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Atmospheric Measurement Techniques Discussions

Interactive comment on "Assimilating airborne gas and aerosol measurements into HYSPLIT: a visualization tool for simultaneous assessment of air mass history and back trajectory reliability" *by* S. Freitag et al.

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The authors would like to thank Grant Allen (reviewer #1) for his valuable comments and corrections that have helped improve our manuscript.

Specific Comments

1/ The reviewer's suggestion to better emphasize and highlight the dominant role of the meteorological error in trajectory calculations has been implemented at the end of

section 3.2 by extending the existing discussion. It is, however, beyond the scope of this work to test other meteorological input data sets and compare these to the employed GDAS data. We also note that such a comparison may not be feasible in this study area as the only other readily available data set covering the Equatorial Pacific has a much coarser resolution (NCAR reanalysis, 2.5° x 2.5°). Instead, we included two new references (Gebhart et al., 2005; Harris et al., 2005), which discuss the sensitivity of trajectory models to meteorological input data in detail. Both publications underline that this is the dominant source of trajectory uncertainty. We also discuss now another reference (Riddle et al., 2006), which validates trajectory models employing altitude-controlled balloons. This study supports our approximation of the average total trajectory error as 20 % of the travel distance and also nicely points out how the magnitude of the meteorological error varies greatly depending on whether the general flow depends on synoptic-scale or subgrid-scale features.

2/ As recommended by the reviewer, we have included a "best practice advice" in section 6 summarizing when backward trajectories may be utilized and where they should be interpreted with great caution.

Technical and other comments

1/ - 4/ All text passages have been revised as suggested and the optional reference has been included.

5/ The sentence on page 5349, lines 15-18, has been slightly reworded to "If changes evident in these in-situ tracers over the narrow range of a research flight profile are reflected in trajectory features characteristic of recognized sources or processes credibility is added to the trajectory ensemble for that profile." This has been discussed in section 5 where we study pollution and deep convective outflow layers measured along single flight profiles that also exhibit trajectory paths characteristic for these air masses.

6/ - 8/ All text passages have been revised as suggested.

9/ The reviewer made a good point. In the absence of NOx and VOC measurements as methane no clear distinction can be made between ozone of stratospheric origin and photochemically-produced ozone in the free troposphere. We now include the latter explanation in the manuscript. The former air mass, however, is expected to contain very low amounts of water vapor as observed for the case study discussed in section 5.2 in the manuscript.

10/ “Always” has been replaced with “typically” on page 5361, line 11.

Gebhart, K. A., Schichtel, B. A. and Barna, M. G.: Directional biases in back trajectories caused by model and input data, J. Air Waste Manage. Assoc., 2005, Vol. 55, pp. 1649-1662.

Harris, J. M., Draxler, R. R. and Oltmans, S. J.: Trajectory model sensitivity to differences in input data and vertical transport method, J. Geophys. Res., 2005, Vol. 110, pp. D14109.

Riddle, E. E., Voss, P. B., Stohl, A., Holcomb, D., Maczka, D., Washburn, K. and Talbot, R. W.: Trajectory model validation using newly developed altitude-controlled balloons during the International Consortium for Atmospheric Research on Transport and Transformations 2004 campaign, J. Geophys. Res., 2006, Vol. 111, pp. D23S57.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5345, 2013.