# User guide for NCL scripts

## General

PALM produces NetCDF output files of
- 3d
- 2d
- profiles
- timeseries
- spectra

These data can be plotted with the program NCL (http://www.ncl.ucar.edu/). NCL is an interpreted language designed specifically for scientific data analysis and visualization.

Four NCL scripts and one configuration file exist for PALM users in **trunk/SCRIPTS/NCL** to get a quick overview of the output data:

- **cross_sections.ncl** (draws contour, isoline or vector plots (of a 2-dimensional vector) from 2D or 3D data; instantaneous or time-averaged xy, xz, yz or 3D data can be used)

- **profiles.ncl** (draws profile line plots from profile or 3D data)

- **spectra.ncl** (draws NCL spectra plots from spectra data)

- **timeseries.ncl** (draws line plots from timeseries data)

- **.ncl.config.default** (default configuration file)

The shell script **palmplot** is designed for running the NCL scripts and can be found in **trunk/SCRIPTS**. The usage is as follows:

**palmplot plot_identifier**

**plot_identifier** has to be **xy**, **xz**, **yz**, **pr**, **sp** or **ts** in dependence of the data that is to be plotted:

| plot_identifier | data | used ncl script |
|---|---|---|
| xy | instantaneous or time-averaged xy or 3D data | cross_sections.ncl |
| xz | instantaneous or time-averaged xz or 3D data | cross_sections.ncl |
| yz | instantaneous or time-averaged yz or 3D data | cross_sections.ncl |
| pr | profile or 3D data | profiles.ncl |
| sp | spectra data | spectra.ncl |
| ts | timeseries data | timeseries.ncl |

Several parameters can be steered to change the output of the plots. They can be either written in the prompt or modified within the configuration file *.ncl.config.default*.

## Using *.ncl.config*

It is recommended to create a personal configuration file by copying the default configuration file *.ncl.config.default* to the PALM working directory *~/palm/current_version* and naming it *.ncl.config*. It is used by NCL directly. So, the parameters have to be written in *.ncl.config* according to the rules of the scripting language NCL. The configuration file contains all steering parameters with a short description and can be modified to personal needs.

## Using *palmplot*

For controlling the parameters within the prompt, they need to be written as follows:

*palmplot   plot_identifier   parameter=value   parameter=string*

It is necessary to set the string parameters which can contain lists (var, c_var, vec1, vec2, plotvec) in single quotes. The list itself has to be separated by blanks.
Example: var='pt u w*pt* w"pt"' or c_var='v w' or var='E*'

Changing of parameters in the configuration file will be ignored if parameters are specified in the prompt.

A short introduction for using the shell script is given by typing **palmplot -?**.

In the following, some examples are given for plotting data of the PALM default run example_cbl.

Change to the directory where the data is stored:
cd  palm/current_version/JOBS/example_cbl/OUTPUT

Enter the following commands:

Plotting xy-cross section data:
palmplot xy file_1=example_cbl_xy.nc var='pt_xy'

Plotting profile data:
palmplot pr file_1=example_cbl_pr.nc format_out=eps file_out=pr_data var='pt w"pt" w*2'

Plotting timeseries data:
palmplot ts file_1=example_cbl_ts.nc format_out=pdf file_out=ts_data no_rows=6

## Further information

The following lists give an overview of all existing parameters. Further descriptions can be found in the configuration file *.ncl.config.default*.

Most parameters are allocated with a suitable default value in the configuration file but some need to be changed before running any script. They are marked with a REQUIRED otherwise with OPTIONAL.
In case of a job chain without extended output files, the scripts will automatically read all necessary files after indicating the first and the last cyclic number (see start_f and end_f).

