

## ***Interactive comment on “Heavy rainfall episodes over Liguria of autumn 2011: numerical forecasting experiments” by A. Buzzi et al.***

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### **General comments**

This paper investigates two heavy precipitation events from 2011 occurring in the Liguria region with numerical simulations and observations. An ensemble is generated with different driving global models and with the use of a hydrostatic model and a non-hydrostatic model with varying horizontal grid spacing. These rainfall episodes lead to severe flooding in these regions. However, these phenomena are still an important forecasting problem in the Mediterranean region.

I found this to be an interesting and generally clear paper that covers an actual topic of atmospheric research which is related to the HyMeX programme. The majority of my  
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comments on the paper are editorial in nature, I have (almost) no concerns regarding the methods used and the author's scientific conclusions. In general, the paper is well written and structured. However, there are a some clumsy formulations and too long sentences which makes it sometimes hard to follow. Some of the figures also need some refinement, please see my suggestions below.

### **Specific comments**

1. I suggest to change the title of the paper to: “Heavy rainfall episodes over Liguria **during** autumn 2011:...” or “Heavy rainfall episodes over Liguria **in** autumn 2011:...”.
2. Most of the investigation is done by comparing the location of precipitation and its maximum value. I understand that the maximum value is very important for flood forecasting, but the spatially accumulated precipitation has been addressed only rarely (maybe I missed it). For example, in Figure 7 and the discussion on P. 7108, the authors state that the maximum precipitation amount simulated with 1 km grid spacing is less than with 1.5 km grid spacing. The spatially integrated precipitation, however, seems to be larger with 1 km grid spacing. The authors could add a comment on that.

Another possibility would be to calculate some simple skill scores like the bias or root mean square error for the rain gauge stations in the area of interest.

3. P. 7096, L. 20: The authors state that chaotic convective dynamics are present in their cases and strongly limit the QPF. In my opinion, this formulation is too strong: As you can see from the precipitation location and amount, all model runs provide comparable results (even if the maximum precipitation amount is different). Under a strongly limited QPF, I would assume totally different localisation, timing, and amount of precipitation.

4. I wonder if it would be possible to add supplementary material like radar or satellite pictures (or even animations). Although the authors describe it and refer to other papers, this would help the reader to get a better overview about these rainfall episodes.
5. P. 7100, L. 12: The conditional instability over the Ligurian Sea...was definitely larger in the CT than in the GE case. Was this determined based on measurements or simulations?
6. Often, the term **model resolution** is used which implies that the model actually resolves features at this scale which is not true. I would prefer **horizontal grid spacing** instead. But this is just a very minor point, the authors could also leave it that way.

#### Technical corrections

1. P. 7094, L. 2: ... by two heavy rainfall **episodes** and **subsequent severe flooding episodes**...
2. P. 7094, L. 4: **In both cases**, the very large ... associated , *in both cases*, with intense.... systems **that** developed...
3. P. 7094, L. 12: in forecasting quantitative precipitation (QPF) → in quantitative precipitation forecasting (QPF)
4. P. 7094, L. 12: I would rather speak of **initial conditions** instead of initial analyses.
5. P. 7094, L. 14: ... that *forecast* errors of QPF ...
6. P. 7094, L. 17: *in both episodes* ... the ability **in of** representing...

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7. P. 7095, L. 2: of the order *or of* less
8. P. 7095, L. 7: severe flood episodes, **which** both
9. P. 7095, L. 13: *or of* the order of
10. P. 7095, L. 10-19: This sentence is much too long. Please divide it into smaller, more readable pieces.
11. P. 7095, L. 21: alfa → alpha
12. P. 7095, L. 26: and small scale **processes** (i.e....
13. P. 7096, L. 10: Please explain the acronym HyMeX. Instead of using the term **field campaign**, I would rather specify it to **special observation period 1 (SOP 1)**, since long-term measurements are performed also before and after autumn 2012.
14. P. 7096, L. 15: floods due mainly to → floods mainly due to
15. P. 7096, L. 21-25: Please rewrite this sentence.
16. P. 7096, L. 27/28: of grid horizontal resolution → of horizontal grid resolution (or spacing)
17. P. 7097, L. 1: and **by** comparing
18. P. 7097, L. 6: I think, there is no term **QPF amount**. What about QPF deficiencies?
19. P. 7097, L. 7: depending also *from on* the initial time
20. P. 7097, L. 25: Although **the** rain gauge network

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21. P. 7098, L. 6: Figures 2 and 3 *synthetically* show... accumulated *in* over 24 h.
22. P. 7098, L. 8: what appears
23. P. 7098, L. 17: ...the presence of positive CAPE...: Please explain the abbreviation CAPE at its first use. Furthermore, CAPE is per se positive, I would suggest to remove the term "positive".
24. P. 7098, L. 18: Please explain the abbreviation PV.
25. P. 7103, L. 25: Please explain E-I.
26. P. 7107, L. 8: ...to keep the lateral boundaries far enough to try to minimize such influence. Please consider: ...to keep the influence of the lateral boundaries far away from the area of interest.
27. P. 7108, L. 4: simulated one
28. P. 7110, L. 13: Such a feature...
29. P. 7112, L. 10: The different precipitation regimes exhibited by the CT and GE cases, *neatly*...
30. P. 7112, L. 25: I don't understand what is meant with **linearly unstable**?
31. P. 7112, L. 25-26: ...only parcels lifted from the lowest levels are close to marginal instability. I find this formulation confusing, the temperature difference is negative and therefore (slightly) stable.
32. P. 7114, L. 16: of the convective ion on the larger scale
33. Some of the figures should be included with higher resolution, some numbers or small wind vectors are too blurred (e.g. Fig. 11).

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34. Figs. 1-4 should also have labels on the respective axis (longitude, latitude).
35. Figs. 5-7, 9, 11-12: Please increase the size of the figures. In Fig. 5b, the values of the colourbar are cropped.

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 7093, 2013.

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