

Geosci. Model Dev. Discuss., referee comment RC3  
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## Comment on gmd-2022-18

Anonymous Referee #3

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Referee comment on "Intercomparing radar data assimilation systems for ICE-POP 2018 snowfall cases" by Ki-Hong Min et al., Geosci. Model Dev. Discuss.,  
<https://doi.org/10.5194/gmd-2022-18-RC3>, 2022

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### General comments:

The paper uses radar data to run two different data assimilation methods, LETKF and 3dVAR, during two snowfall events observed in ICE-POP 2018 field campaign. The authors compared the analysis and the forecasted data of different variables including wind, water vapor, temperature, and snowfall to show the importance of water vapor assimilation. The logic and structure of the paper are clear and easy to follow. However, several sentences need to be rewritten/reconsidered as well as some concerns which need to be considered before publication.

### Specific comments:

- It seems the authors run only one forecast cycle to compare two methods which cause few samples to do the verification methods. Please consider running more forecast cycles to have enough samples which make the verification as well as the results more reasonable.
- The authors use two different data assimilation methods; however, in many sentences particularly in the results and summary sections, the "simulation" word was used to refer to the LETKF or 3DVAR methods. Please note that this is the wrong word referring to the assimilation method. The LETKF and 3DVAR do the "assimilation" not "simulation". Sentences like „The snowfall in GWD was less simulated in LETKF“ are logically wrong and need to be rewritten.
- The word "underestimate" was used many times in sections 3 and 4 to compare two assimilation methods. Since non of these methods were considered as a reference experiment or reference data, using the words "underestimation" or "overestimation"

for this comparison is meaning less. The words "underestimation" or "overestimation" could be used when the results are compared with reference data such as observation. Please consider rewriting these sentences.

- In section 2.2.2 the radial wind and the reflectivity errors are assumed 3 ms<sup>-1</sup> and 5 dbz respectively; however, the authors did not mention the source of these numbers.
- In section 2.3 was mentioned that the precipitation up to 24.8 mm was recorded in the red box area from 00 to 12 UTC. It is an unclear sentence. The precipitation reported from an SYNOP station (which probably is the concern of the author in this sentence) would be for a specific point not for a whole specific area. The sentence could be rewritten by pointing to the minimum and maximum precipitation amount in this area as well as the location of the station which had a maximum report of precipitation. Please consider also the last paragraph in this section which has the same problem.
- In section 3.1 the sentence „The snow mixing ratio is higher in LETKF“ is a general sentence that of course is not generally correct. Please consider mentioning clearly about the specific case (time/location) where the assimilated snow mixing ratio is higher than assimilated snow mixing ratio in 3DVAR.
- In Fig. 8, there is no explanation for the dashed lines.
- Fig. 14(d), there is a weird feature regarding the FSS score. The FSS scores for both LETKF and 3DVAR methods are very low at the first forecast hours and they increase after about 6 hours. This is not a common behavior in the FSS score of a forecast validation. It would be good if the authors recheck this case or explain a bit about such a weird behavior of the FSS score.

### Technical correction:

- Line 35: „cool ocean winds“ □ „cold ocean winds“
- Line 49: „has“ □ „get“
- Line 69: „only include information“ □ „include only information“
- Line 88: „Further“ □ „Furthermore“
- Line 141: „improves“ □ „calculates“. Please consider changing all other „improve “ in this paragraph and the next one to „calculate“ or „produce“
- Line 206: „at 3 km“, 3km resolution? Or 3km height? Please specify it.
- Line 208: The sentence „Increment in wind and hydrometeors show similar patterns, depending on the DA method“. Please consider rewriting this and the similar sentences in this section. The sentence is unclear and ambiguous.
- Line 235: „,the LETKF underestimates the temperature,“ □ „.there is an underestimation in the temperature derived from the LETKF method,“
- Line 253: „Note the amount of change in the snow mixing ratio“, what is the point of this sentence?
- Line 278: „The observed GRS radar CFAD“ □ „The observed CFAD of the GRS radar“
- Line 294: „In Case 1, The“ □ „In case 1, the“
- Line 305: „hour prediction“ □ „forecast hours“ please also consider replacing the „prediction“ with „forecast“ in this and the next section.

Please also note the supplement to this comment:

<https://gmd.copernicus.org/preprints/gmd-2022-18/gmd-2022-18-RC3-supplement.pdf>