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Interactive comment on "A Lagrangian analysis of the present-day sources of moisture for major ice-core sites" *by* A. Drumond et al.

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Thank you very much for your review. Please, read our answer to your commentaries below.

* In the Introduction on the discussion on D-excess there is no mention of air moisture trajectory history as a control, ie the D-excess will change when moisture moves over dry as opposed to wet land for example (a major influence in the Central domain?). Should trajectory history be added?

- This statement has been mentioned in the first paragraph of the Introduction.

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* In the second paragraph (and the title) the authors mention the Lagrangian diagnostic

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scheme but there is no explanation of this for the non-expert.

- We totally agree that the explanation of the method would be more detailed for in order to illustrate the potential use of the technique for the scientific community. Please, read the answers for the Reviewer 2 and the re-written version of the “data and methods” section.

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* The authors follow a previously published approach from about a decade ago, which was updated in a 2014 paper, but they do not consider the updates. It wasn’t really clear to me why they didn’t apply the updated method.

- The methodology applied here follows the pioneers works of Stohl and James (2004; 2005) simply considering the regions of (E-P) >0 as moisture sources and tracking all the air masses reaching the target region, being or not associated with precipitation events. Other moisture sources diagnostic schemes are available (Gimeno et al.2012), such as the Lagrangian method proposed by Sodemann et al. (2008) to identify the origin of precipitation. In their approach, the cumulative moisture changes along the trajectory are also considered besides the net gain or loss at each grid point, what is necessary for quantifying the contribution of the air parcel for the precipitation in the target region. Anyway, since the purpose of the present work is to estimate the climatological moisture sources of all air masses reaching the target regions, independently of the occurrence of precipitation in the ice core sites, we believe that the use of this simple Lagrangian approach is reasonable. This discussion was included in the last paragraph of the “Data an Methods” section.

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* Overall they identify moisture source areas which are as expected or have previously been identified from trajectory studies. I wonder if they can ground truth some of their findings from data in the literature as this purely modelling approach seems deficient

when so much observational data is available?

- Two references published in the last five years have been added in order to provide comparison with up-to-dated works. Anyway, the findings of both methods are not considering exactly the same climatic conditions and the comparison between them must be done cautiously. On one hand, as explained in the previous question, our method tracks all the air masses reaching the target region (being or not associated with precipitation events). On the other hand, the results based on observational data imply in investigating the origin of vapor associated with precipitation episodes in the ice-core sites (and these specific synoptic situations).

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Kurita, N. (2011), Origin of Arctic water vapor during the ice-growth season, Geophys. Res. Lett., 38, L02709, doi:10.1029/2010GL046064.

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