

## ***Interactive comment on “Observation of unusual chlorine activation by ground-based infrared and microwave spectroscopy in the late Arctic winter 2000/01” by T. Blumenstock et al.***

**T. Blumenstock et al.**

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Response to comments by Referee #3

We thank Referee #3 for the review and comments to stimulate the discussion of our manuscript.

First of all, we would like to comment that we didn't respond to the previous review of Referee #3. In our understanding of the journals' guidelines the authors are not allowed to change the manuscript and to discuss the conclusions at that stage. Instead, for authors it is only allowed to address formal issues at this stage.

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The main concern of Referee #3 is that there are only 2 days of observation showing enhanced ClO outside the polar vortex and their observational evidence. We would like to address this:

- On both days ClO is not only seen in the microwave retrieval results, but already in the difference spectrum (see Fig. 5 of the manuscript). The difference spectrum of March 17 is of very good quality showing no signatures of O<sub>3</sub> demonstrating stable atmospheric conditions. From a microwave spectroscopist' point of view the signature in the spectrum can be attributed only to enhanced ClO in the atmosphere. A comment of a further microwave spectroscopist would be appreciated by the authors to help to clarify the discussion.

- Furthermore, the day - night difference spectrum of February 6 shows an unusual shape which is different from the double peak shape in the case of chlorine activation by PSCs. This corresponds to ClO in altitudes above 25 km. This is consistent with an aerosol layer at that altitude at that time while the aerosol layer has been subsided until middle of March.

- In contrast to microwave spectra FTIR spectra do not show signatures of ClO directly. FTIR (Fourier Transform InfraRed) spectroscopy has a worse sensitivity to ClO as compared to MWR (Millimeter Wave Radiometry). This is also shown by large error bars of the FTIR ClO data. Given the large error bars of ClO column abundances measured by FTIR the FTIR results do not contradict the MWR results. FTIR error bars shown in figure 4 just include the error due to spectral noise and are given as 1-sigma errors.

- Furthermore, due to the lack of night time measurements day - night differences of IR spectra cannot be calculated. Omitting the FTIR data in the paper might give a clearer picture to the reader. On the other hand the authors didn't want to suppress any data which might be relevant to this topic.

- The unusual chlorine activation is present only at very specific atmospheric conditions. Therefore it cannot be observed regularly. So, there are not so many observa-

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tions showing it. Also in case of balloon or aircraft campaigns there is just a very limited number of profiles available which are used for scientific conclusions.

- And as argued by Referee #2 the observations are clearly above the model calculations.

Since the submission of our manuscript a paper was published about meteoritic dust by Klekociuk et al in Nature on August 25, 2005 (Klekociuk et al., Nature 436, 1132-1135, 2005). This paper shows LIDAR observations of meteoritic dust and conclude that meteoritic dust is present more frequently in the atmosphere and such particles are larger than expected. Then chlorine activation on such particles is not that unrealistic. While in our manuscript the origin of aerosols as observed by Gerding et al (Ann. Geophys. 21, 1057 - 1069, 2003) was unclear, the Nature paper may indicate meteoritic dust particles. In a revised version of our manuscript we would like to cite and shortly discuss this in section 4.3 (chlorine activation on non-PSC aerosols) of our manuscript.

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Interactive comment on Atmos. Chem. Phys. Discuss., 5, 9993, 2005.

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