Arome WMED, a model dedicated to the HyMeX campaign

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HyMeX (HYdrological cycle in the Mediterranean Experiment, http://www.hymex.org) aims at a better understanding and quantification of the hydrological cycle and related processes in the Mediterranean Sea, with an emphasis on high-impact weather events, inter-annual to decennial variability of the Mediterranean coupled system, and associated trends in the context of global change. The 2012-2013 first HyMeX Special Observation Period (SOP) series targeted on the north-western Mediterranean area. The SOP1, from 5 September to 6 November 2012, was dedicated to heavy precipitation and flash-flooding. The SOP2, February- mid-March 2013 aimed at studying intense air-sea exchanges and dense water formation. The choice of this period of the year also allowed to document the Mediterranean cyclogenesis. A special AROME version, called AROMEWMED, was developed at CNRM to provide real time forecasts to the HyMeX operational centre and for the decision making of the observation deployment.

AROMEWMED is a HyMeX-dedicated version of the French operational AROME system (Seity et al, 2011) covering a domain which encompass Portugal to Italy, North Africa to France (34N -9W/ 48N-20E, see Figure 1). Its domain is 11% bigger than the operational one and is defined by 960 by 640 points. Sea surface represents 47% of the domain against 41% for the AROME model. The lateral boundary conditions are provided by the French global model ARPEGE every each hour. A 48 hour forecast was established once a day at 000TC. A 3-hour assimilation cycle is run with a three dimensional variational data assimilation system at an horizontal resolution of 2.5 km. A background error covariance matrix specific to AROMEWMED has been computed, using the ensemble approach proposed by Brousseau et al. (2012), over a 3 week-period during Autumn 2010 characterized by several active convective periods over the Mediterranean zone.

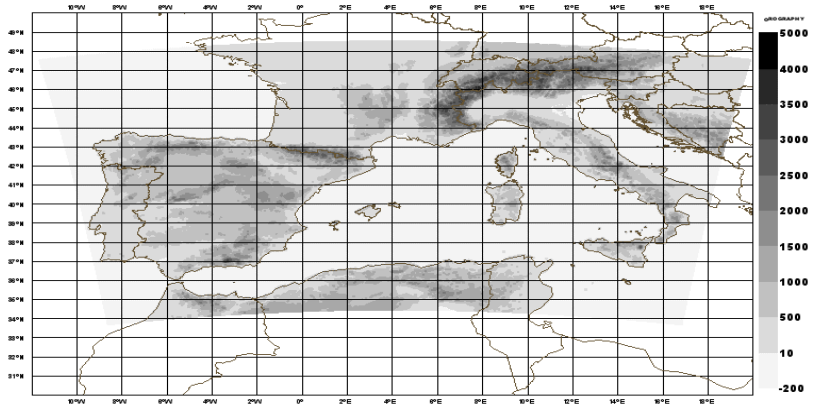

Figure 1: Orography (m) and domain of the AROMEWMED model.

The assimilated observations are the same as the ones used in the operational AROME model: radiosondes, surface data, wind profilers, ship and buoy report, aircraft reports, automated land surface stations. Satellites data are also assimilated: radiances from SEVIRI (Spinning Enhanced Visible and Infrared Imager) and from polar orbiting satellites, winds from atmospheric motion vectors (AMVs) and from scatterometers and GPS Zenith Tropospheric Delay (GPS-ZTD) observations. French network Radar data are also assimilated as Doppler wind (Montmerle and Faccani, 2009) and reflectivities provide information on relative humidity (Caumont et al, 2010, Wattrelot et al, 2008). Despite real time constraints, more satellite micro-wave observations and additional Spanish surface data were used in the analyses to improve the data coverage. A few observations of the field

campaign (Boundary layer pressurized balloons, additional radiosondes) have been also assimilated.

