

Review comments for: “Synoptic development during the ALOUD/PASCAL field campaign near Svalbard in spring 2017”

This manuscript characterizes the synoptic conditions during two concurrent campaigns, one ship-based and one airplane-based, conducted in May and June 2017 in the region north of Svalbard. The analysis aims to provide climatological and synoptic context for the interpretation of subsequent analysis of cloud and aerosol data. During the campaign, three distinct periods are classified and described using various data sources. This manuscript shows how synoptic variability is related to the variability in surface observations, atmospheric profiles, and clouds using the campaign-based data as well as Ny Ålesund observations, reanalysis and satellite data. The analysis also shows that sea ice conditions are largely driven by large-scale atmospheric circulation during this period. The synoptic variability is also put into a climatological context using Ny Ålesund records and large-scale atmospheric indices.

This manuscript provides relevant and significant contribution to the scientific community. I recommend the manuscript for publication with some relatively minor modifications. These are described in the general and specific comments below.

General comments:

In general, throughout the manuscript, the text could be more concise by focusing on the most relevant points from each figure rather than simply describing everything about it. This would help the reader understand which features or points are most important. There are more specific notes below in the Specific comments.

Several figures could be eliminated or combined for clarity. These are pointed out in the specific comments below.

The discussion of synoptic settings (Sec 3.1) needs some clarity. It may help to highlight specific periods on Figure 2, but in general, the narrative style is a bit difficult to read, so perhaps also shortening it a bit would help. Some suggestions are made in the Specific comments below.

It seems the conclusions could be stated more explicitly in order to express clearly what the conclusions from this analysis are and why they are relevant. For example, this work shows that 1) the synoptic variability in this region drives much of the surface meteorology, atmospheric profiles, and cloud distribution; 2) the large-scale atmospheric circulation drives sea ice distribution during this period; 3) Ny Ålesund is fairly representative of the mid-to upper troposphere in this region; 4) understanding the boundary layer variability is important for understanding surface observations; 5) synoptic variability is linked to the large-scale atmospheric variability. These are just a few key results that are not included in the conclusions.

Finally, the text could use another round of editing to improve the language and readability.

Specific comments:

P1 L5: Not sure what is meant by “classical” near-surface... observations.

P4 L23 & P5 L1: Include “Vaisala” before RS41 and RS92

P5 L1-3: These first two sentences are poorly worded. Please clarify.

P5 L34: Explain what “level 2 cloud cover” is.

P6 L2-5: Sentence is poorly worded.

P6 L14: It should be noted that the Ny Ålesund radiosondes are assimilated into ERA-Interim. Were the extra sondes launched during this campaign also assimilated?

P7 L2: Describe the synoptic situation that is driving this cold air outbreak. This could be shown using the synoptic maps that are included in Fig A1.

P7 L3-7: This paragraph is not at all clear. Please rework to clarify.

P7 L8: "The variable wind direction over Svalbard finally caused the highest precipitation..." It cannot be said that wind direction caused precipitation, please explain this more clearly.

P7 L10: In this discussion, it would be helpful to highlight the periods in the timeseries (in Fig 2) that you are describing.

P7 L13: "A few days later..." Its not clear which days are being referred to here.

P7 L18: How do you know there was an atmospheric river? It is not apparent in Fig A1c that it would it be coming from the east. This should be clarified.

P7 L26: This paragraph is not clear. This first mentions beginning of snow melt season, but then switches to first snow-free day and albedo. Please make this more clear.

P9 L14-31: The discussion of lifted inversions does not add much to the overall analysis. Perhaps it could just be mentioned briefly or merged into the discussion of Figure 3?

P10 L27-30: It doesn't seem that the CWTs add much to the discussion or understanding of the synoptics or large scale circulations. In fact it only raises questions (eg. CWTs for Ny Ålesund and Polarstern are more different that one might expect!). I think this discussion (and Fig 5b) could be left out altogether.

P11-12: It is not clear that the back trajectories are adding much to the analysis, and in this section there are some issues with these trajectories that are not addressed. The main issues are 1) the very large uncertainties that exist for going back 10 days (only 5 days is often used for this reason) should be addressed; 2) spatially averaging trajectories with large variability can be very misleading and this should be acknowledged; and 3) it seems overly complicated to use PES instead of a simple residence time (perhaps you could use HYSPLIT instead of FLEXPART)?

P12-13: This section discussing Fig 7 could be much more concisely written. What are the key features of Fig 7? Rather than describing every feature of the plots, just focus on 2 or 3 important points.

P13 L26: Figures A3 & A4 are not mentioned further in the text, and can therefore be eliminated.

P16 L22: Very minor point, but perhaps Section 5.1 should be titled "Large-scale indices" since it does not actually deal with atmospheric dynamics in any way.

P18 L20: Not sure you need Figure 13; I think the text description here is enough.

P19 L8: Make more explicit that SHEBA was in a completely different part of the Arctic and that there are considerable regional differences.

P19 L14-18: Not sure that any of this comparison to SHEBA is relevant due to different region and different climatology. I think it just confuses things, I would leave this out.

P19 L19-24: This paragraph is very confusing, since both Tara and SHEBA are mentioned in comparison to ACLOUD/PASCAL. Please make this more clear.

P20 L1-4: Again, the comparison here is irrelevant because of the different measurement heights and season.

P21 L1: Change to "The sea ice drift resulting from the large-scale atmospheric circulation caused..."

P21 L2: Delete "respectively".

FIGURES:

Fig 2a: The 850hPa windspeed presented as bar graph seems a bit odd, perhaps would be better as just points or line?

Figs 3 & 4: Perhaps these figures could be merged?

Fig 12a: The color scheme should have a smooth transition from day 80 to 160.

Fig 13: could be eliminated.

Fig A1: The grey contours cannot be seen, even when zoomed in a lot. Perhaps just choose the 2 parameters to show here, instead of 3.

Figs A3 & A4: could be eliminated.