



REPUBLIC OF ESTONIA
ENVIRONMENT AGENCY



FINNISH METEOROLOGICAL INSTITUTE

ACCORD scientific visit report

Duration: 08.11.2021 – 03.12.2021 (26 days)
Location: Finnish Meteorological Institute, Helsinki, Finland
Visitor: Ahto Mets, ESTEA (Estonian Environment Agency)
Host: Carl Fortelius, FMI (Finnish Meteorological Institute)

Overview

One of the main purposes of the visit was to get acquainted with diagnostic monitoring and verification practices at FMI such as verification by monitor, harp, mast comparison, DFS-diagnostics, and the visualizations of analysis increments, selected surface fields (sea ice concentration, snow depth, snow density, soil parameters etc.), and forecasts. Also to gain fundamental knowledge, enhance skills and understanding about several aspects in common physical post-processing of model outputs, specifically in GRIB2 format. An additional goal was to get a deeper insight in the use of ecFlow. During the visit various MetCoOp (Meteorological Cooperation on Operational numerical weather prediction) provided tools and MetCoOp-Harmonie ensemble prediction system (MEPS) outputs (see Figure 1) were used for the work.

The work then mainly focused on updating currently existing FMI diagnostic visualisations with capability of reading GRIB2 output files using eccodes in python3. There is little experience in ESTEA in most aspects (specialised product generation, visualisation, data handling, etc.) of different types (statistical, physical) of post-processing of model outputs. Therefore this visit was necessary to further build upon the knowledge and skills through which ESTEA could contribute more in ACCORD common post-processing tasks in the future.

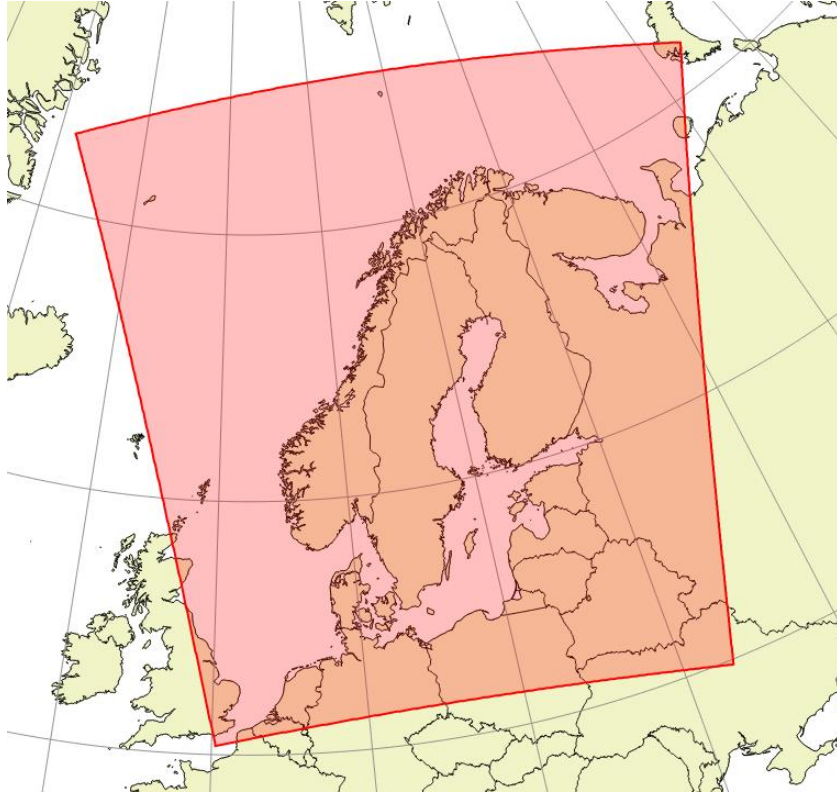


Figure 1. MEPS domain with 2.5 km horizontal resolution , 960×1080 points and 65 layers in the vertical with the lowest level at 12 meters (<https://metcoop.smhi.se/dokuwiki/nwp/metcoop/meps/start>).

Objectives

1. Get acquainted with diagnostic monitoring and verification practices at FMI.
2. Learn to use monitor, Obsmon, harp, ecFlow, FMI diagnostic visualization tools.
3. Further develop and apply FMI diagnostic monitoring tools operationally in MetCoOp (see Figure 2).
4. Familiarize with MetCoOp servers, tools and MEPS output files.
5. Familiarize with common tools like ecFlow, Monitor, Obsmon, harp and their proper installation & setup.

