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Atmospheric Chemistry and Physics Discussions

# *Interactive comment on* "Atmospheric moisture supersaturation in the near-surface atmosphere at Dome C, antarctic plateau" *by* Christophe Genthon et al.

**Anonymous Referee #2**

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Review of "Atmospheric moisture supersaturation in the near-surface atmosphere at Dome C, antarctic plateau" by C. Genthon et al. MS No.: acp-2016-670

This manuscript reports surface humidity observations from Concordia station in Antarctica. It intercompares a heated humidity sensor with a frost point hygrometer and then also compares the results to models. The goal is to look at ice supersaturation. There are some comments about isotope effects and surface fluxes and how they might be affected by the results.

The paper needs major revision. The data analysis is not complete: there are high values that are eliminated and claimed to be important. I am not convinced that there may not be evaporation of ice crystals in the heated inlet, or blowing snow, leading



to anomalously high ice supersaturation measurements. There are also low biases eliminated without explanation why. I think that is because the frost point has a limited dew point, but I am not sure.

Also, the effect of ice supersaturation on isotopic fractionation is mentioned as motivation, but there is now real information here, except some passing discussion (which I do not think is correct).

Surface fluxes are also noted as an important reason for measuring near surface ice supersaturation, and some calculations are made, but these show no effect of the difference in ice supersaturation. That null result should be more prominently stated.

Detailed comments:

Page 2, L15: in general polar regions are an exception, even high latitudes of the S. ocean. It is not just Antarctica.

Page 2, L30: last sentence of abstract is awkward. Maybe state this as an implication of these results?

Page 4, L57: ice supersaturation is common at low altitudes at high latitudes, particularly in stable environments.

Page 4, L60: how close to what tropopause and when? Summer Antarctic conditions still feature mixed phase clouds and supercooled liquid to -30C (Lawson and Gettelman, 2014, PNAS). Be more specific.

Lawson, R. Paul, and Andrew Gettelman. "Impact of Antarctic mixed-phase clouds on climate." Proceedings of the National Academy of Sciences 111.51 (2014): 18156-18161.

Page 5, L84: this is a good point that highlights the uniqueness of Antarctic supersaturation.

Page 6, L112: using direct in situ measurements...

Page 7, L130: has hosted a

Page 9, L177: heating will however evaporate any ice crystals in the air, making this a total water measurement. Do you have a particle counter too? Do you know whether there are particles being evaporated? This is a critical point.

Page 12, L243: is accuracy related to the level of RH? I.e. What if it is extremely dry?

Page 15, L300: all times during the day

Page 15, L303: ,but. (Correct)

Page 15, L309: both of the latter

Page 18, L345: if the temperature and humidity do not match (the errors do not match) then is there a process problem with the ECMWF model?

Page 20, L386: what is happening for RHi > 200% ? That seems like an error. Might that affect other measurements below 200%?

Page 21, L407: has the filtering been done only on the observations? I.e. If the models produce over 150% but the observations do not, has that been reported? It should be reported .

Page 21, L414: is the difference because the frost point is too low as the air gets dry?

Page 22, L419: but there are also deviations at high moisture content. Why is that?

Page 22, L425: at odds... Reflect instrument limitations

Page 22, L435: how do you know if it is correct to remove here low points? Is this a problem with the frost point? You should know if you hit the minimum dew point.

Page 25, L453: direct estimates of

Page 29, L540: but you haven't shown them and filtered them out. Are they an error or not?



Page 31, L572: why is th flux wrong? In the previous section you have shown super-saturation does not matter for the surface fluxes. Please explain.

Page 32, L601 : most isotope schemes in models do account for kinetic effects. I don't know that this discussion of isotopes helps the manuscript very much, you only discuss it in the intro and conclusions.

Page 32, L604: again, you eliminated these from the analysis and I am not convinced they are not an error. Please show them if you are going to discuss them. What instruments showed this and how do you know it was not blowing snow/ice?

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