Data visualization

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Overview

- PALM produces netCDF data output
  - time series
  - profiles
  - 2D cross sections (xy-, xz-, yz-cross-sections)
  - 3D volume data
  - spectra
- Different tools can be used to visualize this data
  - programs with GUI: ncview, Panoply, psy-view, ParaView…
  - NCL-based script delivered with PALM: **`palmplot`**
  - programming languages: NCL, Python, R, …
- **Goal:**

  not presenting the “perfect” tool for visualization,

  but get you started visualizing PALM data output

NetCDF introduction

NetCDF: Network Common Data Form

- Developed by the University Corporation for Atmospheric Research (UCAR)
- A set of software libraries and machine independent data formats (freely accessible and usable by everyone)
- Intended for **array**-oriented scientific data
- Data is **self-describing**:
  - Header describes file layout, content and global attributes
  - Metadata containing attributes like units or data types
- Library's core is written in C and provides application programming interfaces (APIs) for C, C++, **Fortran**; separate netCDF-Java library
- Programming interfaces to netCDF are available in R, Perl, Python, Ruby, Haskell, Mathematica, MATLAB, IDL, Octave,…
- Supports **parallel** I/O (PnetCDF, HDF5)

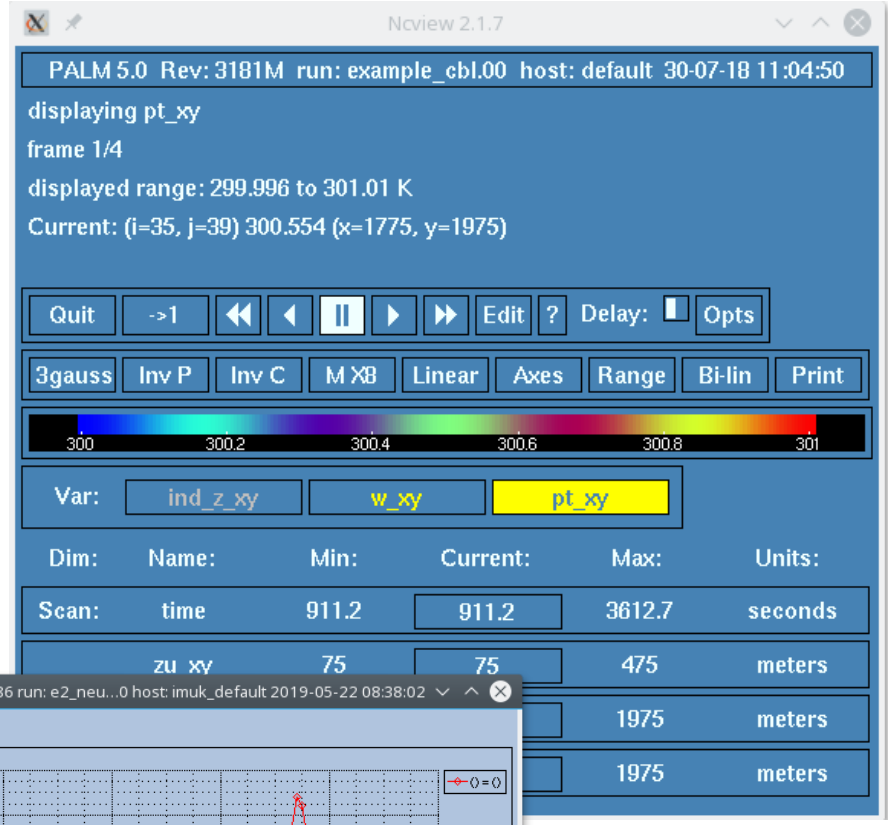
Ncview

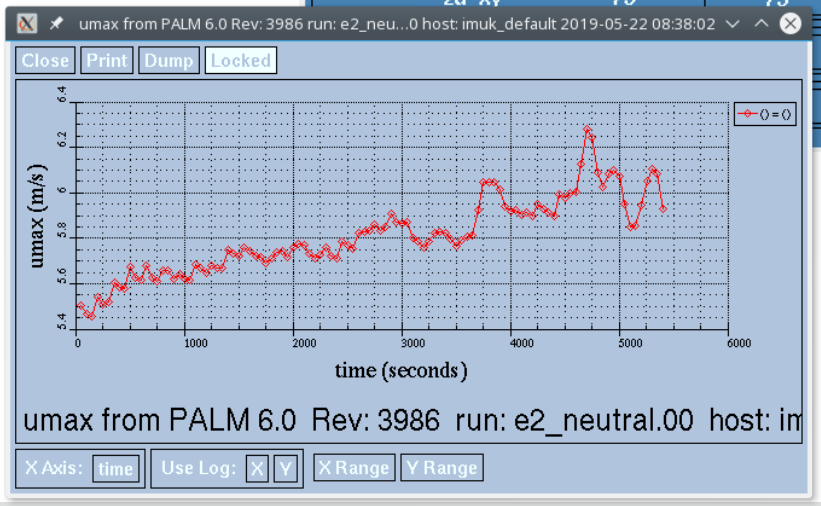
`Ncview` - a simple first look

- Start via command line:

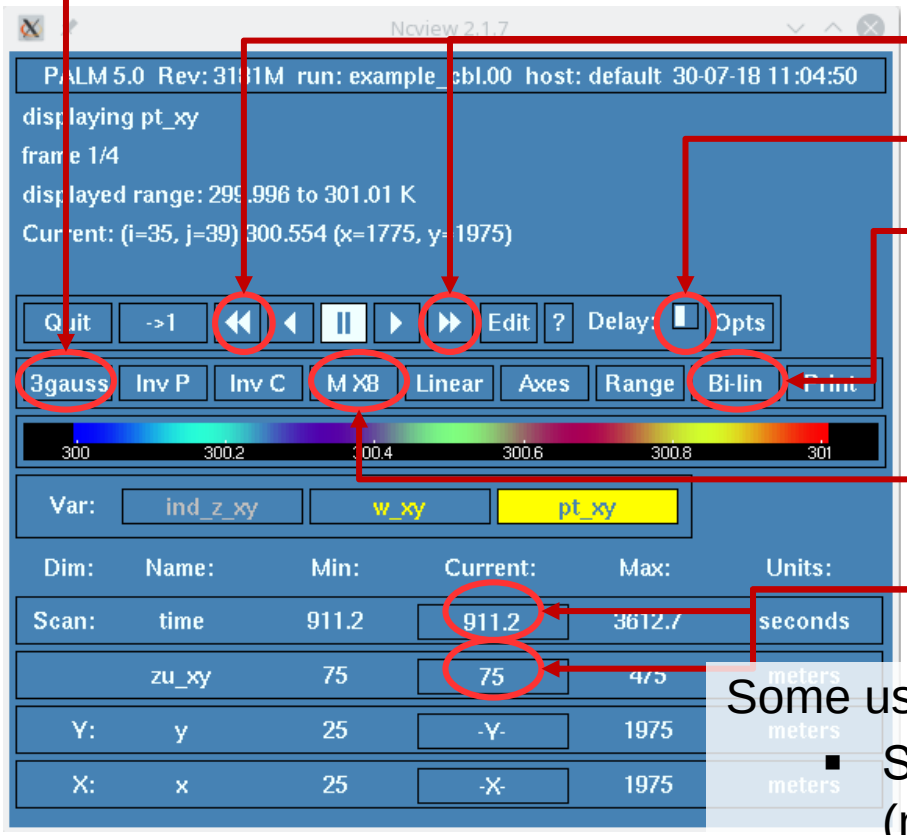
  ```
  ncview <filename>
  ```

- Select variable of interest
- Display 2D contour plots
- Show line plot along dimensions
- Automatically cycle through time





Ncview



color map

animate

animation speed

Interpolation between pixel on/off

magnify

change time step/cross-section

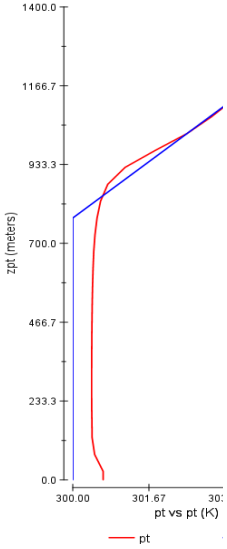
Some useful hints:

