MetCoOp - Swedish/Norwegian Operational NWP Cooperation

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Ole Vignes and Solfrid Agersten, *met.no*

Vision

The primary goal of the collaboration is to provide its participants with a state-of-the-art operational short- and very short-range NWP system. Through a joint NWP production MetCoOp shall be a driving force in high resolution short- and very short-range forecasting.

The joint NWP production shall also facilitate closer collaboration between SMHI and *met.no* in other areas of common interest, such as pre- and post processing software, forecast production tools and operational infrastructure in general.

Background

With the steadily improving quality of global models it is quite hard for small services to add forecast value with their own local LAM models. To do so, considerable investments in man-power, NWP knowledge and High Performance Computing (HPC) resources are necessary. Norway and Sweden run more or less on the same domains already, and have co-operated in different areas (e.g., HIRLAM) for many years. MetCoOp is an extension of this cooperation into the area of daily operational NWP production.

A working group was established in December 2009 and made a “feasiblity study” for the cooperation. It concluded in May 2010.

Organisation

In August 2011 a project group, with Solfrid Agersten as manager, was established. The group consists of 5-6 people from each of the participating institutes, and the group members ideally spend around 50% of their working time in the project (some a bit less). The project employs the «Tieto Enator Practical Project Steering (PPS)» as steering model, and SCRUM as production model. The project plan consists of a set of requirements and milestones, and the work is organized in «sprints», each of approximately one month duration. Sprint review and planning is held once a month, alternating at SMHI or *met.no,* and lasts a full day. Short video meetings are held regularly (twice a week) to update each other about the status of the ongoing sprint tasks.

The MetCoOp project group is scheduled to finish its work by end of March, 2014, at the time the common operational production begins.

HPC systems

A new HPC system in Norway (SGI Altix ICE 8600LX, ~140 Tflop/s (*met.no* part), scheduled delivery May 2012) will be used in the development and pre-operational phase. In early 2014 the first production suite will be installed on a new (planned) HPC resource for SMHI in Sweden. The intention is that a new HPC system should be acquired approximately every second year, alternatingly located in Sweden and Norway. The previous HPC system will then act as a backup system, giving each system a life cycle of around 4 years.

Model choice

The choice of NWP model was at the beginning an open question, but it quickly became clear that with the current model expertise and the investment already made by both institutes in the HIRLAM consortium, the only rational choice was to go for HARMONIE. So far a first version of a common domain (AROME at 2.5 km resolution) has been agreed upon, as depicted in Figure 1.

Observation collection

It has been decided that SMHI and *met.no* keep their existing observation collection systems, including their (different) message switches. Instead, conventional observations collected from both institutes are sent to a common server, where a system for merging, mainly removing of duplicates, has been developed. A similar system is implemented for remote sensing data, both centers send their received data to the common server, where the final processing takes place.

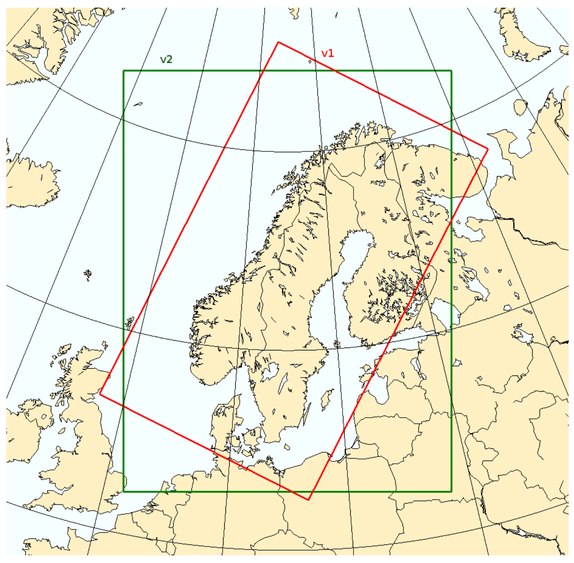

Figure 1. Preliminary model domains for MetCoOp. Both with AROME at 2.5 km horisontal resolution and 65 levels in the vertical.
v1: 540x900 points, all tests so far have been made with this domain.
v2: 750x960 points, hopefully better suited to a more extensive use of remotely sensed data, i.e., ATOVS, IASI, radar etc.
More tests will follow when the new HPC system for *met.no* is in place in June.

Job scheduler

At *met.no* the SMS system developed at ECMWF has been used in operations for many years, while at SMHI the commercial system Control-M has been used for the same purpose. For MetCoOp, three other job scheduler systems have been evaluated:

- JobScheduler (an open source, general system).
- cylc, job scheduler system designed for meteorological purposes, and used in New Zealand and at MetOffice.
- ecFlow, the new ECMWF developed job scheduler system that will replace the current SMS system.

MetCoOp has decided to go for ecFlow.

Verification and monitoring

The project finds it very important to have good systems for verification, monitoring and diagnostics, not only in the operational phase, but also for (the ongoing) model development and tuning. So far only a few systems have been looked into, but MetCoOp has now chosen to use the HARMONIE standard verification and monitoring systems, and the visualization system that comes with them, WebgraF.

Large scale mixing

In recent years it has been realized that LAM models can gain a lot by mixing in coarse scales from the (global) host model, in our case ECMWF’s IFS, which is known to have analyses of exceptional quality. For HARMONIE two different approaches exist for the mixing:

- LSMIXBC, which by a pragmatic approach spectrally mix long waves from the first boundary file (typically a +6h forecast) with the models own first guess (mainly short waves) before screening and (3D-Var) assimilation.
- Jk, which adds a new quadratic term penalizing deviations from the host model state to the 3D-Var cost function, with its own error covariance matrix.

In MetCoOp, it is an ongoing task to evaluate these two approaches, see also Per Dahlgren’s presentation.

Test periods and verification

A set of test periods have been established, and the model has so far been tested on a few periods, both with cycle 36 and cycle 37 of HARMONIE, with or without 3D-Var assimilation. When the new HPC system finally is in place, the plan is to test much more extensively, in particular assimilation of remote sensing data, notably ATOVS, IASI and radar. Preliminary verification results look quite promising for AROME, wind and precipitation look clearly better than for HIRLAM.

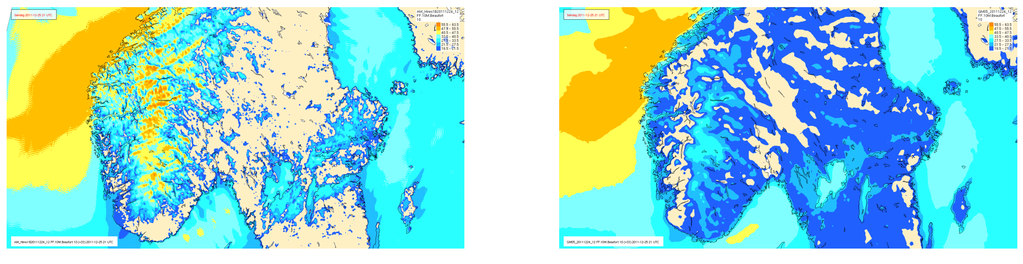

Figure 2. A case from southern Norway (25.12.2011) with observed wind speeds > 50 knots in the mountains. Left: AROME 2.5km. Right: HIRLAM 8 km.