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Interactive comment on "Cirrus, contrails, and ice supersaturated regions in high pressure systems at northern mid latitudes" *by* F. Immler et al.

F. Immler et al.

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We like to thank referee #2 for her/his detailed comments that helped a lot to improve the manuscript. We are planning to submit a revised version based on the reviews that are documented in our final response together with answers on the detailed comments of referee 2.

Referee #2 has raised concern about the accuracy of the water vapour measurements. We agree that this issue is of major importance and far from being settled. However, we think that the data we have used are suitable for our study and have explained our reasons in detail in the author comment in response to referee #1. The accuracy of the corrected RS-80 humidity data is about 5% in the upper troposphere at high humidities (Miloshevich et al., 2006). Since there is no significant bias in the corrected data, the statistical significance of our findings is strong enough to cope with these uncertainties.

However, there are a number if issues that require better accuracy. For example, we found that 15% of the upper troposphere (UT) is supersaturated and does not contain particles. It is unclear whether this is indeed the case or a results of the uncertainties in the observations. However, we found 85% of the supersaturated regions to contain ice particles. This is a strong correlation which is well supported by the accuracy of the data and the large number of observations.

Referee # 2 suggested to omit the comparison with the ECMWF data. Our main conclusion, that supersaturated regions (ISSRs) in mid-latitude high pressure systems generally contain ice, is not only supported by the radiosonde data but also by the comparison with the ECMWF operational analysis. Since upper air radiosonde observation are not assimilated to the analysis, the humidity of upper tropospheric air and consequently the occurrence of clouds in the model are consequences of vertical transport and cooling of air masses. If stratiform clouds occur in the UT in the model it means that air was lifted and cooled and is therefore saturated with respect to ice. Since in the model stratiform clouds are formed when saturation is reached, the agreement between model and observations demonstrates that this simple concept works well in the conditions that were investigated here. For this reason we think that the comparison with the ECMWF data is an integral part of our study.

In the second part of this section 3.4 we derive effective particle radius (r) from that comparison, which was criticised by referee #2, while referee #1 asked to exploit more details from this size retrieval. We agree that this retrieval has its caveats. On the other hand, it is based on a very basic consideration that OD scales with r^2 while IWC scales with r^3. We think its is fair to mentions these relations and deduce some basic information from them without going further into details. Certainly, a more detailed study will need some validations based on in-situ observations of particle properties. Once those are available, we will certainly follow the suggestion of referee #2 and publish a manuscript which will focus on the microphysical properties of cirrus and contrail particles in relation to lidar and ECMWF data.

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Interactive Comment