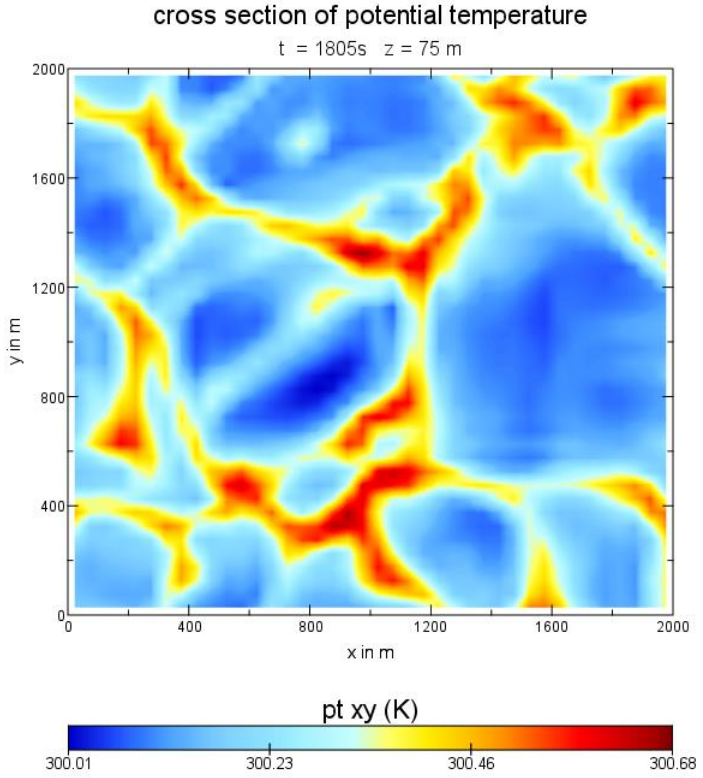
- Select “close” to close single plot windows (not shown)
- “Left click” goes forward,
  “right click” goes backwards (time, slices, …)
- When typing, the cursor must be within the input-field (changing range,…)

Panoply

Panoply – a netCDF, HDF and GRIB Data Viewer

- Developed by NASA (*https://www.giss.nasa.gov/tools/panoply/*)
- Intuitive and easy access to content of data file
- Edit plot easily
  - plot range/scale
  - area
  - labels
- Creation of presentable figures
- Export pictures and animations





Palmplot

NCL-script **`palmplot`** (outdated)

- Shell script delivered with palm (mainly used during the seminar)
- **Idea:** Explicitly developed for PALM output to standardize/unify visualization among the community
- Based on **NCL** (NCAR Command Language)
  - Interpreted language (no compilation) designed for scientific data processing
  - Capable of data analysis and visualization
  - Supports NetCDF3/4, GRIB 1/2, HDF4/5, ASCII, binary, etc.
  - See here: *www.ncl.ucar.edu/*
- Find the NCL scripts at `palm_model_system-*/packages/visualization/palmplot/src/`
- Find the documentation at *https://palm.muk.uni-hannover.de/trac/wiki/doc/app/ncl*
- Due to stopped development of NCL: new, python-based **`palmplot`** might come in near future
- **Attention**: Results of **`palmplot`** might contain wrong height information

Palmplot

Creating the **`palmplot`** command line
(execution within `JOBS/<run_identifier>/OUTPUT`):

```
palmplot <plot_identifier> \
         file_1=<file> \
         file_out=<file> \
         format_out=<format>
```

- Possible options for **`<plot_identifier>`**:

<plot_identifier>	**data set**	**used ncl script (.ncl)**
xy	xy or 3D	cross_sections
xz	xz or 3D	cross_sections
yz	yz or 3D	cross_sections
pr	profile or 3D	profiles
ts	time series	timeseries
sp	spectra	spectra

Palmplot

Creating the **`palmplot`** command line
(execution within `JOBS/<run_identifier>/OUTPUT`):

```
palmplot <plot_identifier> \
         file_1=<file> \
         file_out=<file> \
         format_out=<format>
```

- Further parameters can be given depending on the setting of

  `<plot_identifier>`

- List of available parameters:

  https://palm.muk.uni-hannover.de/trac/wiki/doc/app/nclparlist

- A short help text can be displayed by typing: **`palmplot ?`**
- Example palmplot commands are given during the exercises

References

palmplot

- Documentation
  https://palm.muk.uni-hannover.de/trac/wiki/doc/app/ncl
- List of available parameters
  https://palm.muk.uni-hannover.de/trac/wiki/doc/app/nclparlist

NCL

- www.ncl.ucar.edu/

ncview

- http://meteora.ucsd.edu/~pierce/ncview_home_page.html

panoply

- https://www.giss.nasa.gov/tools/panoply/

netCDF

- https://www.unidata.ucar.edu/software/netcdf/

ParaView

- https://www.paraview.org/

The end

PALM online:
https://palm.muk.uni-hannover.de

Our YouTube channel:
https://youtube.com/user/palmhannover