The impact of different NWP forecasting systems on acqua alta forecasts: Two IOP case studies over the NEI target site

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RESEARCH PURPOSE
This work is part of the strong coordinated activity carried on by the Italian HyMeX partners during the first Special Operation Period (SOP1: 5 Sep-6 Nov 2012). This activity, described in Ferretti et al. (2013), included the deployment of several observational instruments and weather forecasting modelling chains and the support to the HyMeX Operational Centre in Montpellier (France) during Intensive Operation Periods (IOPs). Model forecasts and observational data provided by some of these partners are deployed here in a cross-verification study on two IOPs associated to intense precipitations in the North-Eastern Italy (NEI) hydro-meteorological monitoring site and storm surge events (“acqua alta”) in the Venice Lagoon.

NWP & TIDE MODELING CHAINS
NWP model chains:
- the GFS-driven 0.1° BOLAM-ISAC + 0.0267° MOLOC chain developed and run by CNR-ISAC;
- the ECMWF-driven 0.3° BOLAM + 0.1° BOLAM chain and the new 0.07° BOLAM + 0.0225° MOLOC chain run by ISPRA.
- Tide forecasting systems:
  - the ISPRA statistical model;
  - the ISAC-SHYFEM developed by CNR-ISAC and driven by ECMWF model and ISAC’s 0.1° BOLAM;
  - the CNR-ISAM KASSANDRA syst. based on SHYFEM and the BOLAM-MOLOC chain of ISAC (not shown).

OBSERVATIONAL DATASETS
In addition to common data (e.g. MSG) and HyMeX datasets (e.g. rain gauges), ARPAV and ARPA FVG radars, ground-based profilers and lidars (ARPAFVG) were deployed together with the CALMET analyses on part of Veneto region, employing surface stations and radiosoundings (ARPAFVG). ARPAV CALMET stations: SYNOP, ARPAV grid stations - Milano, Udine.

IOP 16: Meteorological forecast verification
The IOP16 event involves high-predictability weather systems (synoptic trough, Alpine cyclogenesis). As a result, forecasts provided by different models and/or with different initial dates does not differ much among them, all displaying good forecasting ability (see below cyclogenesis and rainfall event over NEI).

IOP 18: Synoptic-scale verification for ISPRA’s BOLAMs
Large changes are found in path and evolution of the 31 Oct Mediterranean cyclone in the ISPRA’s BOLAM forecasts when varying the grid step (0.1° vs. 0.07°) and initial time (from 29 to 31 Oct, @ 12UTC). Satellite images (MSG pseudo-WV) evidence wrong cyclogenesis, depth in both runs starting on 29 Oct, @ 12UTC.

Conclusions and future work
• Low predictability strongly affects the tide forecast for the IOP18 Venice acqua alta event (compared to IOP16).
• Peak forecast skill can be strongly degraded by “small” errors in predicting local features as low level jet shape and details in the surface low pressure.
• All these features can be verified thanks to the wide observational database collected within HyMeX.
• Precipitation verification is suitable for assessing model skill even when rain is not the target of the forecast.
• Future work: SHYFEM sensitivity study to drag coefficients; completing QPF verification study of forecast error development in the different models/runs;