WRF Postprocessing

Dealing with the simulation data

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Lecture topics

1. Extracting output variables
2. Visualizing simulation data using MATLAB

1. Extracting simulation output I

As output-files from a WRF-simulation usually is quite big, it is necessary to extract only the variables of interest from a WRF-run. A typical outfile from a domain with grid spacing of 2000 m $\times$ 2000 m produces a outfile of the magnitude 50 GB. A description of the variables, variable name, its units, etc. can be found by typing the command `ncdump -h <filename>`. When developing a MATLAB script it can be useful to download a small outfile from WRF to test on a local machine.
In MATLAB, a NetCDF-file can be inspected using the command `ncdisp`. The command for extracting a NetCDF variable is `ncread`, e.g. the line

```
u  = ncread(<NetCDF-file>, 'U');
```

1. Extracting simulation output II

reads the variable U (x-wind component).
A small excursion along the surface of sphere can be expressed

$$(\delta \boldsymbol{x}, \delta \boldsymbol{y}, \boldsymbol{z}) = (r\delta\lambda \cos\vartheta_o, r\delta\vartheta, z),$$

where r is the radius of the sphere, λ is the longitude, and ϑ is the latitude. The subscript o denotes the an arbitrary observational point. The excursion was done at constant altitude.
The distance from a point "O" to all WRF grid points can be expressed using the Pythagorean trigonometry

$$d(i,j) = \left(r^2 \cos^2 \left(\frac{\vartheta_o + \vartheta(i,j)}{2} \right) \left(\lambda_o - \lambda(i,j)\right)^2 + r^2 \left(\vartheta_o - \vartheta(i,j)\right)^2 \right)^{1/2}. \tag{1}$$

Here r is the radius of the Earth, the point "O" is at (λ_o, ϑ_o) and $(\lambda(i,j), \vartheta(i,j))$ denotes the WRF grid points.
A pseudo-code for extracting an example-variable at the grid point closest to the point "O" calculated using Eq 1 is given as a pseudo-code below.

1. Extracting simulation output III

```
% Read variable from WRF output file
variable = ncread('path to WRF output file', 'variable name');

% Longitude and latitude of the site
lon = 20.6804;
lat = 69.1867;

% Find the distance to all grid points
for longitudes && latitudes in variable
d(i, j) = ...                                          (Eq.1})
end

% Find the minimum distance to the Rieppi site
[min_lon, min_lat] = find(minimum d(i,j));

save('Save variable to file')
```

2. Visualizing simulation data using MATLAB

A very useful tool for map projetions in MATLAB is the mapping functions `m_map`. This package can be downloaded from `https://www.eoas.ubc.ca/~rich/map.html`.