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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A review of the Match technique as applied to AASE-2/EASOE and SOLVE/THESEO 2000" *by* G. A. Morris et al.

G. A. Morris et al.

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page 4666, line 10: Our filters exclude only about 30-50% of the matches, not 99% as stated here.

****We have clarified the text in Section 3.5 of the paper to say that in the original Match technique, the authors state that 30 - 50% of the matches are eliminated. We have separated our result of 99% more clearly from those of the original Match technique.

page 4666, line 11: The finding that most of the filters are not necessary and would not improve the results is in contradiction to our findings that all the filters do reduce the impact of potential dynamical effects. It is also in contradiction to the independent work of Gross et al. (2002), who showed that the trajectory divergence criterion is

indeed important to reduce the uncertainty of the results and most importantly also to eliminate a bias due to mixing effects. Since this filter is not used in the Morris et al. work, differences between our results and the Morris et al. results could be due to this bias in the latter analysis.

****Our results simply disagree with the prior analyses. As we argue in the text, most of the filters have little impact on the final loss rates calculated. In particular, we refer you to the new figure we have inserted in the paper in conjunction with the text of Section 3.6 in the paper at the suggestion of Reviewer #3. As can be seen from this figure, the difference between our results with and without all the filters are minor, and by eliminating all the filters, we actually are able to reduce the statistical uncertainty associated with our results. Furthermore, we believe it good practice to utilize all the data unless a solid, concrete, indisputable reason can be articulated for eliminating the data.

page 4674, line 22: I do not get the meaning of the sentence: "Each tracked air parcel is only permitted a single match with each other sonde on a given day, ..." Of course each air mass can only match once with any other sonde - not only on a given day, but in general. How could any individual air parcel match twice with the same sonde?

****We actually track the air masses for up to 3 hours after the initial ozonesonde launch. Parcels are allowed to match throughout the 3-hour window. Those that track closely will have more matches than those that briefly satisfy the match criteria before heading off in a different direction. Again, the goodness of the match can be determined by how well the trajectories from the old air mass track the trajectories associated with the new sonde launch.

Figure 9 and black dots in Figure 8: using only half of the data in each subsample will increase the uncertainty of the results from the subsamples by a factor of 1.4 (when the uncertainty of the individual match events is constant, the uncertainty of the fitted slope depends on the square root of the number of match events in the sample). Hence, the

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scatter of the black dots overestimates the real uncertainty of a fit that is based on the complete data set.

****Of course, Markus' point is correct. However, the matches yielded in the Match analysis can only be thought of as an imperfect subset of the actual matches. Furthermore, the set of matches produced may include erroneous matches that should not be included in the analysis. In trying to estimate the errors associated with the Match ozone loss rates, we have argued that numerous quantities have not been included to date. We concede that such quantities can be very difficult to determine. Nevertheless, despite our subsampling of the matches, our error bars show good agreement with those of the Rex et al. papers.

page 4696, line 8: "..., although our data seem systematically to reveal less ozone loss than the data from Rex et al. (1998)." Looking at the figure I cannot see the basis for this statement. For me the only difference, if any, is that the Morris et al. point for sunlit times below 10 hours seems to suggest some ozone production during darkness, which I would not call "less ozone loss". I doubt that this slight ozone increase is significant. But if anything it would suggest that some systematic effect tends to increase ozone during darkness along the Morris et al. trajectories. This could be further explored by using a bivariate regression to separate ozone change during darkness from ozone change during sunlit times. Any significant change of ozone during darkness would suggest the presence of a systematic bias in the analysis. In our version of Match the change of ozone during darkness is virtually zero. In principle a significant ozone change during darkness could arise from an artificial systematic drift of the trajectories in PV or theta space (on top of the small natural drift due to diabatic effects), or from mixing effects. The latter could be an issue in the Morris et al. work because they do not filter out trajectory clusters that are highly divergent. Gross et al. (2002) showed that this is important to avoid air masses that were impacted by mixing.

****We have run the bivariate regression. See the response to Referee #2.

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