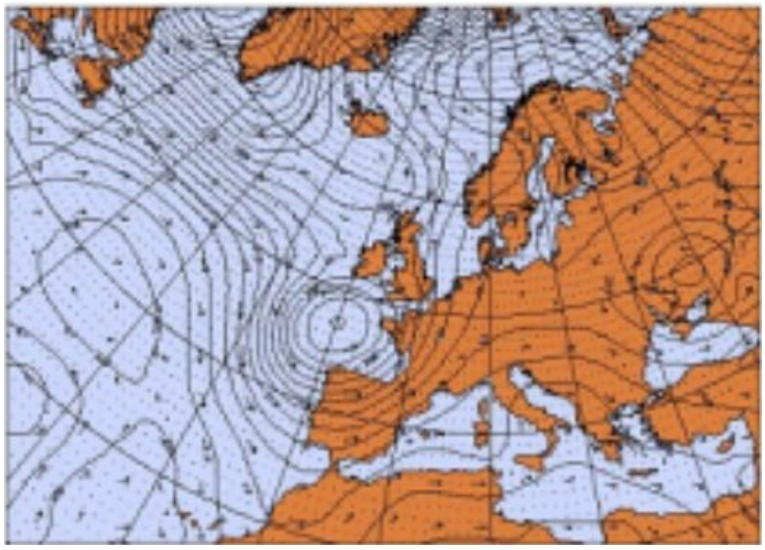
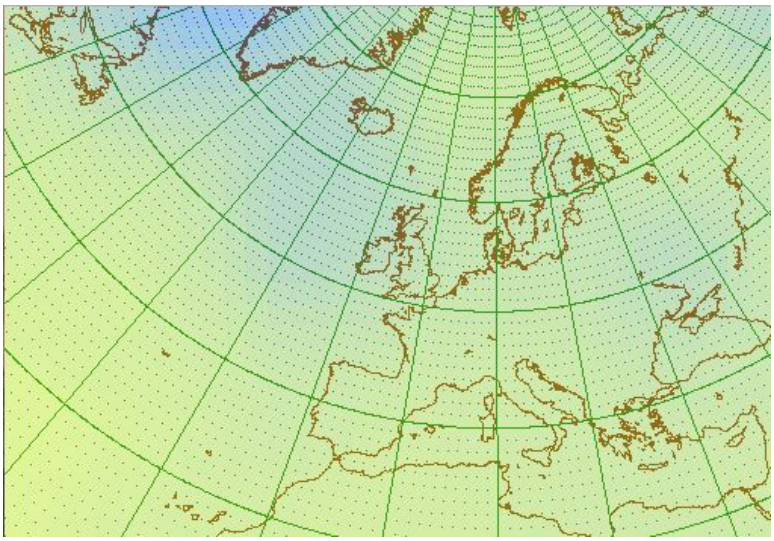
March 2017
Visualization and Interaction Systems

Context

The idea is to represent geopotential data from a concrete instant of time and draw it over the cartography to visualise the necessary property values by using OpenGL.



In order to perform this kind of visualisation with the provided geopotential data a technique is proposed : **transfer function**



Data Set

First, a set of files with the **cartography** like the previous figure are provided (europe. folder) :

- **euro_contour** – list of points limiting the contour of Europe and closest zones
- **euro_meridians** – list of points defining the meridians over the previous zone
- **euro_parallels** – list of points defining the parallels in the same zone
- **euro_points** – list of point which complements the parallels in the same zone

Indeed, this files contains the points which define all the necessary elements. The first value from file is the number of points, N, followed by the N pairs of values corresponding to the coordinates (x,y) of each point.

Example :

```
4
0.01 0.09
0.05 0.07
0.08 0.04
0.12 0.01
```

Secondly, a set of data for the geopotential height for this zone in different time instants is provided (geopotential folder). The geopotential height is the way to measure the surface pressure. Quoting Wikipedia :

> **Geopotential height** is a vertical coordinate referenced to Earth's mean sea level — an adjustment to geometric height (elevation above mean sea level) using the variation of gravity with latitude and elevation. Thus it can be considered a "gravity-adjusted height". One usually speaks of the geopotential height of a certain **pressure level**, which would correspond to the geopotential height necessary to reach the given pressure.

For this data, another set of files is provided, using the pattern name geoXX.grd, where XX is the time instant. These files are in ASCII code and contains a header with the following structure:

```
DSAA 35 25 // number of columns and rows
0.00 26.20 // values for the geometric points valors in the X axis
0.00 18.60 // values for points in the Y axis
272.06 325.15// range for the following property values
```

Finally, in the second part, each file has a list with the corresponding property values of the same time instant.

Interaction

A minimal interaction with the OpenGL application is required, for example, by pressing a specific key :

- Allow to change the different parameters, depending on the visualisation mode
    - Ex. change the different ranges of colours
- Allow users to modify the mode between transfer function or the isocontours on the fly

Skeleton

A skeleton project with all the dataset included is provided. Like in the laboratory classes, you can use this project to implement the algorithms in the corresponding classes.

Delivery

Collect all the explanations and conclusions from previous sections and elaborate a **report** to deliver them, including graphical results and outstanding snapshots from each visualisation.

Your deliver have to include the OpenGL code with the instructions to run it, and the report document (PDF).

Evaluation

- Transfer function implementation
- Legend information
- Interaction (real time params modifications)
- Report (decisions, results, conclusions)