Ensemble forecasting for Sochi-2014 Olympics: the COSMO–based ensemble prediction systems

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Introduction

In the framework of the forthcoming Winter Olympics and Paralympic Games, taking place in Sochi, Russia, from 7 to 23 February 2014 and from 7 to 16 March 2014, WMO launched two dedicated initiatives: a WWRP Forecast Demonstration Project (FDP) and a WWRP Research and Development Project (RDP). Both components are part of the **FROST-2014** project (**F**orecast and **R**esearch in the **O**lympic **S**ochi **T**estbed; http://frost2014.meteoinfo.ru/), aimed at advancing the understanding of nowcasting and short-range prediction processes over complex terrain, since the region of Sochi is characterised by complex topography, with the Caucasus mountains in the vicinity of the Black Sea (Kiktev, 2011). Since Russia belongs to the COSMO consortium (http://www.cosmo-model.org), several activities have also been undertaken within the consortium to support NWP aspects. The COSMO tasks within FROST-2014 are organised in the framework of the Priority Project CORSO (Consolidation of Operation and Research results for the Sochi Olympic games), which deals, among other topics, with the relocation of COSMO-LEPS (Montani et al., 2011) over the Sochi area, generating a new system named COSMO-S14-EPS. As for this topic, the main activities include the set-up, generation, implementation and maintenance of COSMO-S14-EPS, the convection–parameterised ensemble prediction system based on COSMO model and targeted for the Sochi-area.

Methodology and implementation

COSMO-S14-EPS shares several features of the COSMO-LEPS methodology for its generation. On the other hand, computer-time constraints and the interest towards the short-range made it necessary to make some changes. The main characteristics of COSMO-S14-EPS are summarised in Table 1, which also reports some details relative to the global ensemble ECMWF-EPS as well as to COSMO-RU2-EPS, the convection-permitting ensemble which takes both initial and boundary conditions from COSMO-S14-EPS.

Table 1: Main features of ECMWF-EPS, COSMO-S14-EPS and COSMO-RU2-EPS.

	ECMWF-EPS	COSMO-S14-EPS	COSMO-RU2-EPS
Hor./vert. res.	∼30 km / 62 ML	7 km / 40 ML	2.2 km / 50 ML
Forecast length	240h	72h	48h
Ensemble size	50+1	10	10
Initial time	00/12 UTC	00/12 UTC	00/12 UTC
Convection	Parameterised	Parameterised	Resolved
ICs and BCs	SV ini pert + EDA	from selected ECMWF-EPS members	from COSMO-S14-EPS members

COSMO-S14-EPS was implemented on ECMWF super–computers in November 2011 (Montani et al., 2013) and has been running on a regular basis since 19 December 2011. It generates a set of standard probabilistic products, including probability of surpassing a threshold, ensemble mean and ensemble standard–deviation for several surface and upper-air variables. These products are delivered in real time to the Met Ops room of the Hydrological and Meteorological Centre of

Russia. In addition to this, initial and hourly-boundary conditions (up to T=48h) are provided for the experimentation with COSMO-RU2-EPS, whose main features are also summarised in Table 1. In the next section, we analyse the performance of COSMO-S14-EPS for a case of high-impact weather occurred during the last winter and we try to assess the usefulness of high–resolution in the probabilistic prediction of heavy precipitation.

Case-study results

The attention is focused on the performance of COSMO-S14-EPS for the heavy precipitation event of 13 January 2013 with 21 mm of rain during the day on the coast (Sochi/Adler) and 33 mm of snow-water equivalent in the mountain (Krasnaya Polyana). Fig. 1 reports the per-

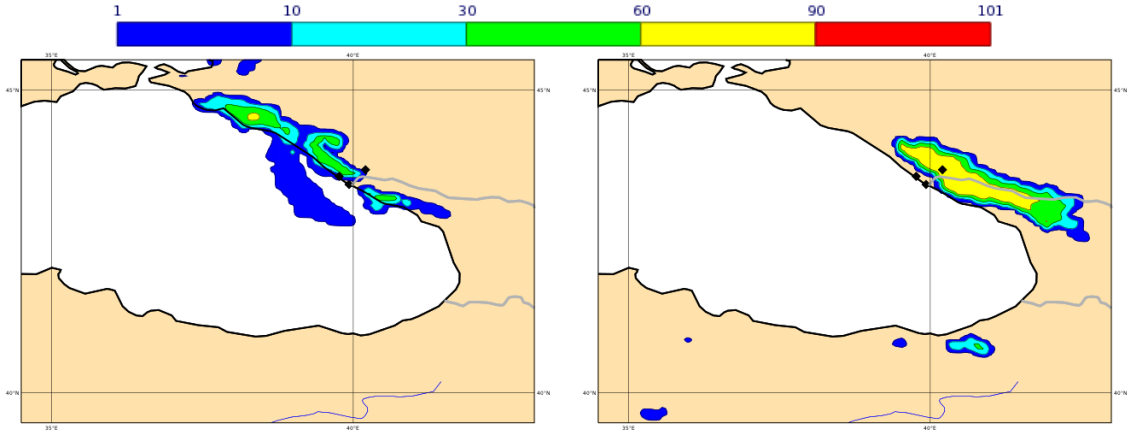

Figure 1: COSMO-S14-EPS run starting at 00UTC of 11 January 2013 (48-60 hour forecast range): probability of 12–hour rainfall exceeding 20 mm (left panel) and of 12-hour snowfall exceeding 15 mm of water equivalent. The dots on the coast denote Sochi and Adler; the dot inland denotes Krasnaya Polyana.

formance of the system in terms of probabilistic prediction for two variables: probability of 12–hourly accumulated rainfall exceeding 20 mm (left panel) and probability of 12–hourly simulated snowfall exceeding 15 mm of equivalent water. The ensemble runs start at 00UTC of 11 January and the attention is focused on the 48–60 hour forecast range: it can be noticed that COSMO-S14-EPS provides a quite accurate forecasts. Despite the steepness of the orography and the length of the forecast range, the system is able to distinguish between the area more likely affected by rainfall (along the coast, left panel) and the region mainly interested by snowfall (in the mountain, right panel). This is an important result, as the knowledge of the possibility of this weather event, with an advance of about 2 days, would give organisers the chance of taking counter–measures and relieving the weather-related problems.
As for the future, it is planned to consolidate the generation/transmission/use of probabilistic products from ECMWF to the Sochi forecasters and to quantify the value of a blended deterministic/probabilistic approach.

References

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