# Overview of the first HyMeX Special Observation Period over Italy: observations and model results

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Answer to referee #2

In the general comments:
*'As such, this article is not a scientific manuscript which provides new results but it gives a detailed description of a new dataset collected over Italy to better understand, simulate and forecast precipitation in Italy.'*
The paper does not only give a detailed description of the new dataset but it presents as example three severe weather events occurred during the SOP1 over Italy and it discusses the major dynamics and thermodynamics features using both measurements and modeling results. Moreover, the chain from the meteorological hazard, to the hydrological response, to the socio-economical impact, as well as the link between weather forecast and storm surge and coastal wave for the Mediterranean Sea will be briefly addressed.

1. *'I found the description of all models unnecessary, Table 4 is enough. The strategy of use of such models should be emphasized. '*

   There is no detailed description of the models in the paper (it is no longer than 13-20 lines for each), but we will try to reduce it. On the other hand, we have to take into account also the Referee 1 request of adding specific information about the models. However, what it has been accurately described is the **models set up** that are what you call **the strategy of use**. Indeed:
   WRF-CETEMPS pag 11653 lines 15-24
   WRF-ISAC pag 11653 line 25 to pag 11654 line 2
   WRF-LAMMA pag 11653 lines 3-14
   BOLAM-MOLOCH-ISAC pag 11655 lines 5-10
   BOLAM-MOLOCH-ISPRA pag 11655 lines 10-19
   COSMO pag 11656 lines 1-15

   Moreover, the strategy of use of the models (support to IOPs decision, support to flight schedule, forecast of heavy rain event,…) is described throughout the paper.

2. *With respect to HyMeX objectives which points out the need to investigate ocean/land surface/atmosphere coupling on heavy precipitation events (HPE) and floods, nothing is mentioned in this paper. With respect to HyMeX objectives which points out the need to investigate ocean/land surface/atmosphere coupling on heavy precipitation events (HPE) and floods, nothing is mentioned in this paper. How will the Italian community investigate the effect of the Mediterranean Sea and Adriatic Sea on the Italian events? Were Italian oceanographers involved in HyMeX and if yes, what are their contributions to this project? Also, nothing is said on the hydrological response to the heavy precipitating events. There again, HyMeX objectives aims at making the bridge between HPE, floods and socio-economical vulnerability. Are there Italian hydrologists and social scientists involved in HyMeX project? If yes, what are the plans to investigate in an integrated way the full chain between HPE, floods and vulnerability/resilience/risk management?*

Several Italian oceanographers are involved in HyMeX, especially in working groups 1 (The water budget of the Mediterranean Sea), 2 (The continental hydrological cycle and related water resources), and 4 (Intense sea-atmosphere interactions). The second Special Observation Period (SOP2), held in February-March 2013, focused on air-sea exchanges and dense water formation. Conversely, the SOP1 described in this paper focused on heavy precipitation and flash-flooding, and therefore the oceanographic community was involved only marginally, for example just for storm surge and coastal wave predictions. The hydrological response to heavy precipitation was an important part of SOP1. Indeed, the NWP outputs were used to feed the operational forecast of the distributed CETEMPS hydrological model (CHyM) (Coppola et al. 2007), implemented over the whole Italian territory, as well as outputs from ISAC-CNR and ISPRA meteorological suites were also used to force two version of the Shallow water HYdrodynamic Finite Element Model (SHYFEM, Umgiesser et al., 2004) that were operational within the ISMAR-CNR KASSANDRA and the ISPRA SIMM forecasting systems.

We try to better clarify the aim of this paper that was dedicated to SOP1, therefore we **added** the following sentence in the Introduction:

In this context, a special emphasis is given to the occurrence of heavy precipitation and floods, considering also the associated impacts on society which were the topics of SOP1, whereas SOP2 was dedicated to the intense sea-atmosphere interactions……..
……
The second field campaign, SOP2 was dedicated to intense air-sea exchanges and dense water formation, and it took place in winter 2013 (February-March 2013).
For what concerns socio-economical vulnerability, this is a HyMeX topic only accidentally related to SOP1 that was dedicated to intense precipitation events. Moreover, the problems related to resilience, vulnerability, risk would require a deep investigation, that should be better addressed in an additional paper than by further extending the present, already very long, study.

To clarify these points we **added** the following statements in the paper:

In Section 2.2
Moreover, specifically for the campaign, the output of this chain was used to force the Cetemps Hydrological model (CHyM, Coppola et al., 2007), implemented over the whole Italian territory. The meteorological-hydrological models chain was used operationally to issue severe weather and hydrological alerts. For example, the severe conditions forecasted for September 14, which one-day ahead lead to call for the IOP4 briefly described in the next section, caused major flash floods in Central Italy.
……..
Both ISAC-CNR and ISPRA meteorological suites were also used to force two version of the Shallow water HYdrodynamic Finite Element Model (SHYFEM, Umgiesser et al., 2004) that are operational within the ISMAR-CNR KASSANDRA and the ISPRA SIMM forecasting systems, respectively, to produce storm surge forecasts for the Mediterranean Sea. In addition, outputs of the two ISPRA meteorological suites were deployed for feeding the SIMM Mediterranean-embedded Costal WAve Forecasting system (Mc-WAF, Inghilesi et al., 2012) that has been operational since September 2012.

In Section 3
Rain was persistent throughout the day, reaching maxima of over 150-200 mm/24h. More than 150 mm were registered in a few hours over coastal areas, causing several river overflows and the flooding of dense urban areas (Pescara, including the city hospital) and coastal areas, where many beach resorts were severely damaged. Note that the regional branch of the Civil Protection Department, which was part of the Italian operational center in L'Aquila, included this event in their guidelines for hydro-meteorological decision support system (AdriaRadNet REPORT ACTION 3.1, 2013). The hydrological aspects of this event are discussed in more detail by a paper currently in preparation (Verdecchia et al. 2014). The SHYFEM forecasts were useful to investigate the tide peak events occurred over the Venice Lagoon (acqua alta) where the sea level exceeded twice the warning level (more than 120 cm on 27-28 October 2012), during IOP16 and when the sea level exceeded once the alarm level (more than 140 cm on 1 November 2012) during IOP18. Preliminary results on the SHYFEM performance during IOP16 and IOP18 are presented in the study by Mariani et al., (2013, 2014).

3. *I liked the "peculiarities and model simulations" section. But nothing is said on the strategy to use the data to improve HPE/flood forecast. For such paper in which no conclusion is really expected, a "Perspective" section should replace the "Conclusion" section to make clearer the strategy of use of such data and models to improve HPE/flood forecast.*

   Following the referee suggestion we will add a statement to address the issue of using the data to the *'peculiarities and model simulations'* for each IOP. Moreover, we will replace the 'Conclusion' section with the 'Perspective' one where we will clarify the strategy of use of these data.

4. *If the authors only focus their article to HPEs, excluding the rest of the chain (hydrological response in terms of floods, modulation of HPE by the Sea, socio-economical issues), I would reject the paper since I do not see major scientific improvement with respect to previous campaigns such as MAP. If an effort is made to show how the Italian contribution to HyMeX will help in investigating the whole chain from the meteorological hazard, to the hydrological response, to the socio-economical impact, I then think this paper should be published.*

   We added a statement in the IOPs section to address this issue as explained in point 2, where also the socio economical impact is reported.

Specific Comments:
1 Done, we added the reference
2 Done we improved figure 9