Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2018-246-RC2, 2018

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Assimilation of wind data from airborne Doppler cloud-profiling radar in a kilometre-scale NWP system" *by* Mary Borderies et al.

Anonymous Referee #2

Received and published: 22 October 2018

Review comments to the paper "Assimilation of wind data from airborne Doppler cloud-profiling radar in a kilometre-scale NWP system", manuscript nhess-2018-246.

This paper describes the assimilation of airborne W-band radar observations in a km-scale NWP model. The observations are collected from aircraft flights but the main purpose of the paper however, is to introduce this observation type in preparation for satellite based observations. This is why the paper is important and interesting. However, to draw any strong conclusions from this study, e.g. whether a short or long assimilation window is more beneficial is too wild I think. The results are also rather inconclusive as shown by the authors. The reason is that the observations are very

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Discussion paper

limited both in time and space. The functionality and positive results however are very promising. My opinion is that the paper is well written and worth publishing when the comments below are taken into consideration.

Comments: Page 2, line 16: "...at each kilometer levels..." Please explain better what this means?

Page 2, line 35: What is different compared to the operational version? Just a brief, short explanation would be good.

Page 3, line 30: 7.8 m/s is a rather low value for the unambiguous velocity. In fact this is one of the main challenges in Doppler wind assimilation. A de-aliasing, or unfolding algorithm can work fine for unfolding once but what if the wind speed is high enough to fold twice? Then it will be much more uncertain. Are the authors confident with the algorithm used and/or that there are no wind speed above this limit? Another complicating factor is that the aircraft is moving and this also needs to be taken into account in the unfolding. Perhaps it is outside the scope of the paper to discuss this in detail but a brief discussion about this is necessary since it is crucial when using the data.

Page 5, line 21: "every 3 time steps" What does this mean?

Page 5, lines 25-28: It could also be so that "important" data is collected late (or early) in a longer assimilation window if the aircraft e.g. flies into a convective cell. In studies like this it would also be very beneficial to run with FGAT (First Guess at Appropriate Time) or even better using a 4D-Var assimilation scheme.

Page 6, line 10: The same observation error as radiosondes. Isn't this a bit optimistic?

Page 6 lines 11-13: Is there any other quality control applied to the observations? If yes, what and how. If no, why not?

Page 6, lines 20-24: The last two sentences in the paragraph is really hard to follow. Please re-write to make it more clear.

Page 7, table 1: In the column of assimilated data it says Conventional and Conventional + RASTA. Are only conventional observations assimilated apart from the RASTA observations? In section 3.2 there are many more observations mentioned that are not consider to be conventional, e.g GNSS and satellite data.

Page 7, lines 10-14: The data collection starts at 06:10 and the analysis time chosen to study is 06:00. This means that the 3 hour window only will be a 1.5 hour window. Is there no better example where one can find a data collection more centered around the analysis time. Why not show an example from 09:00? Then the data collection will also be skewed but there will at least be data available on both sides of the analysis time.

Page 7, line 20: "...expected to improve the forecast..." Is this really the case? It depends on how the data is introduced, observation errors and how the model performed without the data.

Section 5.2: It would be interesting to see the same case in a cycled period. If the cycled run builds up its own "climate" could the results be even better?

Page 8, lines 19-25: Please explain figure 5 better.

Page 9, line 9: The observations assimilated are not from $\pm$30 minutes from 06 UTC. They are from +30 minutes. Right?

Page 9 and figure 6: This is a typical behavior when observations are assimilated with a too small observation error. The analysis is adjusted to fit the RASTA observations too much but as soon the model starts running it adjust itself to its own more comfortable state. The analysis will look very good, especially compared to RASTA observations, but there will be a spinup to the model state as seen in the figure. Why not run the same experiment with different observation errors too see if that can reduce the spinup and improve the forecasts, not only the analysis?

Page 9, line 28: What forecast lengths are used for the 12 hour accumulation? Inter-

esting to know in view of the above discussion about spinup.

Page 10, line 18: Calculations are only performed over the 35 runs (I assume that this means analysis times) with RASTA observations. Why?

Page 13, line 11: Again quality control is mentioned and that it is important. What quality control was applied to the data assimilated here (see also comment above)?

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