**Radar data (MIRA)**

Data are in NetCDF. Folder is radar

I provide you with two version of the raw data since sometimes the NetCDF files provided by the manufacturer (folder radar/metek, files are named “.mmclx”) can create some trouble in the reading. In the folder radar/cloudnet you will find a second chance (named “……mira.nc”).

In the files you will find both lv1 (spectra momenta) and lv2 products (retrievals and target classification).

In the following the parameters you should consider an their meaning:

1. Z: the equivalent radar reflectivity factor or radar reflectivity factor only, that is the radar equivalent of the lidar backscattering, thus somehow proportional to the number density of the atmospheric particles, given their backscattering cross-section. This is reported as Ze in the “.mmclx” files and as Zh in the cloudnet files

2. LDR or ldr: linear depolarization, indicating the particle non sphericity: higher it is in the upper troposphere, more likely it is the presence of ice crystals.

3. VEL or v: The Doppler velocity if you wanna have a look at the vertical moving of the hydrometeors (vertical wind). Very useful to classify/quantify the size of the crystals.

If you want to consider only the masked clouds you can consider also the variable in the .mmclx files with the final two letter “cl”, like LDRcl. Please do not consider any other variable with a similar name like Zg instead of Ze, or LDRg instead of LDR. Those I suggested are already filtered for radar noise and the filtering does not affect ice clouds.

To identify ice clouds you have two options:

a. identify as ice clouds, those showing a non negative value of SNRcl and a value of LDRcl > -25 dB. Of course the altitude/temperature can further constrain your classification. For example the melting layer can be easily identified from radar data if you find it useful.

b. Have a look at the Cloudnet files named “classification”. Below everything is well explained.

In summary the main variables to consider are:

Ze or Zh for the layering of ice clouds.

SNRcl and LDRcl to classify the ice clouds.

VEL or v if vertical wind is also appealing for your analysis.

For the Cloudnet files the classification is already done and available.

**Cloudnet data**

In the folder /Cloudnet there are the “classification” files (per each file, there is also a corresponding quicklooks in the typical Cloudnet format). These files contains the "Instrument Synergy/Target Categorization" product describing the type of target (liquid cloud, ice, drizzle, insects, aerosol etc.) at each level.

Moreover, I included the files reporting the vertical profile of ice water content, along with its uncertainty, as calculated by Cloudnet (folder /cloudnet/Ice\_water\_content). The retrieval is based on the use of Ze and the temperature profile as retrieved by a mesoscale model and on the use of a relationship extracted by comparing with airborne in-situ measurements. The files are NetCDF and the variable to consider is the “iwc”, that also has a variable for the bias and the corresponding random uncertainty. Also for these files quicklooks are included and all the variables are described in the related attributes in each file.

Finally each variable is also complemented by a flag indicating the quality of the retrieval. Please exclude for now the profile addressed as not good.

**Lidar data**

Though it is true that we agreed to have a look at this later on, I included a folder named lidar RCS, with the quicklooks of all the measurements available in the 15 days. One big map, and all the single maps with the usual target discrimination.

**Ceilometer data**

I have no enough time to plot lidar and ceilometer data together to provide you with a continuous map (as I told you in Castellaneta), but I also include all the ceilometer data. If you wanna have a look at the full time series of the lidar attenuated backscattering, roughly proportional to the density of the optical scatterers (aerosol, droplets, ice crystals, …) from 01 to 15 May you can try to plot all the data together.

The file are NetCDFs and the variable to consider is “beta\_raw”.

Obviously, everything I suggested above can be referred to the existing literature.