

Science Meeting 1 Summary

Held on 15th March 2022

Introduction

The focus of this first meeting was to discuss the question **How do we handle satellite observations scientifically as model scales reduce (both in the global and limited area models (LAMS))?**

Discussions were held in 3 separate chat rooms (using Microsoft Teams). Thanks to the chat room moderators : Cristina Lupu, Stefano Migliorini & Niels Bormann.

In order to facilitate discussion, a short questionnaire was carried out before the meeting. Generally, the following was found from the questionnaire:

- Some global centres intend to increase NWP spatial resolution to 3-4 km. Some centres have an aspiration to run at 1 km globally.
- Other global centres are focusing on improvements to the ensemble and/or coupling (to ocean, land, ice) aspects of their NWP scheme.
- City-wide very high resolution models (with resolution upto 100 m in the horizontal) are also under development at some centres.
- Finally, there are also refactoring activities for the DA systems. Several centres are moving towards software with a greater emphasis on object orientated methodology (e.g. JEDI, OOPS).

As the model resolution improves the data assimilation method and any associated outer loop cycling will need to increase. However, the 4D-Var method is not easily scalable. Also, information content of current observations are not likely to constrain the fine scales of the model at these increased resolutions.

Thinning

This is likely to be reduced as the resolution increases. General wish to use as many observations as possible. But it is not clear how to determine optimal settings. Dynamic thinning as opposed to accounting for spatial correlations? Could we use the ensemble as thinning radius predictor?

Representation Errors

These will still be problematic, even at higher spatial resolution, where there may be an increase as proportion of the error budget. The determination of these errors and how we deal with optimal thinning might be something we could tackle together as a community

Vertical Resolution

As the horizontal resolution increases it is important to consider the vertical resolution too. Possible that microwave sounding will become less important, compared to infrared, for forecasting some parameters (due to lack of vertical resolution in MW sounding channels)

Cloud and moisture

As NWP horizontal resolution increases, cloud and precipitation become more important. Likely to become a more critical part of the analysis so better treatment of cloud & moisture in DA required. But we know this is challenging, e.g. accounting for fine scale variability. General feeling that we require more information on cloud state (e.g. sub pixel variability), possibly obtained via using visible observations.

Infrared measurements

For hyperspectral sounding CO₂ variability could be an issue that needs to be addressed as resolution improves. Possibly more important for LAMs, e.g. JMA have found some evidence here. Some centres have plans to make more use of geostationary IR data, at higher temporal frequency. Scene dependent errors in cloud for IR will be important and is still an area of active research.