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Atmospheric Measurement Techniques Discussions

Interactive comment on "Trajectory matching of ozonesondes and MOZAIC measurements in the UTLS – Part 2: Application to the global ozonesonde network" *by* J. Staufer et al.

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We thank you very much for the careful review. Please find below our responses.

Comment: The verification of this procedure appears in a companion paper being reviewed by AMT, but is not available to this reviewer. For this review, it is assumed that the matching procedure is valid and accurate. However the authors might consider narrowing their 450 hpa criteria since the ozone vertical gradients could be large in this range. The criteria for distance and "altitude" (potential temperature) might be tightened somewhat also. The authors should at least comment on the validity of their matching

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criteria. The authors claim that their method is robust although biases were found in comparing forward and backward trajectories. The quality of match was determined by the value of the comparison. This is not an independent method. Perhaps this is all explained in the companion paper. Perhaps the trajectory discussion appearing in Section 3.1.7 should be moved to Section 2.3, which describes the matching technique.

Response: Since ozone cannot be assumed constant in the UTLS, forward and backward trajectories will not give similar results. Hence, both forward and backward trajectories are used simultaneously. The quality of the match criteria as well as their derivation has been reviewed in detail in the companion paper, which is accepted for publication in AMT. The match criteria were derived using measurements from just one instrument (MOZAIC-MOZAIC self-matches). It was found that the root mean square error was smallest within the proposed ranges (r = 75km and dTheta = 0.6K). Regarding the uncertainty of the matching technique, we derived the values of +/- 2% by assuming that the MOZAIC measurements were noise-free. However, as pointed out by reviewer #3, there is some limitation of the technique with trajectories > 50 hr. The +/- 2% were derived when most matches are found within the first 2 days. In the revised manuscript we will discuss the method in some more detail in the methodology section (Section 2.3).

Comment: Section 3.1.2. The authors describe a time dependent background signal. The background signal is established in the sonde launch preparation. Do the authors mean trend in the background signal? Why should this be?

Response: For ECC sondes the background current is measured as part of the pre-launch preparation, following the guidelines of Komhyr et al. (1986). For processing the ozonesonde data, the measured background current is either applied as a constant value (for example, 0.5μA), or, it is assumed that the background current declines with altitude (this is explained in Section 2.1). Originally, it was believed that the background current was oxygen dependent (for example, Saltzman and Gilbert, 1959) and therefore a function of altitude. Later, several studies (for example, Thornton and Niazy,

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1982, 1983) were unable to confirm any oxygen dependency and recommended applying a constant value to the whole profile. Figure 3e (original manuscript, Fig. 4e in the revised manuscript) shows a trend in the mean background current values (measured prior to launch) at DeBilt, which are applied to process the ozonesonde data (by subtracting either a constant value or a value decreasing with altitude, as explained above). As explained in Section 3.1.2., a change in the pre-launch procedures leads to reduced measured currents after 2003 compared to 1994-2003.

References: Saltzman B. E. and Gilbert, N.: Iodometric Microdetermination of Organic Oxidants and Ozone. Resolution of Mixtures by Kinetic Colorimetry, Anal. Chem., 31, 1914–1920, 1959.

Thornton, D. C., and N. Niazy (1982), Sources of background current in the ECC-ozonesonde: Implication for total ozone measurements, J. Geophys. Res., 87, 8943–8950.

Thornton, D. C., and N. Niazy (1983), Effects of solution mass transport on the ECC ozonesonde background current, Geophys. Res. Lett., 10, 148–151.

Comment: There is a large array of sonde data taken at various stations using varying operational procedures which are summarized in the Table 1. The comparison results are comparably complex, and are represented in subsequent figures and described in the text. It would be useful to the reader if these results could also be tabulated in a format similar to Table 1, but also include the time component (e.g., before and after 1998).

Response: We feel it is not necessary to tabulate the results in a format similar to Table since (a) Figure 9 (Figure 16 in the revised manuscript) comprises already the results for 20 launch sites and (b) the results are discussed in detail for the individual sites in the Results section (Section 3).

Comment: Section 3.3.1. The differences shown at Izana are puzzling. Could this

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result from a Background Correction error (too large)?

Response: Unfortunately, there are no background current values available at any archive for this site. So, we could not analyze our results regarding too large or too low background current values.

Comment: An interesting finding, but with no conclusion unfortunately, is that the authors analysis indicate that there could be systematic, and possibly time dependent errors, in the MOZAIC UV photometers. These measurements have not been questioned before to the knowledge of this reviewer. Some discussion about MOZAIC comparability appears in Section 3.1.6. Perhaps there might evidence elsewhere which might justify a Section on this separately. This is important issue and therefore should be stated in the Abstract so that this finding will get more attention.

Response: In the revised manuscript we will clarify that Logan et al. (2012) and Staufer et al. (2013, companion paper) already presented some evidence for a potential drift in the long-term stability of MOZAIC and we intend to modify the Abstract and Conclusions of the revised manuscript in order to mention a possible time-dependent drift in the calibration of the MOZAIC UV photometers.

Minor editing comments: Thanks for pointing out the typos, spelling errors, and for suggesting some better wording.

Comment Figure 8: Why are trajectory distributions only shown for Izana? What about other stations at mid latitudes?

Response: For Payerne we show the trajectory distribution in the companion paper. For Izana, we want to illustrate the problem when different air masses are sampled, as well as the influence of the temporal distribution on the results. We showed this only for Izana because it was felt that otherwise the paper appears somewhat overloaded.

Comment: Why do the Figure numbers change to a letter and a number after Figure 9?

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Response: We corrected this. All Figures now have a number and are arranged in order according to their appearance in the text.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 7099, 2013.