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Comment on nhess-2020-406

Anonymous Referee #2

Referee comment on "Investigating 3D and 4D variational rapid-update-cycling assimilation of weather radar reflectivity for a heavy rain event in central Italy" by Vincenzo Mazzarella et al., Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2020-406-RC2>, 2021

General comment

In this paper, the radar reflectivity measured by the Italian ground radar network is assimilated in the WRF model to simulate an event occurred on May 3, 2018 in central Italy. The impact of 3D and 4D variational rapid-update-cycling assimilation is compared with the control simulation using the Fraction Skill Score and the Receiver Operating Characteristic curve methods. Results show that the assimilation of radar reflectivity by 4DVar improves the precipitation forecast at 1h, 3h, 6h and 12h, especially considering the warm start.

While the precipitation forecast over the Mediterranean basin is very important, there are some key issues that need to be addressed by the authors before this paper can be accepted for publication.

Major points

- There is lack of the key figures to show the spatial results of 3DVar, 4DVar forecasting and control simulation in this paper.
- Figures (1-3) in this paper are in poor quality. It seems that they are not made by authors, just copied from some applications, there is no longitude or latitude in these figures at all. There are 9 plots in Figures 5-7 in same form, it is better to display them in one panel.

- The assimilation methods or evaluation methods are not novelty at all in this paper, it may be possible to show the efficient of forecasting. It is recommended to show the time cost and reasonable forecasting of 3DVar and 4DVar for 1day, 2days, 3days and even longer time, e.g. 7 days.
- This paper only shows the forecasting result of 1 day, it is far from the goal of forecasting for the Mediterranean basin, it is better to forecast for future 1 day, 2days, 3days and even longer time, e.g. 7 days.
- The 2×2 contingency tables and indicators such as POD, TS, FAR and ETS are recommended to evaluate the discrete variable, e.g. precipitation.