**Parameter list for cross_sections.ncl:**

| file_1 | REQUIRED | string | input file; "/path/name(.nc)" |
|---|---|---|---|
| start_f | OPTIONAL | integer | first cyclic number |
| end_f | OPTIONAL | integer | last cyclic number |
| xyc, xzc, yzc | OPTIONAL | integer | [=0] or [=1]; XY- or XZ- or YZ section |
| format_out | OPTIONAL | string | "x11", "pdf", "ps", "eps", "epsi", "ncgm", "png" |
| file_out | OPTIONAL | string | output file; "path/name" |
| no_columns | OPTIONAL | integer | number of plots in one row |
| no_rows | OPTIONAL | integer | number of plots in one column |
| sort | OPTIONAL | string | "layer" or "time" |
| var | OPTIONAL | string | by default all variables otherwise: e.g.: ",u,v," for output of u and v |
| start_time_step | OPTIONAL | double | first time step in [hour] |
| end_time_step | OPTIONAL | double | last time step in [hour] |
| xs | OPTIONAL | double | first value of x range in [meter] |
| xe | OPTIONAL | double | last value of x range in [meter] |
| ys | OPTIONAL | double | first value of y range in [meter] |
| ye | OPTIONAL | double | last value of y range in [meter] |
| zs | OPTIONAL | integer | first index of z-range |
| ze | OPTIONAL | integer | last index of z-range |
| mode | OPTIONAL | string | "Fill" for contour plot , "Line" for isolines, "Both" for both |
| fill_mode | OPTIONAL | string | type of filling the contour plot: "AreaFill", "RasterFill" or "CellFill" |
| shape | OPTIONAL | integer | aspect ratio is kept [=1] or not [=0] |
| font_size | OPTIONAL | float | font size of strings |
| font_size_legend | OPTIONAL | float | font size of legend strings |

| legend_label_stride | OPTIONAL | integer | reduction of number of labels in legend |
|---|---|---|---|
| axes_explicit | OPTIONAL | integer | explicit setting of axes is switched on [=1] |
| major_ticks_x | OPTIONAL if axis_explicit = 1 | integer | number of major tick marks at x-axis |
| major_ticks_y | OPTIONAL if axis_explicit = 1 | integer | number of major tick marks at y-axis |
| norm_x, norm_y, norm_z | OPTIONAL if axis_explicit = 1 | float | normalising of axes |
| unit_x, unit_y, unit_z | OPTIONAL if axis_explicit = 1 | string | units of axes |
| vector | OPTIONAL | integer | output of a vector plot [=1] or not [=0] |
| vec1 | REQUIRED if vector=1 | string | first component of vector (e.g.: ",u,") |
| vec2 | REQUIRED if vector=1 | string | second component of vector(e.g.: ",v,") |
| plotvec | OPTIONAL | string | variable where the vectorplot can overlay if desired (e.g.: ",u,") |
| ref_mag | OPTIONAL | float | length of the vector |

# Parameter list for profiles.ncl:

| file_1 | REQUIRED | string | 1$^{st}$ input file; "/path/name(.nc)" |
|---|---|---|---|
| start_f_1 | OPTIONAL | integer | first cyclic number of 1st input file |
| end_f_1 | OPTIONAL | integer | last cyclic number of 1st input file |
| format_out | OPTIONAL | string | "x11", "pdf", "ps", "eps", "epsi", "ncgm", "png" |
| file_out | OPTIONAL | string | output file; "path/name" |
| no_columns | OPTIONAL | integer | number of plots in one row |
| no_rows | OPTIONAL | integer | number of plots in one column |
| var | OPTIONAL | string | by default all variables otherwise: e.g.: ",u,v," for output of u and v |
| no_files | OPTIONAL | integer | up to 6 different input files with identical variables and dimensions can be used |
| file_2 | REQUIRED if no_files>1 | string | 2$^{nd}$ input file; "/path/name(.nc)" |
| start_f_2 | OPTIONAL if no_files>1 | integer | first cyclic number of 2nd input file |
| end_f_2 | OPTIONAL if no_files>1 | integer | last cyclic number of 2nd input file |
| file_3 | REQUIRED if no_files>2 | string | 3$^{rd}$ input file; "/path/name(.nc)" |
| ... | | | |
| name_legend_1 | OPTIONAL if no_files>1 | string | legend item 1 can be labeled |
| name_legend_2 | OPTIONAL if no_files>1 | string | legend item 2 can be labeled |
| name_legend_3 | OPTIONAL if no_files>2 | string | legend item 3 can be labeled |
| ... | | | |
| start_time_step | OPTIONAL | double | first time step in [hour] |
| end_time_step | OPTIONAL | double | last time step in [hour] |
| time_stride | OPTIONAL | integer | temporal stride for the plots |
| start_x | OPTIONAL | integer | start value of x-axis for horizontal averaging if 3D-data is used; in [gridpoint] |
| end_x | OPTIONAL | integer | end value of x-axis for horizontal averaging if |

