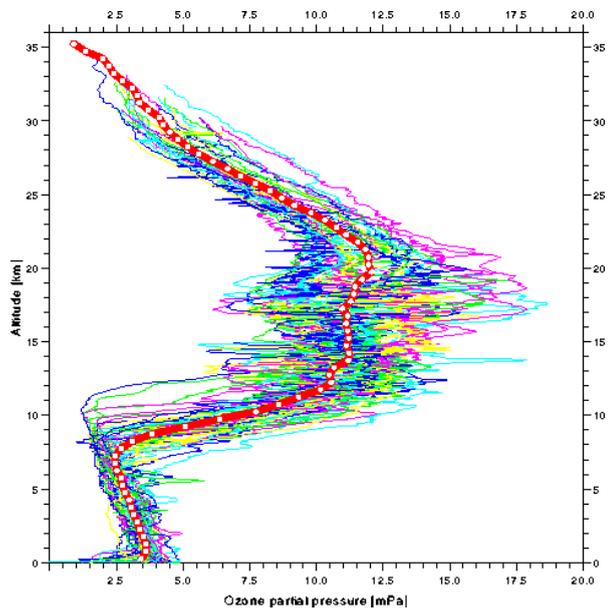


Figure 19. Plot of a mean ozone profile resulting from averaging approx. 40 ozone soundings carried out inside the polar vortex during March 1995. One can clearly see the ozone deficit in the 15-20km range which

Time series of data on $2.5^\circ \times 2.5^\circ$ 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 675 K, 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
```



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.

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 475K 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 12UT 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 $2.5^\circ \times 2.5^\circ$ 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 htp3a4
        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 `pvatstat_new`.

• 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 station 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

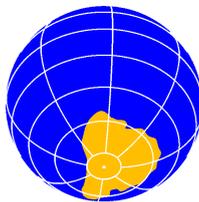
```
isoprof date forecast_hours lat lon outfile
```

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
```

of the plot (1-4) and `juopt` is an optional parameter which should either be omitted or set equal to `jul`. If `juopt` 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 20 shows what the plot will look like.

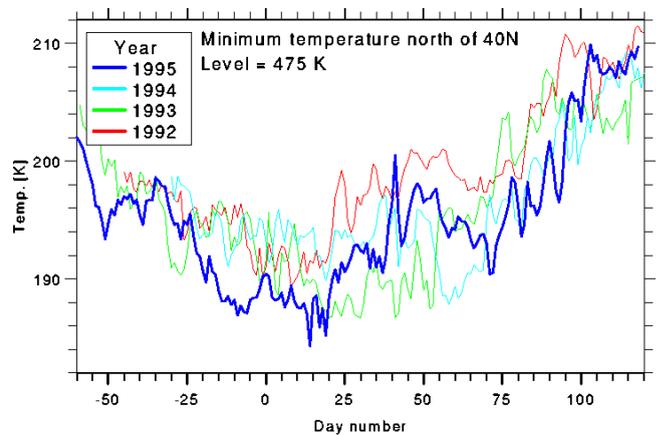


Figure 20. Time series of Northern Hemisphere minimum temperatures for the last few winters. The 1994-95 winter has been enhanced with a thicker curve.

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 the last few winters. First, you run the program `isen_minmax`, which is described on page 15. 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 [juopt]
```

where `device` is the Uniras device, `orien` is the orientation

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 `zardo`, run

`traj -help`

to get instructions on how to use this program.

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
isen_extr	Lists a lat./lon. portion of isentropic ECMWF data on the screen.	17
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.	9
isen_minmax	Makes a time series of the maximum and minimum temperature anywhere north of 40°N from the isentropic ECMWF data.	15

Table 1. (Continued) Program summary.

Program name	Purpose	Page
isenplo	Plots a map of isentropic ECMWF data at 2.5° × 2.5° resolution.	8
isen_ts	Extracts a time series of isentropic ECMWF data for a given grid point and level.	15
isenvert	Plots a vertical section of isentropic ECMWF data along a meridian	9
iso_extr	Extracts a portion of the isobaric ECMWF data. Output is written to the screen.	18
isolist	Writes out the contents of an isobaric ECMWF file with one line per grid point. The output is written to a file.	17
isomap	Plots a map of isobaric ECMWF data at 2.5° × 2.5° resolution.	10
isoprof	Extracts the four parameters of an isobaric ECMWF file for all 13 levels at a specified grid point.	17
iso_ts	Extracts a time series of isobaric ECMWF data for a given grid point and level.	16
meanprof	Calculates and plots a mean ozone profile from a list of ozonesonde files.	14
met-mars	Extracts and interpolates gridded spectral ECMWF data. This program must be run before you can use the plotting programs t106glob, t106map and t106plot.	6
modplot	Plots data from NILU's chemical trajectory model.	2
profile	Interactive Uniras program that displays a list of ozonesonde profiles in succession.	14
pvatstat	Extracts time series of PV data for individual stations.	17
pvpick	Picks out data files for a station according to certain PV criteria.	18
sondeplo	Plots individual ozonesonde profiles.	14
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.	5
statlist	Produces a list of end points in a trajectory data file.	10
t106glob	Plots T ₁₀₆ data in orthographic projection. met-mars must be run first to extract the data.	11
t106map	Plots T ₁₀₆ data (any parameter) in stereographic projection. met-mars must be run first to extract the data.	11
t106plot	Plots T ₁₀₆ data (T, PV or PSC) in stereographic projection. met-mars must be run first to extract the data.	12
tomsglob	Plots TOMS data in orthographic projection.	13
tomslist	Lists a lat./lon. portion of a TOMS file on the screen.	19
tomsplot	Plots TOMS data over the Northern Hemisphere in stereographic projection.	13
tovsplot	Plots TOVS data in stereographic projection.	13

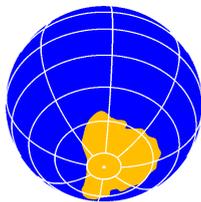


Table 1. (Continued) Program summary.

Program name	Purpose	Page
traj	Extracts trajectory data for a single station from the large collective trajectory files.	19
trajplo	Plots up to six trajectories.	10
xyplot	Plots one or more curves in an XY diagram.	18

NADIR on the Web

Information about NILU and NADIR is now available on the World Wide Web. Updated information about the activities within stratospheric ozone research at NILU and news about NADIR can be found at <http://www.nilu.no>. The Web server is under development, so new information will be added constantly. If you have any ideas about information that ought to be available on the Web server, please contact us.

Who to contact at NILU?

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

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

Bojan R. Bojkov (meteorological data).
Tel: +47 63 89 81 81
E-mail: bojan@nilu.no

Poul H. Sørensen (technical questions regarding the computer system).
Tel: +47 63 89 80 32
E-mail: poul@nilu.no

Cathrine W. Tellefsen (general questions, user accounts, access to data, protocols).
Tel: +47 63 89 81 83
E-mail: cathrine@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 1996-98 time period, and a new protocol has been made. This protocol can be obtained by contacting Cathrine W. Tellefsen (see above).

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