# Tagging moisture sources with Lagrangian and inertial tracers: Applications to intense atmospheric river events

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## OVERVIEW

The manuscript presents an analysis of atmospheric rivers (AR) comparing the performance of two tracers tools to diagnose the occurrence of AR events and provide further detail on the evolution of the systems. The method followed is properly fundamented and well described, inspite the simplicity of the approach it is based on a solid base for transport diagnosis in fluids. The results remark the role of moisture exports for the AR, however this is a very well known result and is not fully stated in the introduction (is mentioned at the end but lacking detail). The evaluation of the results supports that active tracers show better skills compared to Lagrangian tracing techniques, which is comparable to previous results obstained by the authors. From this perspective it is suggested to make clear and sound in the manuscript how the analysis of AR benefits from the use of one or other technique. For example, is it worth to use for AR climatology analysis, or whether the results support the use of IVT for forecasting. The manuscript still needs more effort in the presentation of results and their interpretation, the recomendation is to make a detailed revision of the manuscript to include major corrections, re-write the sections and improve the analysis.

## SPECIFIC COMMENTS

1. The introduction requires a more coherent structure, it provides an introduction to AR, briefly introduces the case analysis and jumps to the introduction of analysis methods to finally include the role of tropical moisture exports for AR. As it is now is disorganized and hard to read. I suggest to rewrite the introduction with a better defined structure e.g a) ARs (what they are, how they benefit from tropical moisture and why are important in terms of heavy rainfall), b) analysis methods and key previous results and c) what new approach is proposed in the study.

2. Section 2 is well written, the methods are described in very good detail to ensure reproducibility. I recommend to include a section to present the case analyses, a formal synoptic description of the events and if possible information of the effect (e.g rainfall accumulated and rainfall rate during the AR life cycle) so that this piece of information can be considered for the analysis of the results. Figure 1-3 are poorly described and that may affect the interpretation of the results or at least their relevance.

3. Paragraph 20: Explain why tagged moisture is lost quickly from the pure Lagrangian model and what implication this have on the representation of the AR evolution.

4. Orographic ascend is a good mechanism to explain the fast moisture decrease for the Pacific case, however this mechanism is not comparable for the Atlantic, since the land configuration is very different and the pressure effect casused by the US topography is absent for the Atlantic case. Which mechanism is proposed for the Atlantic case?

5. Conclusions section is rather poor, the main result reported is a finding known from a previous research and it is not clear what is new from the present manuscript. The discussion lacks explanations on processes or how the results might provide new tools for climatology ARs analysis or even forecast support. The entire section must be re-written and pinpoint the main findings with a better justification.