Figure 2 gives an example of the 24 hours rainfall rate predicted at 48- and 24- hour ranges with AROMEWMED for the 26 October 2012 and the rainfall rate observed with raingauges. This case corresponds to a Cevenol event and to high precipitations in Liguria-Tuscany and in central Italy, followed by flash floods. Theses precipitating events are forecasted by the model at a one day- and two day- ranges. In addition, a special effort was made to increase the verification data density with additional Spanish and Italian surface data, provided from meteorological centres in near real-time.

These mesoscale meteorological fields are available in the HyMeX database (http://mistrals.sedoo.fr/HyMeX/) and a first reanalysis, which takes into account a maximum of available observations, is under way.

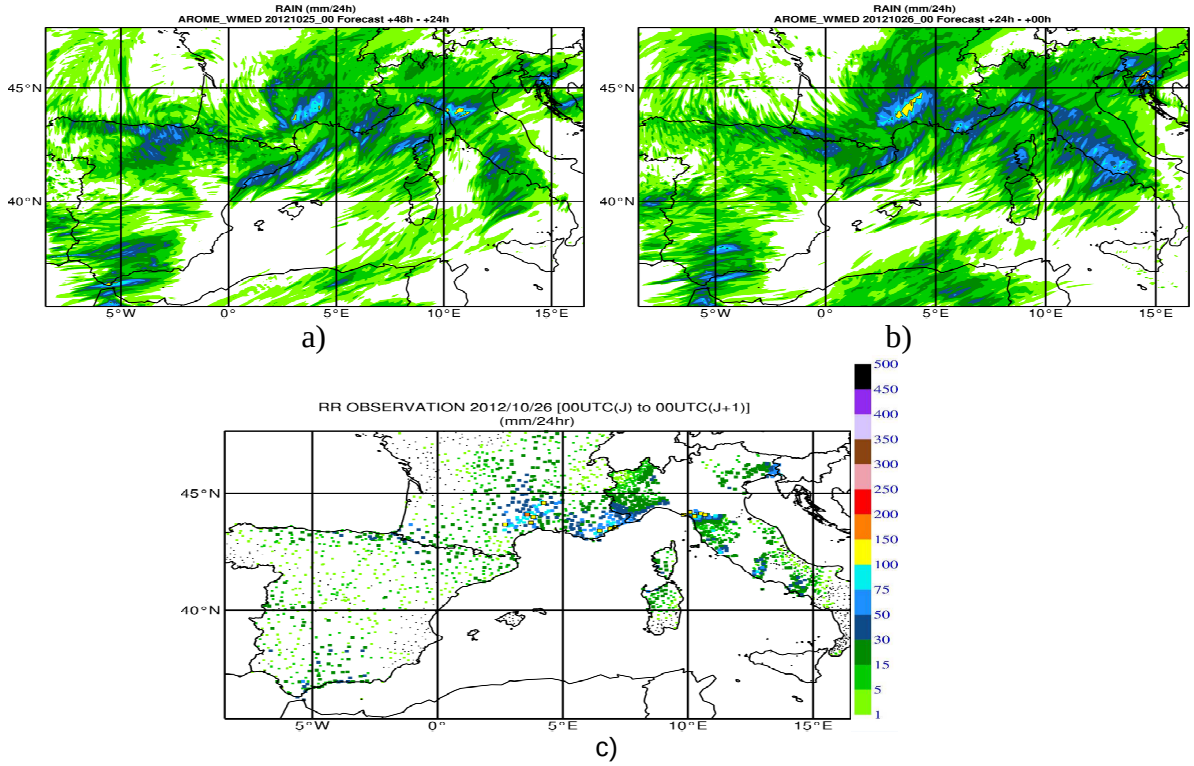

Figure 2: 24-hour rain rate (mm) predicted by the AROMEWMED model at the 48-hour range from the 25 October 2012 (a), at the 24-hour range from the 26 October 2012 (b) and 24-hour rainfall rate observed the 26 October 2012 with raingauges(c).

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