SPECIAL PROJECT PROGRESS REPORT

Progress Reports should be 2 to 10 pages in length, depending on importance of the project. All the following mandatory information needs to be provided.

Reporting year 2011

Project Title: European regional re-analysis for monioring and obserbvations

Computer Project Account: spseeur4

Principal Investigator(s): Per Undén

Affiliation: SMHI

Name of ECMWF scientist(s) collaborating to the project (if applicable)

Start date of the project: 1 January 2011

Expected end date: 31 December 2013

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)	-	-	2,000,000	374,000
Data storage capacity	(Gbytes)			8,000	

Summary of project objectives

(10 lines max)

To carry out a 22 km resolution regional re-analysis with the HIRLAM 3D-VAR system for the ERA-Interim period 1989-2009 and 2010. Observations are conventional ones from ECWMF MARS and boundary forcing from ERA-Interim. Large scale forcing at initial time is provided in 3D-VAR through a large scale forcing cost function term.

The large scales are mainly determined by ERA-Interim while more details are added due to the higher resolution. Apart from providing a consistent data set, the main purpose is to give background values for 2D meso-scale (5 km) analyses of Essential Climate Variables near or at the surface. That will be with MESAN at SMHI and SAFRAN and CANARI at Météo-France.

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Summary of problems encountered (if any)

(20 lines max)

The Reference version of HIRLAM, 7.3 , has some bias problems in the forecast model in terms of a negative pressure drift. This has caused concern and led to more testing. First, the albedo over Africa and snow properties over Greenland and treatment of sea ice in the surface analysis were changed and corrected.

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Summary of results of the current year (from July of previous year to June of current year)

This section should comprise 1 to 8 pages and can be replaced by a short summary plus an existing scientific report on the project

The HIRLAM Reference version 7.3 was set up over a relatively large area encompassing the EEA countries (Europe and N Atlantic region) and at 0.2 by 0.2° and 60 levels. A number of options were tested like the HIRLAM large-scale mix (use of ERA-Interim in the first guess generation), 4D-VAR and also the ALADIN system. 3D-VAR and control of large scales in the cost function through a J_k for vorticity difference were found to be very satisfactory in monthly data assimilation experiments.

First, one month, January1989, was tested extensively. A few problems with the HIRLAM model system were found in comparisons with both ERA-Interim and independent satellite derived data. The albedo over Sahara was too high and lacking in structure. A more correct albedo is taken from the SMHI Regional Climate Modelling system over this area only instead. Over Greenland the snow density had to be corrected to reduce temperature biases. Finally, the ice limit is taken from ERA-Interim instead of the HIRLAM climate and some correction was needed near the coast line.

Then 3 months were assimilated, October-December 2009, were assimilated and verified and compared against ERA-Interim. The large scales and synoptics were very similar, but local effects became visible due to the resolution, land-sea mask and more realistic orography. Precipitation and 2m temperature means are more realistic in the downscaled re-analyses.

The full “production” reanalysis for the 20 years was delayed due to the problems of pressure drift and temperature and wind bias in the HIRLAM 7.3 version compared with earlier versions. The J_k cost function statistics were derived with 7.3 and a number of improvements in the data assimilation code were included in 7.3 so it became rather imperative to use this version.

A first (almost) year of assimilation was run from 1 October 2009 to June 2010 and verified and validated in a number of ways.

The forecast drift was still present but less severe in the summer (pressure). The drift in temperature is visible but not so alarming. Drifts can be seen from the 48 h tendencies and more importantly from the bias in analysis increments.

Synoptics and mean fields agree very well with the ERA-Interim (and ECMWF operations except the somewhat more intense lows in the 16 km ECMWF operations).

Observation fits to background and analysis were monitored over the whole period and found to behave very well (apart from the aforementioned biases in the background).

There were also some technical developments in order to get fluxes of precipitation and radiation at model levels (for use by SAFRAN e.g.). A review of all the necessary post-processing fields to be saved on ecfs was done. The demands can easily become high and the volumes affect the turn-around speed of the assimilation. Still, the production can run quite quickly and it has been possible to achieve up to 1 month of assimilation (and forecasts) over 24 hours.

Plans how to use the results in the 2D-analyses, MESAN and SAFRAN and CANARI have been discussed and where the data will reside. The MARS system at NSC / SMHI seems the most attractive long term archive.

List of publications/reports from the project with complete references

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Summary of plans for the continuation of the project

(10 lines max)

The output from the first year of re-analysis will be used for the 2D-analyses with MESAN. MESAN will be set up for this large European area, which may need both technical and tuning work. It will probably be done at our computer centre at NSC and then the data need to be transferred over to NSC and probably also archived in MARS there.

This will serve as a validation if the quality of the HIRLAM 7.3 is satisfactory or not. In parallel the HIRLAM re-analysis for the full period will be started, from 1989. The 2D MESAN downscaling will be carried out, but also a conversion of data for input to the CANARI and SAFRAN systems will be done.