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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Precipitation regime and stable isotopes at Dome Fuji, East Antarctica" *by* A. Dittmann et al.

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This manuscript studies the regimes of precipitations and their stable isotopic composition at Dome Fuji (East Antarctica) based on 1-year observations and on modeling (AMPS, ECHAM5-wiso and MCIM).

It is found that 60% of the precipitations were caused by synoptically-induced events, while the remaining 40% are due to diamond dust (although these numbers depend on the definition used for synoptic precipitation and diamond dust).

The synoptic situations were analyzed and classified in 5 categories, with the most common being an upper-level ridge that extends onto the Antarctic plateau and causes strong northerly advection from the ocean.

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A mean source of precipitation centered at ∼55°S was determined.

MCIM was able to reproduce the seasonal cycle of deuterium, O-18 and deuterium excess, but the isotopic fractionation was on average underestimated, even after tuning the model. ECHAM5-wiso was on average closer to the observations, but it could not reproduce the seasonal cycle of excess. This is problematic for using this kind of GCMs equipped with isotopes to interpret the deuterium excess records.

This study has consequences for ice core interpretation. It is indeed found that the relationship between d18O and surface temperature is higher for precipitations events that for diamond dust. This is an important conclusion regarding the use of the isotopic paleo-thermometer.

It is also found that deuterium excess does not have any clear link, neither with relative humidity, nor with sea surface temperature at the moisture source. This challenges the use of excess to reconstruct source conditions.

Before giving my comments, I should state that I am not an expert of atmospheric processes. So I am not well aware of the recent bibliography regarding atmospheric processes in Antarctica, although the current study gives a good overview of previous works in its section 2. That being said, I found this manuscript particularly easy to access for a non-specialist. Everything is very clear and accessible.

As an ice core scientist, I found that this study has important implications regarding the use of isotopic composition of ice to reconstruct past temperature and snow accumulation conditions at the site of deposition. For example, the correlation between snow isotopic composition and surface temperature is weak for diamond dust, which represent almost half of the precipitations at Dome Fuji. Also, the corrections based on deuterium excess applied to reconstruct past temperature variations seem to be not appropriate. Overall, I found that this study is almost ready for publication.

Minor comments :

- p. 2, l. 11-12: "In the light of .. fluctuations (Masson-Delmotte et al., 2006)" I would place this sentence right at the beginning of the introduction.

- p. 2, l. 27-28: "Noone et al. (1999)" -> "(Noone et al., 1999)"

- p. 5: Please better explain what is "Rayleigh-type model", "trajectory model", "simple isotopic models".

- p. 6, l. 28: dot after "2009)".

- p. 8, l. 1-3: what is the chosen value for n?

- p. 12, l. 21-23: I did not understand why the arrival level of precipitations is not determined by the model.

- p. 13, l. 21: "rout" -> "root"

- p. 14, l. 28: "cantered" -> "centered"

- p. 15, l. 27-28: "contrary to the assumption used for decades in ice core studies..." I am not sure this was really the assumption made in ice core studies. Ice core scientists simply said that the isotopic composition of precipitation is linked to the site minus source temperature difference, and not to the site temperature alone.

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