

The COSMO-LEPS Suite at ECMWF: Present Status and Developments

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1 Introduction

COSMO-LEPS is the Limited-area Ensemble Prediction System that has been developed within the COSMO consortium. It aims to improve the short-to-medium range predictability of localised and intense weather events (e.g. heavy rainfall, intense winds, strong temperature anomalies). Its present set-up comprises 10 Lokal-Modell integrations, nested on selected members of ECMWF EPS global ensemble. The main features of the COSMO-LEPS system are summarised in Fig. 1 and are described in greater details in Montani et al. (2003a and 2003b) and in Marsigli et al. (2005).

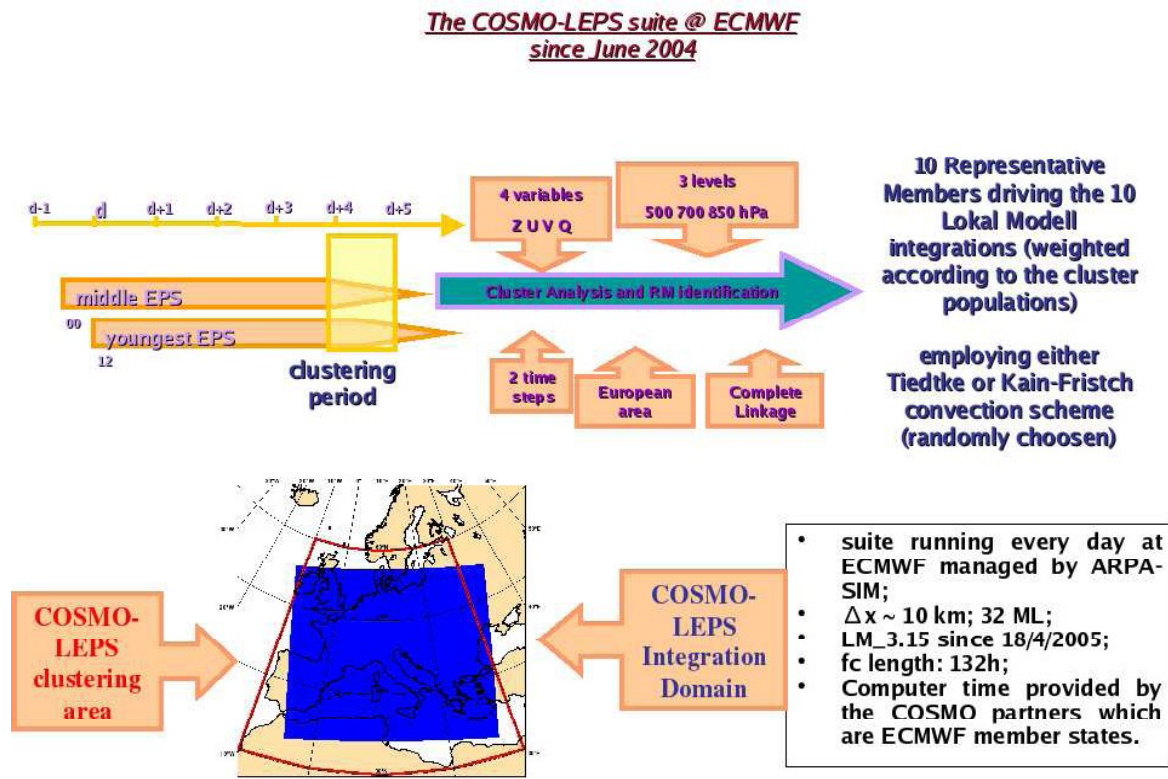


Figure 1: Main features of COSMO-LEPS application running at ECMWF.

More specifically, the products generated by the operational set-up can be summarised as follows:

- core products: ten perturbed LM runs (taking initial and 3-hourly boundary conditions from 10 selected EPS members) to generate probabilistic output (start at 12UTC; forecast length: 132 hours);

- additional products:
 - one *deterministic* run (taking initial and 6-hourly boundary conditions from the high-resolution deterministic ECMWF forecast) to assess the relative merits between deterministic and probabilistic approach (start at 12UTC; forecast length: 132 hours);
 - one *proxy* run (taking initial and 3-hourly boundary conditions from ECMWF analyses) to “downscale” ECMWF information (start at 00UTC; forecast length: 36 hours)

