

Interactive comment on “Ensemble-based statistical interpolation with Gaussian anamorphosis for the spatial analysis of precipitation” by Cristian Lussana et al.

Anonymous Referee #1

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Review of "Ensemble-based statistical interpolation with Gaussian anamorphosis for the spatial analysis of precipitation" by Lussana et al.

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The authors propose a statistical interpolation approach, EnSI-GAP, to provide hourly precipitation fields based on the optimal combination of surface observations, radar QPE and NWP. They use standard hybrid data assimilation (DA) methods to achieve this objective, with a static and a dynamic component in the background error covariance matrix. The study differs from standard DA on several points. First, the precipitation are transformed using Gaussian anamorphosis, instead of the classical log or cubic transforms. Second, they fit a theoretical distribution to hourly precipitation using the two-parameter Gamma distribution. Finally, the static component of the background error covariance matrix is estimated using different hypotheses on the background and observation uncertainties. The authors evaluate the EnSI-GAP on a synthetic dataset, on a specific extreme event and over a time period with a cross-validation framework.

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General Comments:

The methodology is well organized and is clearly explained in a very educational way. However, the fitting of a gamma distribution and the back transform of the precipitation could be more explicit (see comments below). We can guess what is done when reading the applications but it is preferable if it appears earlier in the paper.

How do you think this approach perform during the cold season with solid precipitation ? The reporting gauges are less numerous and the radars are difficult to use but NWP's have better performances for large scale precipitation do I was curious about the performances. Moreover, how do you think your tunable parameters will behave ?

A broader question is how do you think your approach is better than a standard hybrid approach that uses as a static covariance based on 2DVar or other DA approaches (see for example, Hamill et al. 2000), that has the advantage of not tuning parameters based on some assumptions ?

Specific comments:

L5-6, page 1: Could you be more specific about the additional source of uncertainty that is used ?

L35, page 2: The word "prediction" may be inappropriate as not forecasts are provided by the approach.

L34-36, page 2: When you say "The objective of our study is the precipitation reconstruction through the combination of numerical model output with observations

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from multiple data sources... data sources", you define the general objective of data assimilation approaches. Could you be more specific on the objectives of the study ?

L47-49, page 2: The Lundquist et al., 2019 study does not demonstrate that, generally, the performances of NWP models in representing orographic precipitation are better than observations. It does for annual precipitation amounts, it also depends on the model, its resolution and configuration. Plus, this statement is in contradiction the working assumption 3.

L79, page 3: A reference supporting the gamma distribution assumption for the hourly precipitation must be added. You should be careful when you mention the extremes and the IDF curves in L42-44, as the Gamma distribution is known to be inappropriate for such events.

L99-100, p4: As it is an innovative part, maybe you could give more details on "opportunistic sensing networks".

L110, page 4: Maybe you could mention that the temporal autocorrelation of hourly precipitation field exist and is insured by the background fields.

L137-140, page 5: This part is a bit confusing, do you fit a Gamma distribution on hourly precipitation and for each grid-cell independantly over a time period? Indeed, we can see in the introduction in L70 that "the aim at estimating its shape and rate parameters for each grid point", suggesting different Gamma parameters at each grid cell. But, in the conclusion, we can read in L654 that "the Gaussian anamorphosis [...] is based on the same gamma distribution parameters for the whole domain."

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L630, page 20: Rephrase the following sentence "The independent observations are used to judge if an event does in fact obtain."

L649-651, page 20: We can see that performances decrease for the BSS and the ETS for precipitation strictly above 1mm/h. Are you seeing similar results when investigating the reliability for higher precipitation thresholds ? Consistency bars as suggested by Brocker and Smith (2007) in the reliability diagram could help better assess the reliability.

Figure 6, page 33: Please, add the unit to the figure and explain the gray color in the caption (as in the text).