M.Sc. Course Notes

Validation of Data Compression

One way of validation the various data compression techniques is to pass both the full data and the compressed data through a mathematical model which describes some physical process such as a radar propagation or radiative transfer model. However, for the purpose of this project these models are computationally to expensive so here we are going to use a simple mathematical equation that allows us to model the modified refractivity of the atmosphere. The equation for the refractivity m is given by:

$$m = m_{dry} + m_{moist} + 10^6 \frac{h}{R}$$

where h is the height in meters at which you want to compute the refractive index, and $R = 6371000m$ is the radius of the Earth.

The refractivity of dry air m_{dry} and of moist air m_{moist} are given by:

$$m_{dry} = 77.6 \frac{p}{T}$$

and

$$m_{moist} = 373256 * e/T^2$$

where

$$e = \frac{qp}{(r_\varepsilon + (1 - r_\varepsilon)q)}$$

Here T denotes the atmospheric temperature in Kelvin (K), q is the specific humidity in kg/kg and p is the pressure in hecto Pascal (hPa). r_ε is a dimensionless constant whose value is given by $r_\varepsilon = 0.62198$.

This model should be fairly straightforward to implement in Python (but if you need any help let me know). By comparing the refractivity for the full data m_{full} to refractivity $m_{compressed}$ of the compressed data you should get a good idea how well the compression algorithm is doing.

NOTE: If you want to make sure that your computation of the modified refractivity m are correct feel free to send me the output from the model. Vertical profiles (modified refractivity vs. height) of the refractivity would be easiest to check!