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Interactive comment on “Snow on the Ross Ice Shelf: comparison of reanalyses and observations from automatic weather stations” by L. Cohen and S. Dean

Anonymous Referee #1

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Review comments

Snow on the Ross Ice Shelf: comparison of reanalyses and observations from automatic weather stations

L.Cohen and S. Dean

This paper describes a comparison of NCEP and ERA-Interim Re-analyses with acoustic depth gauge observations for the Ross Ice Shelf region, Antarctica. Since it is very difficult to determine absolute precipitation amounts from depth gauge observations, the comparison is based on occurrence of precipitation events. I found the manuscript

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interesting, well written with a clear structure and goal.

I do have some remarks, which are listed below.

General remarks

Although I found it a nice overview of how well NCEP and ERA-Interim perform with respect to precipitation over a specific region of Antarctica, the conclusions do not really provide new insides. Given the event type nature of the precipitation, other studies (Antarctic, but also from mid latitude evaluations) already showed that absolute amount, timing and location of the events are not always well captured in the models.

Furthermore, I am missing some discussion points in this manuscript. The focus is completely on NCEP and ERA-Interim reanalyses while some of the problems and results found can probably be generalised to analyses of Numerical Weather Prediction (NWP) models in general. Furthermore, NCEP and ERA-Interim are certainly not the only models used for mass balance studies over Antarctica. In this respect I am also missing in the introduction a general overview of how NWP models perform with respect to precipitation, not only for Antarctica but other regions as well, and also how the findings in this manuscript relate to these performances.

The authors discuss in details the uncertainty in the observations, and how that may affect the comparison. However, I am missing a discussion on how model related issues may affect the comparison. This refers to different model parameterisations, but also to model resolution. For example, modelled precipitation is not independent of model resolution, see e.g. the double penalty problem when increasing model resolution. In this manuscript model output on different resolutions are compared. How does that affect the results? Furthermore, both models are run at higher resolution than used in this study. What methods are used to convert precipitation to the courser resolution and how does that affect the results? I am also missing information about where the grid

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points of the models are with respect to the AWS. Although for Antarctica, 9 stations in the Ross Ice Shelf area is a reasonable amount, the AWS are not located in areas representative for the flat region of the Ross Ice Shelf. They are all lined on the edge of the ice shelf at the foot of the Trans Antarctic Mountains. That makes the comparison with model data especially sensitive to which model grid point is used, on the plateau or on the ice shelf. Furthermore, distances between AWS site and grid points of up to 100 km occur, which is significant. How much does that influence the results?

I would not call the described method as 'new' since more studies have been carried out showing comparisons between model precipitation and observations based on the occurrence of single events, although perhaps not as extensive as in this study. Note also that several studies of evaluation of precipitation in global weather forecast models are available.

Results and discussion are very specific for ERA-interim and NCEP on the given resolution and the chosen region. I would like to see that this is put into a bit broader perspective. Not necessarily adding more AWS observations in other regions, or another model, or different model resolution, but at least discuss the broader implications.

Specific remarks

Abstract

- P1244 L2 replace 'is developed' with 'is carried out'.
- P1244 L4 See comment above.

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Introduction

- P1245 L25 See comment above, I am missing a discussion on general performance of NWP modeled precipitation.
- P1245 L29 Write out the abbreviations when mentioned for the first time (such as ECMWF).
- P1246 L18 Replace 'represents' with 'represent'.

Site description and snow accumulation data

- P1247 L24 Consider adding 1 or 2 figures illustrating the general (wind) conditions in the Ross Ice Shelf region.
- P1248 L22 Replace 'accumulations' with 'accumulation'.

Data processing

- P1249 L26 The SR50 records the distance to the snow surface based on the speed of sound at 0°C. Are these data corrected for temperatures deviating from 0°C ?
- P1250 L6 Remove 'of' between 'timing' and 'can'.
- P1250 L20 See comment above. What is the effect of the different resolution on the estimated amount of precipitation?
- P1251 L3 Where are the grid points located with respect to the AWS and what is the effect of the horizontal difference of up to 100 km, which considerable, on the amount and timing of the events?
- P1251 L16 Consider adding a figure with time series of daily accumulation/precipitation rate for 1 site as a function of time including the cut off line to illustrate

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this procedure.

- P1251 L17 Do I understand this correctly that when there is no overlap in time but there is not more than 1 day difference in time, the event is considered to overlap?

Results

- P1252 L1 Remove 'the' before 'ERA'.
- P1252 L4 Explain or discuss possibilities why ERA is producing much more precipitation than NCEP.
- P1252 L23 In the last 2 paragraphs of this page a comparison between ERA and NCEP is given based on Tables 2 and 3. This comparison is a little difficult because the time periods for both models are different. For an easier and more honest comparison, please compare/present only for the same periods.
- P1253 Somewhere on this page, you should discuss the influence of model resolutions and distance between AWS and model gridpoint on the found correspondence between models and AWS, and the found difference in correspondence between NCEP and ERA. For example what role this plays in the found 'false' events.
- P1254 L17 Although 90% is significant, I am not really convinced, especially since the figure 4 is too small to see anything in it.
- P1255 On this page some discussion on model resolution and inaccuracies is also appropriate.

Conclusions

- P1255 L23 Remove 'new'.
- P1255 L26 Add 'relatively' before 'dense'. Remark that although the Ross Ice Shelf is indeed relatively flat, the locations of the AWS are not really representative for the area

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since they are lined along the foot of the Trans Antarctic Mountains or other topographic deviating regions.

- P1256 Discuss the resolution and other relevant model issues.
- P1256 L16 Add that the significance level is 90%.
- P1257 I am missing some remarks towards a more general conclusion on precipitation events in NWP models. It remains very specific for NCEP and ERA at the given resolution.

Figures

Figures 2 and 4 are too small. Consider plotting them in 3 rows of 3 panels. The grey box for Margaret (fig. 2) is not visible in these size plots.

Figure 3. Check the second sentence of the caption, the last part about the different scales of the axes is not correct English.

Interactive comment on The Cryosphere Discuss., 7, 1243, 2013.

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