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Interactive comment on "Analysis of water vapor LIDAR measurements during the MAP campaign: evidence of sub-structures of stratospheric intrusions" *by* P. D'Aulerio et al.

Anonymous Referee #1

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This paper examines two cases from MAP using a combination of LIDAR measurements and Lagrangian modeling techniques. The authors provide comparisons between the observations and simulations and show that the simulations reproduce the observed structures well, even though the ECMWF analyses do not. Both cases exhibit deep tropopause folds, and their associated intrusions of dry stratospheric air. While these are interesting cases, the discussion of the Lagrangian trajectories is insufficient to determine the extent of true "exchange" or "dehydration", or whether these folds are reversible. I suggest some major and minor comments to the authors, most of these concern presentation.

Major comments:

1 - "dehydration" and "exchange" - the authors should take care in using this word. I don't think there is any evidence of true dehydration. Rather, the results indicate the transport of dry air downwards, with little evidence of a change in the air mass. These dry intrusions remain in the tropopause fold, and maintain stratospheric values of PV. There is evidence of some possible exchange in the second case, where shallow moist layers seem to be mixing with the dry layers at the western edge of the tropopause fold in Fig. 5. Also, the change in PV from 3PVU to 1 PVU units in case 2 - region A, indicates exchange. However, the analysis of the changes in PV along the trajectories (in both cases) is insufficient to determine whether these folds are reversible or irreversible.

2 - Accuracy of Lidar measurements - section 2. It would be useful (and more convincing) to see a figure comparing the lidar measurements to the radiosonde profiles directly, so the reader can appreciate the accuracy and robustness of the measurements.

3 - Section 3. Entire section is unclear, and does not describe the Lagrangian simulations well. The section should be improved. Especially the paragraph starting at line 22.

Minor comments:

1 - Results are presented in some sections in local time, and in other sections UTC. Be consistent.

2 - The authors present mixing ratio and specific humidity. These two quantities are not exactly the same. You should use one or the other.

3 - Presenting the trajectories in tabular form hinders interpretation by the reader.

4 - Both cases show a shallow secondary fold in the PV, to the West of the main fold. What is the mechanism for this?

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5 - The authors use the term "associated to" this should be either "attributed to" or "associated with".

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 8327, 2004.