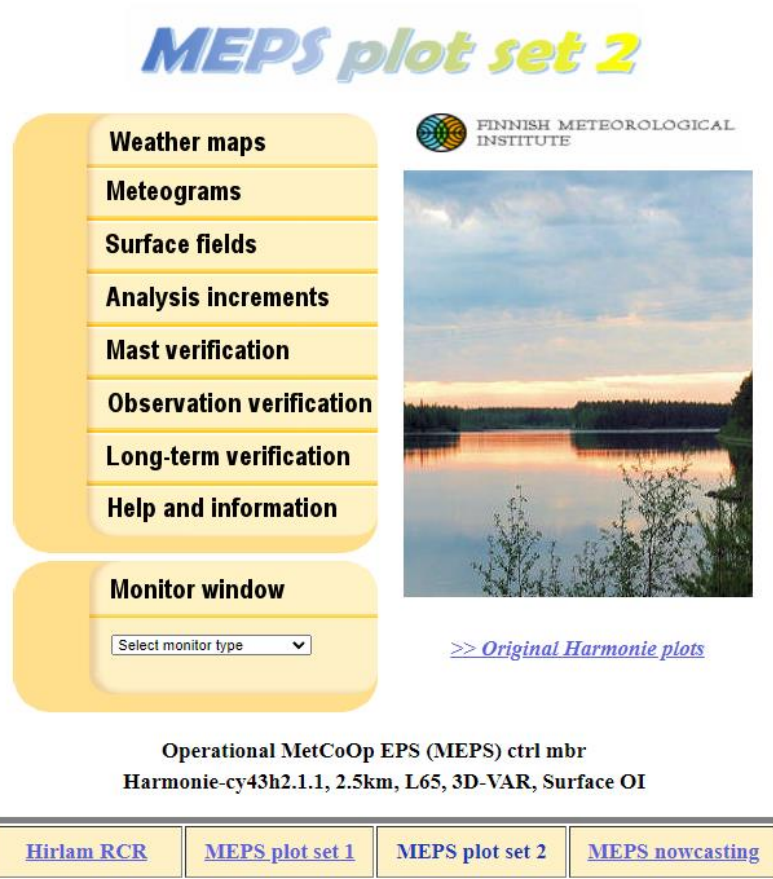


Figure 2. One of several locations in MetCoOp web domain where operational visualisations can be seen.

Specific tasks

- 1) Prepare MetCoOp development server, its working environment and tools (with SMHI).
- 2) Prepare necessary software (python3 + modules, eccodes etc).
- 3) Prepare model outputs (GRIB & GRIB2 from MEPS).
- 4) Modify diagnostic visualization scripts (weather maps, metgrams, analysis increments, epsgrams) to accommodate reading GRIB2 output files.
- 5) Integrate scripts into forecast production under ecFlow and test (and fix errors/problems if any arise).
- 6) Move scripts into common code repository (git) once it is successfully tested.
- 7) Upload code to production.

Outcomes

By the end of the visit tasks 1-4 were completed (with the exception of epsgrams) and 5-7 are currently ongoing. Scripts were modified (weather maps, meteograms, surface fields) to accommodate reading GRIB2 output files while maintaining previous visualisation style (see Figure 3) and familiarity of original code structure. Plotters for weather maps, meteograms and surface fields (also analysis increments and DFS plotters done by Carl Fortelius and David

Schönach in FMI) are ready to be implemented as part of a subroutine in ecFlow which currently needs to be set up in MetCoOp working environment before moving forward with the work. Work with epsgram visualisations is still ongoing.

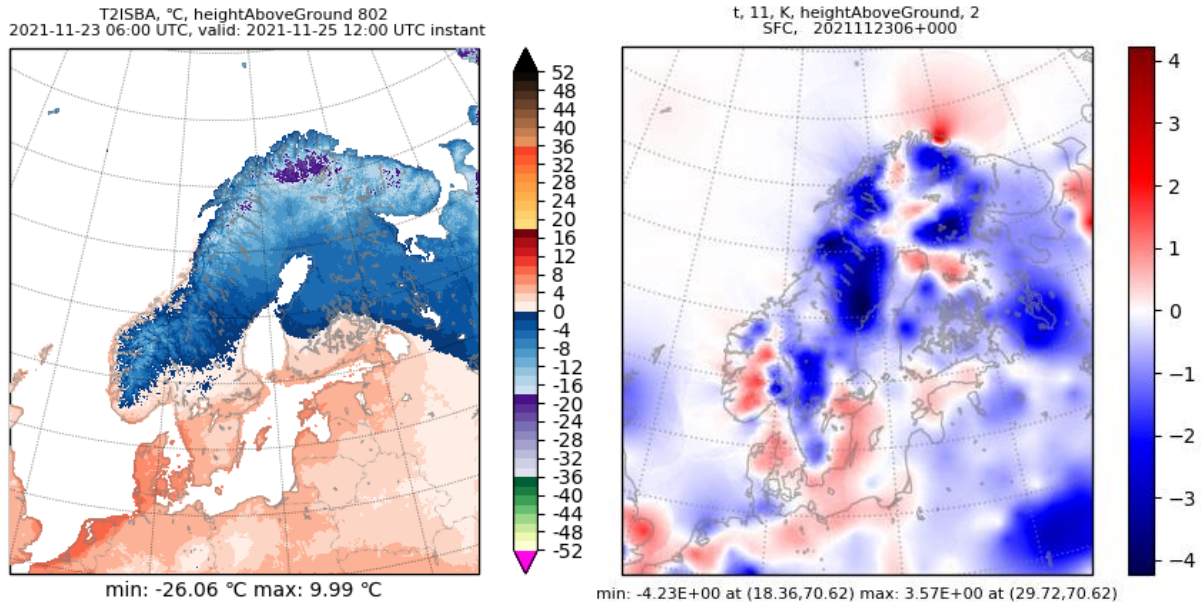


Figure 3. Examples of diagnostic visualisations using modified python scripts with faster GRIB2 reading algorithm from Carl Fortelius. The chart on the left shows 2 metre temperature with ISBA (Interaction Soil Biosphere Atmosphere) land surface scheme over natural tiles. The chart on the right shows temperature anomalies at 2m height from the surface.