2 Dissemination

The products generated by the operational COSMO-LEPS suite are disseminated to the National and Regional Weather Services of COSMO and, for a number of case studies, also to Hungary. Fig. 2 illustrates some of the products which are sent on a daily basis to the

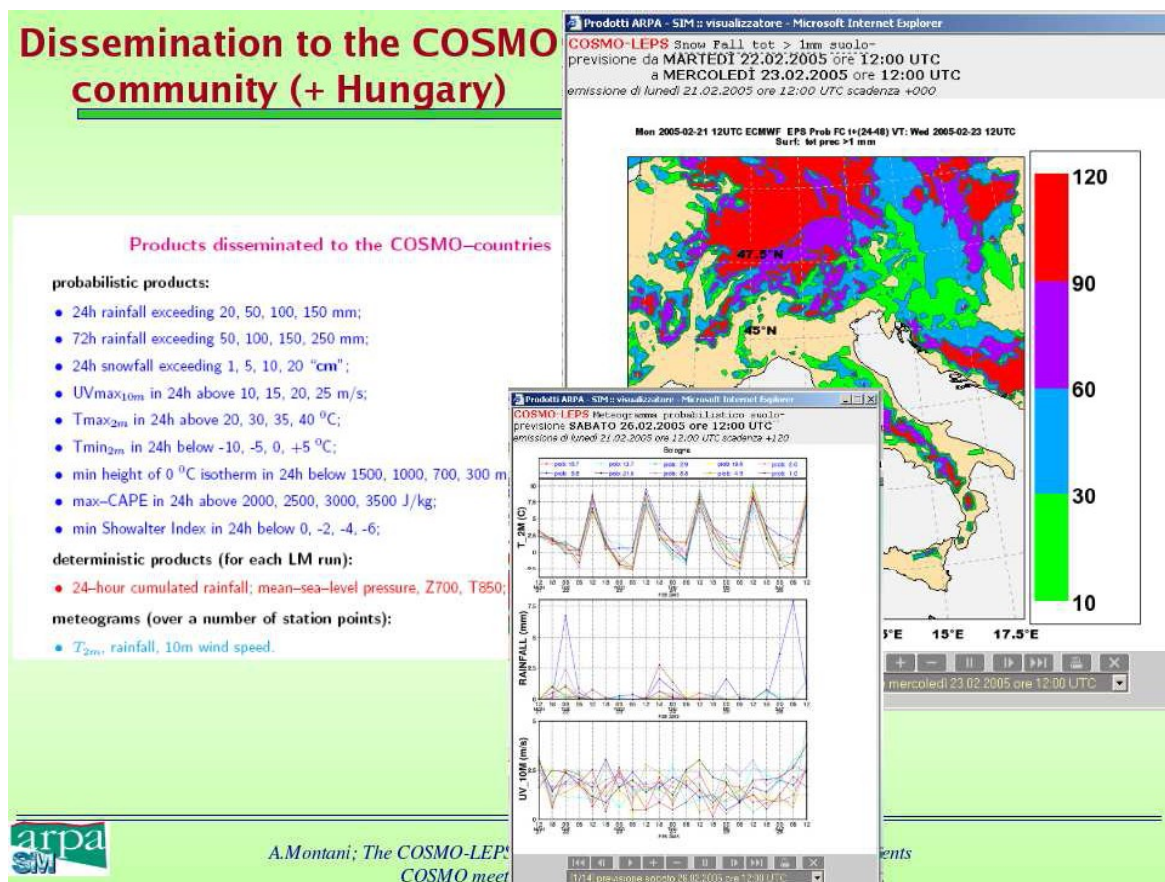


Figure 2: Examples of the COSMO-LEPS products disseminated to the COSMO community.

weather services, including probabilistic output (probability of exceeding of a threshold for a certain variable), deterministic output (the fields predicted by each individual COSMO-LEPS integration) and meteograms over station points (in terms of 2-metre temperature, 10-metre wind speed and rainfall).

As for the timing of delivery (see Fig. 3), COSMO-LEPS application is triggered on ECMWF supercomputers at about 20.30 UTC of day D and output files are disseminated to the

operational weather services already after 5 hours, at about 1 UTC of day $D+1$. Since forecasts have a range of 132 hours (that is up to the end of day $D+5$), COSMO–LEPS products turn out to have a long range of validity and utility for forecasters.

