

***Interactive comment on “Atmospheric rivers moisture transport from a Lagrangian perspective” by A. M. Ramos et al.***

Dear colleagues,

I wish to begin by congratulating you for your manuscript which includes original results on the sources and pathways of atmospheric rivers that cross the North Atlantic and affect different European regions.

I've been working for several years on the topic of atmospheric rivers. My interest in this subject began when a student of mine found that six out of the seven cases of intense rainfall events occurred in Madeira during the 2009/2010 winter were associated to atmospheric rivers, acting to increase moisture in the lower atmospheric levels. This winter was unfortunately famous because of the tragic event of extreme precipitation on 20 February 2010, which was the severest event in its recent history, causing more than 40 deaths. After that, we continue to study the influence of the atmospheric rivers in rainfall on the island and we have identified certain patterns regarding the trajectories of the North Atlantic atmospheric rivers that reached Madeira during the winter.

That's why your work caught my attention. It is also why I dared to suggest that the two following articles published by us (Couto et al.), may be useful to the discussion of your results:

Couto FT, Salgado R, Costa MJ. 2012. Analysis of intense rainfall events on Madeira Island during the 2009/2010 winter. *Nat. Hazards Earth Syst. Sci.* 12: 2225–2240, doi: 10.5194/nhess-12-2225-2012.

Couto, F.T., Salgado, R., Costa, M.J., Prior, V., 2015. Precipitation in the Madeira Island over a 10-year period and the meridional water vapour transport during the winter seasons. *Int. J. Climatol.* 35, 3748–3759. <http://dx.doi.org/10.1002/joc.4243>.

First of all thank you very much for the positive feedback regarding our study. We were aware of these two works done by Couto et al., 2012 and 2015, which have been cited recently by the authors in two submitted manuscripts covering topics related with the Island of Madeira. We agree that the two published articles can enrich the discussion and therefore they will be included in the new version of the discussion section.

Other short suggestions:

page 2618, line 4: 2014 should be changed to 2012

The typo will be corrected.

page 2628, line 12, the title of the section should include the term “sources”, better reflecting the content of the section. May be: Atmospheric rivers source.

The title of section 4 will be re-written to: “Atmospheric rivers moisture sources and transport”.

Figure 2: In my opinion it should be better if you show a larger domain that cover the entire North Atlantic Ocean in order to legitimate the conclusions about the location of the moisture sources of the atmospheric rivers.

As mentioned in the manuscript Figure 2 was computed taking into account the maximum IVT positions of the different ARs along their first guess trajectories

from an Eulerian point of view. In Figure 2 we are taking a snapshot of the most common path of the ARs and not analyzing the moisture sources. Two problems arise from doing the suggested modification: 1) there are not many identified ARs that make landfall in Europe and that are sufficiently long to extend west of the 50°W longitude mark and therefore the number of ARs to compute the median position and the respective 90th percentile and 10th percentile is not sufficiently robust. In addition, 2) as we go further south and west in the domain the background mean IVT increases and quite often the maximum IVT is due to its tropical location and not necessarily a local maximum associated with the ARs.

Therefore in the new version of the manuscript we will retain the current version of Figure 2.