Review of manuscript

“Assimilation of GPM-retrieved Ocean surface Meteorology Data for Two Snowstorm Events during ICE-POP 2018“

by Li et al.

General assessment:
The manuscript describes the assimilation of GPM-retrieved near-surface variables into the WRF model for two snow-storm case studies during the ICE-POP 2018 research and forecast programs during the Olympic and Paralympic Winter Games.
The impact of the assimilation of this data into a numerical weather prediction model and its impact for winter storm prediction is in general an interesting topic. However, from my perspective the publication of the present manuscript can only be considered after substantial revision.

Major comments:

- The conclusions drawn from the two experiments are partly self-evident and don‘t provide much useful insight. It is shown that the assimilation draws the analysis closer to the assimilated observations, however, unless there is a bug in the system, this is to be expected. Moreover the authors show and discuss over several paragraphs that the effect of the assimilation are lost quickly during the forecast by the atmospheric dynamics. This is also a normal effect in the dynamic atmosphere, so for the reader it is not so much of interest **that** it happens, but rather **how long** the desirable positive impact lasts. Also the conclusion that A-B (which is actually the increment added in the assimilation step, which is not mentioned in the manuscript) has the same pattern with respect to positive and negative values as O-B is self evident and can be inferred directly from the equations of the data assimilation algorithms.
- I would suggest to rewrite and restructure the manuscript answering the following questions more clearly:
  - What data is assimilated? Describe the GPM mission (I think it is not even mentioned that this is satellite-based...) and not only the retrival of the variables
  - What is the effect on the **analysis**? Verification against independent variables would be desirable
  - What is the effect on the **forecast** (on different variables such as precipitation, temperature...), and how long does it last?
- Motivation: For an improved prediction of snowstorms probably upper air observations would be more useful than these surface observations. This does not mean it is not interesting to exploit this surface data for data assimilation, I just wonder whether the motivation could be formulated slightly broader, e.g. to find out which variables can be improved during these two case studies, and which not.
- Figures: The manuscript contains many too many figures, and many of them do not contain conclusive information, thus can be omitted without loss of information
  - The scatterplots in Figure 5 could be omitted
  - Figure 7 and 8: Can be omitted, it only proves that the atmosphere is a dynamic (chaotic) system
  - Figure 9 can be omitted, Figure 10 is much more informative
  - Figure 11: a RMSE value would probably give more information than this Figure
  - Table 2: It would be much more illustrative to have some visualization here… Time-series or bar plots for example

Minor comments

- L90: This sentence is self-evident. Should be omitted.
- L103: What kind of observations?
- L109: ocean surface meteorology conditions is too unspecific here
- L128-130: What kind of radars are the KMA radars, and what exactly is PIP
- L156-158: This last sentence of the paragraph is not clear to me
- Page 7: Which model domain and which resolution was actually used for the data assimilation experiments? Was the data assimilated into all three model runs?
- L 223-225: Is xb the same as xguess?
- L27: What is pseudo relative humidity?
- L237: What kind are the satellite wind data? Atmospheric motion vectors? Or Scatterometer data?
- L251: What do you mean the data assimilation results are compared with WRF simulations? Don't you actually compare analyses and forecasts with observations?
- L269: Isn't actually the humidiy of the model higher than that of the observation, if you get a negative observation minus background?
- L291: A-B is actually the increment that is added to B in the assimilation step.