| | | | 3D-data is used; in [gridpoint] |
|---|---|---|---|
| start_y | OPTIONAL | integer | start value of y-axis for horizontal averaging if 3D-data is used; in [gridpoint] |
| end_y | OPTIONAL | integer | end value of y-axis for horizontal averaging if 3D-data is used; in [gridpoint] |
| xs | OPTIONAL | float | first value of x axis |
| xe | OPTIONAL | float | last value of x axis |
| min_z | OPTIONAL | double | first value of z-axis in [meter] |
| max_z | OPTIONAL | double | last value of z-axis in [meter] |
| log_z | OPTIONAL | integer | [=1] if logarithmic scale for z otherwise [=0] |
| norm_z | OPTIONAL | float | value for normalising the z-axis |
| over | OPTIONAL | integer | [=1] for predefined overlaying of special variables otherwise [=0] |
| combine | OPTIONAL | integer | [=1] for combining of 2 or 3 variables otherwise [=0] |
| number_comb | REQUIRED if combine=1 | integer | [=2] or [=3] |
| c_var | REQUIRED if combine=1 | string | variables for combining, e.g.: ",u,v,w," |
| black | OPTIONAL | integer | [=1] for black or [=0] for coloured lines |
| dash | OPTIONAL | integer | [=1] for dashed or [=0] for continuous lines |
| font_size | OPTIONAL | float | font size of strings |
| font_size_legend | OPTIONAL | float | font size of legend strings |

**Parameter list for spectra.ncl:**

| file_1 | REQUIRED | string | input file; "/path/name(.nc)" |
|---|---|---|---|
| start_f | OPTIONAL | integer | first cyclic number |
| end_f | OPTIONAL | integer | last cyclic number |
| format_out | OPTIONAL | string | "x11", "pdf", "ps", "eps", "epsi", "ncgm", "png" |
| file_out | OPTIONAL | string | output file; "path/name" |
| no_columns | OPTIONAL | integer | number of plots in one row |
| no_rows | OPTIONAL | integer | number of plots in one column |
| var | OPTIONAL | string | by default all variables otherwise: e.g.: ",u,v," for output of u and v |
| height_level | OPTIONAL | array integer | indicating which height levels from the input file shall be output; e.g: (/1,2,7/) for level 1,2 and 7; by default all levels |
| sort | OPTIONAL | string | "height" for all heights in one plot or  "time"  for all time steps in one plot |
| start_time_step | OPTIONAL | double | first time step in [hour] |
| end_time_step | OPTIONAL | double | last time step in [hour] |
| black | OPTIONAL | integer | [=1] for black or [=0] for coloured lines |
| dash | OPTIONAL | integer | [=1] for dashed or [=0] for continuous lines |
| log_x | OPTIONAL | integer | [=1] if logarithmic scale for x otherwise [=0] |
| log_y | OPTIONAL | integer | [=1] if logarithmic scale for y otherwise [=0] |
| norm_x | OPTIONAL | float | value for normalising the x-axis |
| norm_height | OPTIONAL | integer | normalising x-axis with height is switched on [=1] |
| norm_y | OPTIONAL | float | value for normalising the y-axis |
| unit_x, unit_y | OPTIONAL if axis_explicit = 1 | string | units of axis |
| font_size | OPTIONAL | float | font size of strings |
| font_size_legend | OPTIONAL | float | font size of legend strings |

**Parameter list for timeseries.ncl:**

| | | | |
|---|---|---|---|
| file_1 | REQUIRED | string | input file; "/path/name(.nc)" |
| start_f | OPTIONAL | integer | first cyclic number |
| end_f | OPTIONAL | integer | last cyclic number |
| format_out | OPTIONAL | string | "x11", "pdf", "ps", "eps", "epsi", "ncgm", "png" |
| file_out | OPTIONAL | string | output file; "path/name" |
| no_columns | OPTIONAL | integer | number of plots in one row |
| no_rows | OPTIONAL | integer | number of plots in one column |
| var | OPTIONAL | string | by default all variables otherwise: e.g.: ",u,v," for output of u and v (one comma before and after each variable!) |
| start_time_step | OPTIONAL | double | first time step in [hour] |
| end_time_step | OPTIONAL | double | last time step in [hour] |
| over | OPTIONAL | integer | [=1] for predefined overlaying of the following sets of variables: (E,E*), (u*,w*), (umax,vmax,wmax), (z_i_pt,z_i_wpt), (wpt,w"pt",w"pt"0), (pt(0),pt(zp)) otherwise [=0] |
| font_size | OPTIONAL | float | font size of strings |
| norm_t | OPTIONAL | float | normalising t-axis |
| unit_t | OPTIONAL | string | unit of t-axis |

**Program crash**

If one of the program aborts and there is no comment, check the configuration file - the scripts should not abort with the default values. Be sure to use the right data type (e.g.: integer = **2**; float = **2.0**; double = **2.0d**; string = **"name"** ).