**Feature identification in 4-dimensional simulation data of the polar atmosphere**

1. Access to the data

Connect to Wifi with SSID KIT with your [uuril@student.kit.edu](mailto:uuril@student.kit.edu) account

(Description: <https://www.scc.kit.edu/en/services/6298.php>)

In case your are outside KIT campus, please use VPN (<https://www.scc.kit.edu/en/services/10104.php>)

Open data catalogue <http://eos.scc.kit.edu/thredds/catalog/polstracc0new/catalog.html>

Choose date 2016021600

<http://eos.scc.kit.edu/thredds/catalog/polstracc0new/2016021600/catalog.html>

The datasets to be used are named as  
2016021600-ART-chemtracer\_grid\_reg\_DOM02\_HL\_0001.nc

…

2016021600-ART-chemtracer\_grid\_reg\_DOM02\_HL\_0024.nc

…

2016022900-ART-chemtracer\_grid\_reg\_DOM02\_HL\_0024.nc

To see the structure and the data stored in the netCDF files click on e.g. 2016021600-ART-chemtracer\_grid\_reg\_DOM02\_HL\_0001.nc and then OPeNDAP

Relevant for identification of the features are just the variables

* Longitude: lon (in degrees)
* Latitude: lat (in degrees)
* Altitude: alt (in m)
* Time: time (in day as %Y%m%d.%f)
* Potential Vorticity pv (in K m2 kg-1 s-1)
* Specific Humidity qv (in kg kg-1)

If you are working with Python. A couple of solutions to open netCDF data with Python exist (e.g. see <http://www.ceda.ac.uk/static/media/uploads/ncas-reading-2015/10_read_netcdf_python.pdf> or <http://xarray.pydata.org/en/stable/quick-overview.html#read-write-netcdf-files> )

1. Tropopause identification

Choose one file (e.g. e.g. 2016021600-ART-chemtracer\_grid\_reg\_DOM02\_HL\_0001.nc) and open it with Python

Find the indices for which the array values of the Potential Vorticity (pv) have the value of 2 at each Latitude (lat) – Longitude (lon) grid point.

Plot the altitude (alt) ad Specific Humidity (qv) at these indices for the whole lat - lon

area.

1. Temporal evolution of the tropopause location

Redo #2 for 20160201-ART-chemtracer\_grid\_reg\_DOM02\_HL\_\*\*\*\*.nc until 20160229-ART-chemtracer\_grid\_reg\_DOM02\_HL\_\*\*\*\*.nc. Please keep in mind that each day is stored in a separate directory.

1. Feature extraction

a) Calculate the mean value of qv marked by the indices from above.

b) Identify those indices where qv of the whole dataset exceeds a threshold of +-25 % of the mean value from a).

c) Plot the results for the date of 20160216.

d) Plot the temporal evolution of b) for the whole time period.

1. Feature tracing

Try to find a way to visualise the temporal evolution of high value areas of qv from 20160216 until 20160229 for all indices of the variable alt.

Attention: here, you should no longer use the index list from #1.-#3.

The goal is to find a way to trace the feature of extreme qv values.