

Review of “Quantifying Water Vapor Age: A Dynamical Constraint on the Response of the Global Water Cycle to Climate Change” by Boulanger & Fajber

This manuscript introduces a well formulated and computationally efficient Eulerian framework to diagnose the water vapor (WV) age spectrum by tracking moments of the WV age distribution. The authors make a clear and robust methodological contribution to the study of atmospheric moisture transport and its response to climate change.

The paper is generally well written , and grounded in the existing literature on moisture recycling in the atmosphere. The results are physically interpretable and consistent with known circulation features in the atmosphere which make the model results more interesting.

This manuscript can be considered for publication in the Weather and Climate Dynamics after addressing the points listed below

1. Consider adding line no to each line for future submission.
2. The authors may consider improving the overall figure quality, for instance by increasing the font size. To enhance visual consistency, the colorbar in Figure 7c could be aligned with those used in the adjacent figures.
3. In line number 130, authors mentioned ‘In this model, evaporation from the surface and immediate condensation interacts with the convective relaxation and radiation schemes to calculate moisture tendencies that drive the evolution’. They also discuss about role of convection on the age distribution water vapor (WV). This reviewer is curious: How sensitive are WV age distribution to convective schemes and strenght of vertical mixing?
4. The paragraph around line 220-227 appears somewhat mechanical in its presentation. The authors may consider strengthening the discussion by linking the results related to the shape parameter ‘s’ to known large-scale circulation patterns, as done elsewhere in the Results section.
5. The manuscript contains numerous typographical and grammatical errors. The authors should carefully identify and correct them throughout the text.