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Reply on RC1

Elisabeth Schlosser

Community comment on "A 25-year climatology of low-tropospheric temperature and humidity inversions for contrasting synoptic regimes at Neumayer Station, Antarctica" by Tiago Silva et al., Weather Clim. Dynam. Discuss., https://doi.org/10.5194/wcd-2021-22-CC1, 2021

We thank Referee #1 for the fast review with helpful comments. We will provide a detailed answer when both/all reviews are available, but would like to briefly comment on the referee's comments right now.

We realize that we failed to sufficiently explain our method to define the different weather conditions. Different from the Arctic, weather and climate at Antarctic coastal stations is strongly influenced by the circumpolar trough, a climatological low pressure area that results from a number of cyclones that regularly develop and move eastwards above the Polar Ocean. Weather at Neumayer thus has a fairly "binary" character: either overcast conditions with precipitation (and or blowing/drifting snow) and high wind speeds from easterly to NNEly directions related to a cyclone passing in the north of the base, or, between two cyclones, fair weather conditions with south to southwesterly winds and low cloudiness.

Thus a classification based on model pressure fields, wind direction or cloudiness, as the referee suggests, would basically lead to the same results as our classification based on SYNOP observations. We will add this information in the revised version of the manuscript.

We agree that clouds or warm air advection without precipitation can be very important in the formation or destruction of inversions, however, this is more important in the interior of the Antarctic continent and negligible at Neumayer. (cloudiness would be a difficult variable anyway as there are no eye observations at night and, during the polar night, observation of clouds is difficult and not reliable.)

At Neumayer, as we state in our study, the cyclones (that bring precipitation) are very important for the formation of elevated inversions since they are usually associated with advection of relatively warm and humid air masses.

We also stated that surface based humidity inversions are caused by deposition of hoar frost which is caused by radiative cooling. Arctic and coastal Antarctic conditions are very different, and there are clearly more studies available for the Arctic than for the Antarctic.

We would like to stress that our study is the first in Antarctica to investigate humidity and

temperature inversions at different levels and for different weather conditions and by far for the longest time period (25 years). Seasonality of various inversion features were studied in detail and their relationships with each other and different formation mechanisms were discussed.

As we state in the conclusion, more detailed studies including the surface energy balance and advection terms from models are recommended, but beyond the scope of our study. In particular, the formation and destruction of inversions could be studied with the abundance of data available at Neumayer, but this would be better done in numerous case studies than for a complete 25-yr data set.

So, we will use the suggestions of the referee to improve our introduction and methods section, including a more detailed comparison with Arctic conditions and the revised version of the manuscript will clarify all these points. (T.Silva and E. Schlosser)