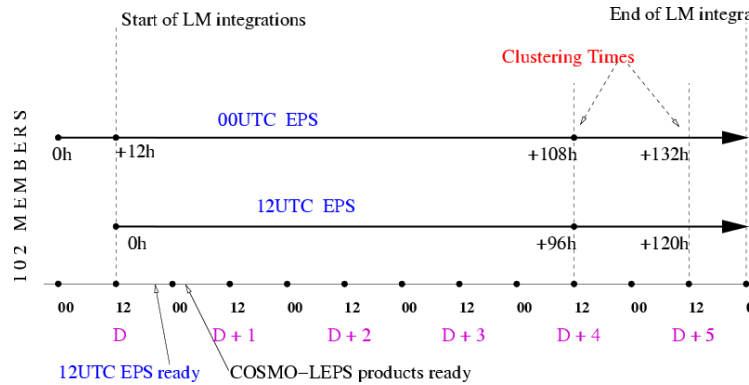


Figure 3: Timing of dissemination of COSMO–LEPS products.

3 Recent changes

Archive at ECMWF

During 2005, the archiving of COSMO–LEPS products on ECMWF’s Meteorological Archival and Retrieval System (MARS) was implemented. This important step, achieved thanks to the assistance and collaboration of ECMWF staff, will make the retrieval and use of COSMO–LEPS products simpler and more user–friendly.

From 1 July 2005, the following products are archived on MARS and can be retrieved (“class=co” needs to be specified so as to obtain them):

- deterministic forecast (from fc+0h to fc+132 every 3h):
 - pressure level: geopotential height, relative humidity and temperature at 500, 700 and 850 hPa;
 - surface: albedo, low cloud–cover, medium cloud–cover, total cloud–cover, short–wave radiation flux, CAPE, height of 0°C isotherm, height of snow–fall limit, mean–sea–level pressure, 2–metre temperature, 2–metre dew–point temperature, minimum of 2–metre temperature, maximum of 2–metre temperature, zonal 10–metre wind, meridional 10–metre wind, maximum of 10–metre wind speed, large–scale rainfall, convective rain, large–scale snowfall, total precipitation.
- ensemble prediction system
 - 10 perturbed forecasts (from fc+0h to fc+132 every 3h):
 - * pressure level: geopotential height, relative humidity and temperature at 500, 700 and 850 hPa;
 - * surface: albedo, low cloud–cover, medium cloud–cover, total cloud–cover, short–wave radiation flux, CAPE, height of 0°C isotherm, height of snow–fall limit, mean–sea–level pressure, 2–metre temperature, 2–metre dew–point temperature, minimum of 2–metre temperature, maximum of 2–metre temperature, zonal 10–metre wind, meridional 10–metre wind, maximum of 10–metre wind speed, large–scale rainfall, convective rain, large–scale snowfall, total precipitation.

