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Interactive comment on "Isotopic exchange on the diurnal scale between near-surface snow and lower atmospheric water vapor at Kohnen station, East Antarctica" *by* François Ritter et al.

Anonymous Referee #1

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The paper deals with post-depositional processes that affect the isotopic composition of surface snow in Antarctica. An exact knowledge of these processes is important for a correct paleo climatic interpretation of ice cores. Recently, it was found in Greenland that the interaction between atmosphere and the snow surface between snowfall events influences the stable isotope ratio of the snow much more strongly than previously thought. The paper describes the first continuous measurements of stable isotope ratios of water vapor on the Antarctic plateau, which were combined with high-temporal resolution measurements of the isotopic composition of surface snow. It is a highly interesting paper with important results and certainly worth to be published in TC. It is mostly well written, the English is generally ok, but not free of small errors (tenses etc.)

and slightly awkward formulations, on which I won't always comment in detail since I believe that this is not the job of a reviewer (while professional companies charge a lot of money for it). This should be checked. The description of previous work could be a bit more elaborate. I do not have expertise in measuring with, and calibration of, a Picarro, so I cannot assess this part. Generally, it is described in detail and seems to have been done with highest diligence. I have a couple of small specific comments (see below). My recommendation is to publish the paper after minor revision.

Specific comments:

32: what is a meteorological time scale? Better use "synoptic" if that is what you mean. (e.g. diurnal variations are also meteorological)

45: to avoid any confusion, please define humidity mixing ratio

91ff: How do you define a precipitation event? It is not correct that precipitation occurs only in summer, and at Kohnen station, only about 20% of snowfall events is directly related to synoptic systems. (additionally, there is diamond dust precipitation, which is not so rare). I personally don't like reviewers, who always want their own papers quoted, but, of course, everybody knows their own papers best and, unfortunately, I do not know any other paper that investigates Kohnen precipitation but Schlosser et al. (2010), which gives some more information about the topic.

101: Shortwave radiation, which includes direct radiation and diffuse radiation

108: You might consider quoting Birnbaum et al. 2011 here (she is one of your co-authors anyway).

111/112: is that your own definition of snowfall and light snowfall? Does "light snowfall" correspond to diamond dust? (Be careful with terms that are already defined)

122: "ratio" rather than relative composition

126: dito

136: explain SLAP and GISP

162: relationship between ïĄd'D and q

222/224: snow accumulation or erosion (not depletion)

243: what is the approximate height of the lowest model level? How is the model 2m-temperature calculated? This would help to explain the differences between model and observations.

256: see above

258: hourly values

268: which have data gaps larger than 8h

271: daily mean values of what?

292: strong (or high) depletion

294: you compare only to the simulated data, how about the measured meteorological data?

305: see comment 352

308: "and" rather than "versus"

336: the mean wind speed is... (delete "concerning the wind speed")

352: is that coincidence then or do you have an explanation for it? You mention this several times, and it is not clear if it is just by chance or if it hints at the ability of the model to calculate this correctly.

407: condensation: strictly spoken, condensation is the transition from vapor to liquid, whereas the transition from vapor to solid is called "deposition" according to the Glossary of Meteorology of the AMS (American Meteorological Society). Sometimes the term re-sublimation is used, too. You should explain this at the first point where

"condensation" occurs in the paper and then stick to one expression, whichever you prefer.

413: Fig. 5: surface height anomaly

452: wind advection? There is advection of warm/cold air or moisture, but not of wind. The wind is rather the cause of the advection.

468: please give a reference for the height of the polar boundary layer

472: Do you mean negative and positive trends rather than decreasing and increasing (thus changing) trends?

486: Why do you assume liquid water? Is this only a model assumption or do you have physical evidence for it? Maybe rephrase a bit.

489: with the relative humidity RH.... and the kinetic fractionation factor k...

536: which is of the same order of magnitude as the observations

551: I suggest deleting "striking". If the results confirmed earlier results by St.-L. they were not too surprising. This does not lower their value, of course.

564: This is likely...

570ff: the fractionation takes place no matter if the wind causes erosion or not. Please, rephrase.

576: you write "partly". Are there other possible reasons for the small day-to-day variability?

Fig. 6 - Fig. 9: I suggest removing the figure titles (in the boxes) for clarity, since the legends already take quite a bit of space, and the caption describes the contents anyway. Also inserting grid lines seems to be always helpful. The legend of Fig. 6 would be easier to read if the explanations of the different lines were placed simply to the right of the lines.

Ref.:

Birnbaum, G., J. Freitag, R. Brauner, G. König-Langlo, E. Fischer, S. Kipfstuhl, H. Oerter, C. H. Reijmer, E. Schlosser, S. H. Faria, H. Ries, B. Loose, A. Herber, M. G. Duda, J. G. Powers, K. W. Manning, M. R. Van den Broeke, 2011. Strong wind events and their influence on the formation of snow dunes: Observations from Kohnen Station, Dronning Maud Land. J. Glaciol. 56 (199), 891-902

Schlosser, E., K. W. Manning, J. G. Powers, M. G. Duda, G. Birnbaum, K. Fujita, 2010. Characteristics of high-precipitation events in Dronning Maud Land, Antarctica. J. Geophys. Res., 115, D14107, doi:10.1029/2009JD013410.

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