Wind uncertainties

Initial assessment

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# Introduction

# Data

# Method

# Results

# 4.1 Covariance Matrices

It might be of interest to visualize the covariance matrices, most of all for the sake of checking the validity of the procedure. Here we provide some example for the Lindenberg station, for arbitrary observation days.

The values are obtained by computing the product of the analysis departure times the background departure for the standard pressure levels as indicated by the axis labels. Note that usually only the diagonal entries are considered, i.e. one should expects no large correlation between the measurements at different pressure levels. For these matrices, the value shown is calculated by taking the average over a period of 30 days following the chose date. Null values, for which no data is available, are neglected.

# Code Usage and Reproducibility

The code used to produce the results here presented is available from GitHub at

https://github.com/MBlaschek/CEUAS/tree/develop/CEUAS/wind\_uncertainty .

In the following description we will refer to scripts that are currently being developed for the complete analysis of the XXXX datasets and will be made available in the future according to the xxx deliverable. However, the analysis presented here is self-consistent and does not depend on any of such external script, unless the user wishes to extend the capability of the scripts presented here to handle a different input dataset or add further functionalities.

The main input files needed are located inside the “data” directory, which contains netCDFs files for the sample observation station Lindenberg (station id 10393) for the u and v wind components, called respectively “ERA5\_1\_10393\_u.nc” and “ERA5\_1\_10393\_u.nc” . These files were previously obtained from the odb files provided by XXX and using the script “readodbxxx” (in the public/harvest directory), which converts the data stored in odb format into netCDF files. To allow for easy reproducibility, the user will find the netCDF files ready in the GitHub repository, while in general, for other observation stations, the user will have to run separately the odb converter and extract himself/herself the necessary netCDF files.

The treatment of the variables connected to the wind measurements follows two separate procedures. For the u and v wind components, the procedure is straightforward and the code implementation basically follows what presented already in the initial assessment of the uncertainties of the temperature and humidity. In fact, in the ERA5\_1 database files the information of the first guess (fg) and analysis (an) departures are already available, and the Desroziers method can be applied straightforwardly.

However, the primary observables of the wind are the values of the direction and of the speed, it is of interesting to come back to these primary observables. This can be done using the u and v components and their analysis and first guess departures values, from which one can extract the values of the observed speed and direction as well as first guess and analysis departures. These values will be used to estimate the observation errors with the Desrozier method, in the same fashion as for the other variables (u,v wind component, temperature).

The main step of the uncertainty assessment requires the evaluation of these data from the netCDF files for the u and v components, by running the script

*extract\_speed\_direction\_netCDF.py*

the files “ERA5\_1\_10393\_speed.nc” and “ERA5\_1\_10393\_direction.nc” are produced in the “data” directory, containg the observed values of the wind speed and direction and the departures as explained above. Note that, to avoid redundancy, since the data is extracted from the netCDF files and not from the original odb files, in addition only the datum information is stored in these files, since the rest can be easily retrieved in the u and v components netCDF files.

Then, the script

extract\_covariance.py [-f True]

is called. This produces a dictionary containing the covariance matrices for the wind u and v components, and speed and directions. The data is stored in a python dictionary, saved in a numpy filed called “covariance\_matrices.npy”.

The script first looks for the numpy file, defined in the variable cov\_file and specified by the user; if the script finds the file, it will terminates. Otherwise, if the file is not found, the script will proceede to the creation of the file. The creation of the file can be forced by passing the optional argument [-f True] when calling the script. Note that the numpy file contains all the covariance matrices for all the possible combination of pressure levels, making it quite sizable (around few hundreds of MB for the Lindenberg station), possibly requiring a few minutes for the creation of the file. If created, the new file will be stored in the current working directory.

Once the numpy file is available, calling the script

analyse\_covariance.py

will perform the analysis and produce the results, including the ones presented in this document, inside the “results” directory.

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# Introduction