SPECIAL PROJECT PROGRESS REPORT

All the following mandatory information needs to be provided. The length should *reflect the complexity and duration* of the project.

Reporting year	2019
Project Title:	Improving the convection-permitting ensemble configuration over Italy
Computer Project Account:	spitconv
Principal Investigator(s):	Virginia Poli
Affiliation:	Arpae Emilia-Romagna, Bologna, Italy
Name of ECMWF scientist(s) collaborating to the project (if applicable)	Thomas Gastaldo
Start date of the project:	01/01/2019
Expected end date:	31/12/2021

Computer resources allocated/used for the current year and the previous one

(if applicable)

Please answer for all project resources

		Previous year		Current year	
		Allocated	Used	Allocated	Used
High Performance Computing Facility	(units)			9,200,000	-
Data storage capacity	(Gbytes)			500	-

Summary of project objectives (10 lines max)

This project aims:

- to improve the convection-permitting ensemble's perturbation strategy;
- to use the analyses obtained from the assimilation of radar volumes in KENDA to test them as Initial Conditions;
- to test the ensemble at 1km horizontal resolution to get benefit in the forecast of high impact weather.

Summary of problems encountered (10 lines max)

The new investigator and scientist took over from Chiara Marsigli, promoter of the special project, and had to become familiar with and understand how to work on ECMWF framework.

Summary of plans for the continuation of the project (10 lines max)

The research that is going on in Arpae, on the theme of assimilation, has shown an improvement in results in the transition from the assimilation of instantaneous precipitation at the surface by means of LHN to the assimilation of radar volumes. Before moving on to the production of analyses for the initialization of the ensemble, it was decided to perform an OSSE to understand the physical processes underlying this improvement.

In general, therefore, it is necessary, as a first step, to upgrade the existing iteps_suite_sms, implemented on ECMWF machines, adding a task to assimilate the radar reflectivity data in the KENDA cycle and reducing the duration of the cycles from three to one hour.

List of publications/reports from the project with complete references

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Summary of results

If submitted **during the first project year**, please summarise the results achieved during the period from the project start to June of the current year. A few paragraphs might be sufficient. If submitted **during the second project year**, this summary should be more detailed and cover the period from the project start. The length, at most 8 pages, should reflect the complexity of the project. Alternatively, it could be replaced by a short summary plus an existing scientific report on the project attached to this document. If submitted **during the third project year**, please summarise the results achieved during the period from July of the previous year to June of the current year. A few paragraphs might be sufficient.

The new version of the COSMO model with the radar forward operator, EMVORADO (Blahak and De Lozar, 2019), needed for the assimilation has been compiled on cca machine.

At the moment there are no results to show, but the OSSE has been outlined and it is presented below.

Nature run:

- 48 hours run
- High resolution (horizontal grid spacing of 1 km)
- Boundary conditions from ECMWF, hourly frequency, using the freshest available (that is using ECMWF forecast initialized at 00 UTC for simulation from 00 to 11 UTC, ECMWF forecast initialized at 12 UTC for simulation from 12 to 23 UTC and so on)

Experiments:

- 48 hours run
- Operational resolution (horizontal grid spacing of 2.2 km)
- Boundary conditions from COMET (for the ensemble) and COSMO-5M (for the deterministic run) from the same run (that is, not "updated" each 12 hours).
- First 24 hours without assimilation, then hourly cycles.
- Two experiments:
    - CNTR: assimilation of conventional observations through KENDA and LHN during forward integration;
    - EXP: assimilation of conventional observations and reflectivity volumes through KENDA.

Synthetic observations:

- Reflectivity volumes created using Mie scattering with attenuation and assimilated using Rayleigh scattering. This allows to model the representation error (observation error can be divided into instrumental and representation error). However, this is not enough to completely describe the representation error. Moreover, it is necessary to model also the instrumental error. Therefore, some noise have to be added (taken, for example, from a Gaussian distribution with mean 0 dBZ and std. dev. equal to 5-10 dBZ; 10 dBZ is the actual observation error employed in the experimental set-up and estimated using Desroziers statistics).
- rain rates for LHN calculated taking as input the same reflectivity files (fof) obtained using the operator and employed as synthetic observations for reflectivity assimilation. In this way the observation error is dealt in the same way as for reflectivity volumes (even if, maybe, a further error on the reflectivity/rainrate conversion should be added).

References

Blahak U. and de Lozar A., 2019. EMVORADO – Efficient Modular VOlume scan RADar Operator. A User’s Guide