# Thesis Atmospheric Physics

## Deriving fog and visibility diagnostics from operational high-resolution numerical weather prediction model simulations

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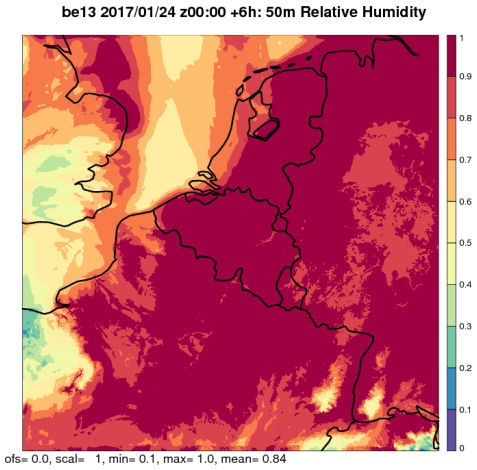
Forecasting fog occurrences and horizontal visibility remain important challenges for numerical weather prediction (NWP) models. Such models forecast the mean values of a set of meteorological variables over grid boxes a few km wide and at least a few decametres deep; fog can vary a lot within a few meters above the surface and over quite short distances, depending on surface properties (e.g. vegetation, composition, soil moisture and temperature) and other local effects. Various phenomena can intervene in the onset as well as the dissipation of fog: state and evolution of the air properties, low level stability and wind, 3-dimensional radiation effects, deposition of water on vegetation, the concentration of pollutants (that can also impact visibility directly), ...




As only part of this information is available from the model and with a limited resolution, a conceptual model combining physical and statistical considerations must be used, which is called a parameterisation.

Fog in itself does not interact directly with the model state evolution, hence fog and visibility diagnostics can be derived from the model prognostic fields, after the forecast is complete. This eases testing different options and tuning a scheme by comparison with observations in different situations from the past.

The work will include

- implementing an existing visibility formulation (initially coded in fortran) as a 'R' script, to automatically derive and show visibility fields from the ALARO model output data, at 4km and 1.3km horizontal resolution and compare them with synoptic observations taken in an Oracle database.
- Assess the tuning possibilities, possibly proposing an evolutive tuning dependent on the degree of pollution from the past days.
- Compare the skill in a few different situations (types of fog, atmospheric situation).
- Search ways of improvements, discussing/testing propositions found in the literature as well as new ideas.
- Option: compare the skill obtained using 2 different driving model setups (choices in the model physics).

Mobility: a substantial part of the work will be done at the RMIB in Ukkel.