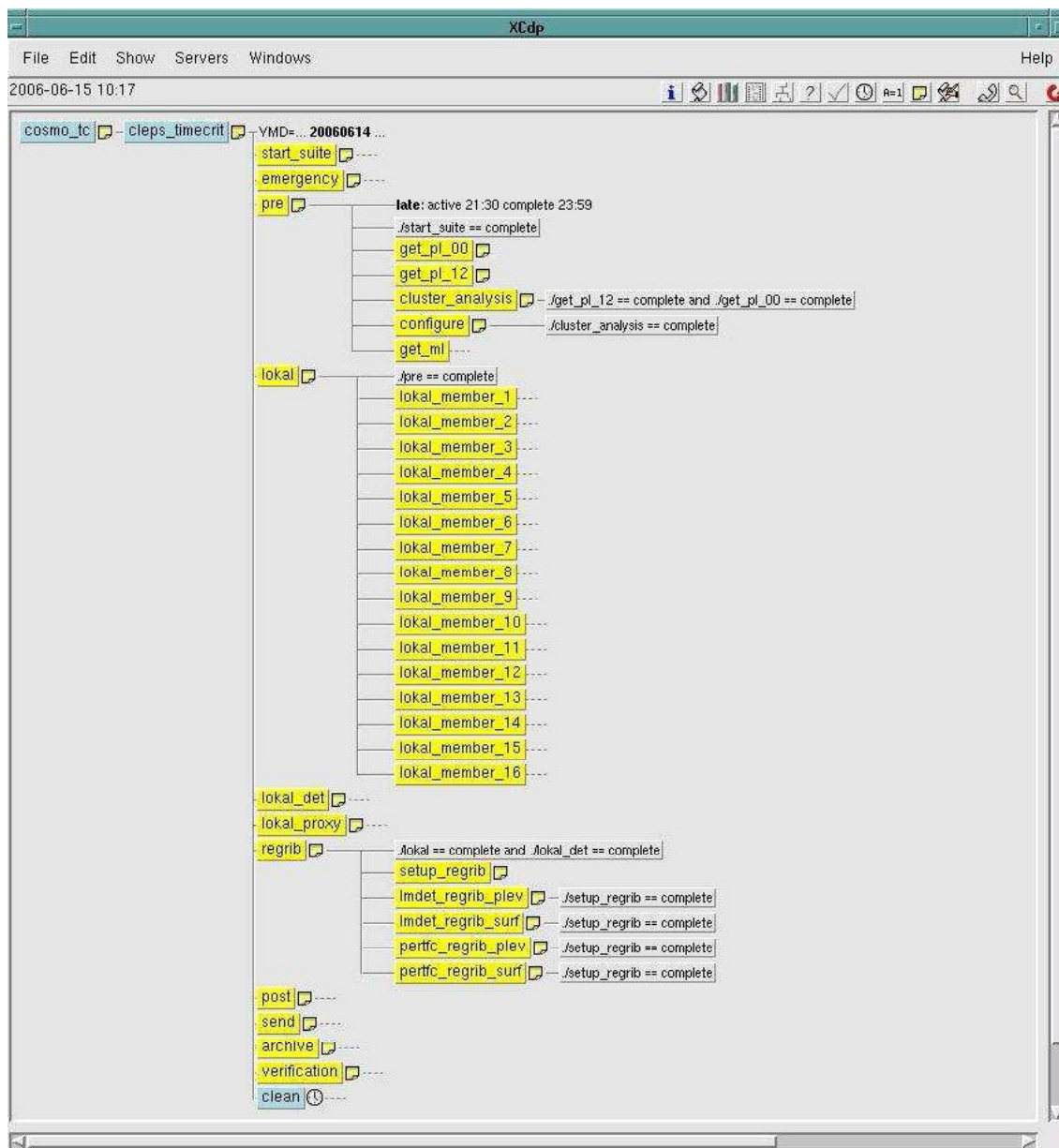


Figure 4: Configuration of COSMO-LEPS time-critical suite at ECMWF (since February 2006 with 16 members).

- Forecast probability (various intervals and thresholds):
 - * surface: CAPE, height of 0°C isotherm, minimum of 2-metre temperature, maximum of 2-metre temperature, maximum of 10-metre wind speed, total precipitation, total snowfall, minimum of showalter index.
- Clustering information (population, clustering variables and intervals, ...).

In the present configuration, about 2.2 GB/day are produced by COSMO-LEPS and archived on MARS.

COSMO-LEPS as a time-critical application

At the end of November 2005, COSMO-LEPS has become a “Member-state time-critical application” at ECMWF. This implies that COSMO-LEPS jobs are given higher priority on ECMWF supercomputers and dedicated file systems are used so as to speed up the

application. In addition to this, ECMWF operators (on duty 365 days a year) monitor the suite (shown in Fig. 4) and can take actions in case of problems, if the intervention from ARPA-SIM is not possible. For this purposes, a number of man-pages were developed so as to instruct operators about the corrective actions to be taken in case of failures and COSMO-LEPS application had to be re-organised so as to follow a number of ECMWF requirements.

The implementation of COSMO-LEPS time-critical application has insured in the last months a faster response in case of problems and a safer delivery of products.

4 Future plans

In the near future, the following activities are planned:

- produce and archive on MARS a number of so-called “derived probability products”, like the ensemble mean and the ensemble standard deviation, so as to assess the features of COSMO-LEPS system in terms of spread-skill correlation;
- (beginning of 2006), increase the population of COSMO-LEPS system from 10 to 16 members and to increase the vertical resolution from 32 to 40 levels.
- produce and disseminate synthetic satellite and radar pictures in ensemble mode on an operational basis.

References

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