Review for:

"Low-level mixed-phase clouds in a complex Arctic environment"
by Gierens et al.

This study examines the influence of local topography and large-scale weather patterns on mixed-phase clouds (MPCs) observed at Ny Ålesund (Svalbard) for a 2.5 year period. They find that MPC occurrence is higher when westerly winds prevail; these clouds are also characterized by somewhat enhanced liquid and ice water contents. MPCs are also found more frequently decoupled from the surface; cloud-surface coupling (or decoupling) is attributed to local wind patterns.

The paper offers some useful insights regarding the behaviour and characteristics of Arctic MPCs. Some of the results could further be used for model evaluation. However, the comments below should be addressed before it is accepted for publication:

Major Comments:

(1) Section 4 is mainly a description of statistics. No attempt to physically interpret these results is made before section 5. I would recommend to the authors to discuss the underlying physical processes and how these are supported by the statistics during section 4. It is hard to remember all the details of this section when reading the recap in section 5.

(2) Seasonality is discussed in section 4.1 and regional wind patterns in section 4.2, but there is no attempt to investigate the links between these two factors. If a certain wind pattern dominates specific seasons, this should be considered when interpreting the results in section 4.2. The authors should present the frequency of the different wind patterns through the year.

(3) When using the MWR θ-profile to assess decoupling, $\Delta\theta$ between the surface and the height half way to the liquid layer is estimated. But if decoupling occurs between this level and liquid base height, then the algorithm would classify a decoupled cloud as coupled. Do results vary significantly when using the gradient between the surface and the level exactly below the liquid layer as criterion? Please check the uncertainty in the applied method

(4) A main conclusion is that cloud-surface coupling is more frequent when wind comes from the sea and that it enhances cloud liquid. However for these conditions coupling occurs for somewhat less than 50% of the time. I suggest to the authors to investigate the meteorological conditions (e.g. large-scale moisture transport) between the decoupled and coupled cases when NW surface winds prevail. This might give indications of what drives coupling, which I don't think is the local wind pattern.

Minor comments:

Abstract: it is stated that westerly clouds had a higher mean liquid (42 g m^{-2}) and ice water path (16 g m^{-2}) compared to the overall mean of 35 and 12 g m^{-2}, respectively. Is a 7 g m^{-2} difference in LWP important, given the large uncertainty in these retrievals? Moreover, I doubt that the impact on radiation is substantially different when changing cloud LWP by 7 g m^{-2}. I don't think differences of this magnitude should be emphasized in the text.

Sections 2.3 and 3.3 offer a summary of the methods used to study the influence of the large-scale and the local wind patterns, repsectively. However the first method is included in Section 2 (Observations) and the second in Section 3. It would make more sense if section 2.3 becomes a subsection of Section 3, too.

Section 4.1: The percentages given in this section would be more meaningful if the actual number of PMPCs and all-PMC cases included in the analysis is stated. Is it same as in Figure 2?

L300-302: how different are the occurence statistics in the sensitivity test?

L481-484: here you combine Figure 5 and 10a to discuss how wind structure affects the PMPCs. However, Figure 5 corresponds to a much longer period than Figure 10a. For consistency, both wind and cloud measurements should correspond to the same time. Please check if utilizing fewer radiosondes results in very different wind structures. If this is the case, then you might consider removing/modifying the relevant discussion.

Figure 6: it would be better if the actual number of profiles is also included in the figure.

Figure 9: the size **of** the dots