More insight was gained in the use of Monitor and its installation on both MetCoOp and ESTEA working environments. Monitor was successfully installed and now runs on an ESTEA development server (see Figure 4) with a small subset of data (vobs and vfld files downloaded from MetCoOp).

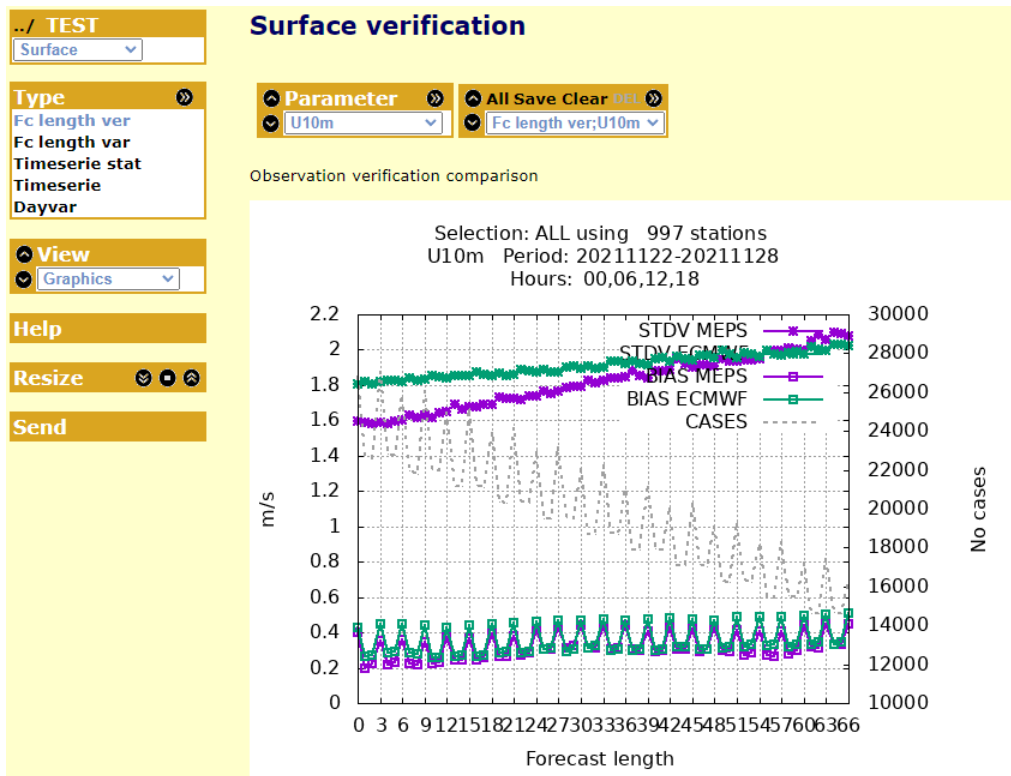


Figure 4. Image of Monitor output from ESTEA development server.

Conclusions

During the visit a deeper insight was given on how to construct and utilize different modules of the python visualisation code to achieve results more efficiently. Carl Fortelius's GRIB2 reading algorithm was successfully introduced in modified scripts that generate diagnostic visualisations from MEPS output. Much was learned about the working environments in MetCoOp servers, how to set up and configure them to suit the needs of the work (with help from Carl Fortelius and Lars Berggren). More insight was gained in the practical application and set up of Monitor, ecFlow and harp for both ESTEA and MetCoOp use. Monitor was set up for use in ESTEA working environments. Further development and experimentation with these tools will however most likely continue on a MetCoOp development server where such tools are more convenient to use for any purposes. Work on remaining future steps will continue.

Future steps

- Continue work on updating remaining diagnostic visualisations (epsgrams).
- Continue proper setup of MetCoOp environment and necessary tools for routine implementation.
- Store finalized version of scripts in code repositories (git).
- Begin routine implementation testing (and improve where necessary).
- Upload to production environment.

Acknowledgments

I acknowledge the ACCORD consortium for giving the opportunity to make the visit to Finnish Meteorological Institute. I'd like to thank the host Carl Fortelius for organizing the working conditions, supervising the work, providing an improved method of reading GRIB2 files using eccodes within python and also helping with advice whenever and wherever possible. Also I thank Lars Berggren (MetCoOp Operation Manager, SMHI) in helping out with the system setups for the working environment.