**Atmospheric
Chemistry
and Physics
Discussions**

Interactive
Comment

Interactive comment on "Impact of stratospheric intrusions and intercontinental transport on ozone at Jungfraujoch in 2005: comparison and validation of two Lagrangian approaches" *by* J. Cui et al.

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Stratospheric intrusions and intercontinental transport are two important long-range transport processes that can influence the measurements of atmospheric chemical composition at a site. It is important to know to what extent models can simulate these long-range transport processes, yet it is difficult to evaluate these processes in the models because there is no single tracer that would allow identifying these events in measurement data. This paper uses different criteria (high O_3, low relative humidity for stratospheric intrusions; high CO, low NOy/CO ratios for intercontinental transport

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events) to screen the measurement data for such events and compare time periods with identified events with time periods suggested by the models to be influenced by stratospheric intrusions or intercontinental transport. A Lagrangian particle dispersion model (FLEXPART) and a trajectory model (LAGRANTO) were used for that purpose. The paper is well written and I recommend its publication in ACP – subject, however, to addressing the following comments.

1) Setup of the FLEXPART model: I fear FLEXPART was not ideally set up for the purpose of that study. First of all, since the focus is on a single measurement site, I wonder why FLEXPART has been run forward in time. It would have been much more efficient to run it backward in time. Furthermore, results should have been more accurate (and also more straightforward to compare with LAGRANTO), since the simulations could have been started at exactly the measurement point, instead of having to use grid-cell averages. I am a little concerned also about the number of particles used in total (below 1 million). Is this really enough to obtain statistically significant results at the receptor site, given the 1x1 degree and relatively high vertical resolution? FLEXPART would allow you to write out associated uncertainties. Have you checked these uncertainties? If the number of particles is too low, you can introduce substantial noise onto the model results, which would degrade model performance.

I do not expect the authors to repeat all the simulations but I think they should at least explore and comment on the uncertainties introduced by this setup.

2) The 10-day duration of the FLEXPART simulations and LAGRANTO calculations is definitely on the short side for capturing intercontinental transport events. While it is true that these fast events are the most likely to be seen in the measurement data, especially in summer (when atmospheric transport is slower) you are likely to capture only a minority of events.

3) Both FLEXPART and LAGRANTO were using ECMWF input data. The two models are, thus, not really independent of each other. This should be clearly mentioned and

commented on.

4) Page 1454, line 24: Why were CO and O3 values from FLEXPART interpolated? FLEXPART writes out grid-cell averages (not point values), so you should just take the grid cell containing the measurement site.

5) Page 1455, line 9: I wouldn't fully agree that by calculating 5 trajectories, you could say this is a cost efficient way to capture diffusion in trajectory models. Trajectory models just don't have diffusion and this does not change when you calculate more than one trajectory. This rather explores the sensitivity of the results to initial position.

6) I am wondering about the 50

7) In Figures 5 and 6, it is virtually impossible to clearly see whether there is agreement between models and with the measurements. I suggest changing these figures by removing the Lagranto panel. Instead, I would color the background in all the other panels according to identified events: e.g., yellow for LAGRANTO, orange for FLEXPART and red for both. This should more clearly allow to see whether, e.g., a drop in humidity agrees with events identified by the models.

8) The Conclusions section is far too long and unstructured. I would shorten it by at least 50

Minor points, language:

Page 1448, last line and at many other places: why not call "sustaining time" simply "duration" of an event?

Page 1451, line 6: small-scale turbulent and diffusive processes: isn't that just the same? Unless you mean molecular diffusion (which should not be important here), small-scale turbulence is often represented as a diffusive process.

Page 1456, line 6: In this terms -> In these terms

Page 1457, line 4: "situations were undisturbed free troposphere" reads awkward.

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Page 1464, line 11: comparions -> comparisons

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