

Interactive comment on “MIPAS detects Antarctic stratospheric belt of NAT PSCs caused by mountain waves” by M. Höpfner et al.

Anonymous Referee #2

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General and Specific Comments

The objective of this study is to demonstrate the importance of mountain wave activity over the Antarctic Peninsula and Ellsworth Mountains in the formation of solid nitric acid trihydrate (NAT) particles. Of the various types of polar stratospheric clouds (PSC), NAT is more difficult to form but can persist to higher temperatures than ice or supercooled ternary solutions (STS). Removal of large NAT particles is also believed to be singularly responsible for the denitrification of the Antarctic vortex. Hence, the study of NAT formation processes is relevant and timely to the field of stratospheric chemistry and dynamics.

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Interactive Discussion

Discussion Paper

This paper is well written, and the methods of analysis of satellite data are rigorous. The authors have compared satellite observations to microphysical simulations of PSC formation, using analyzed meteorological fields. The results demonstrate the possible importance of mountain wave activity to NAT formation, but, contrary to the first sentence of the conclusions, do not rule out other causes. It is possible that a low-pressure system in the Weddell Sea may have raised tropopause heights, forcing vortex air to rise as it passed over the storm, thus producing the NAT particles observed. In order to claim that mountain waves are the only plausible explanation for the observed NAT formation, the authors must present either meteorological data (e.g. tropopause heights) or satellite imagery of weather downwind of the Antarctic Peninsula around June 10, 2003. Such information should be available from the ECMWF meteorological analyses used in the model calculations for this study. If the authors cannot rule out weather-related disturbances, they should acknowledge such in the text.

In addition, the authors conclude from their microphysical calculations of NAT sedimentation that homogeneous nucleation rates of NAD/NAT presented in Tabazadeh et al. (2002) must be reduced by three orders of magnitude in order to comply with satellite observations. Because the microphysical calculations relied on analyzed meteorological fields, this should account for any meteorological disturbances. Hence this conclusion should be robust regardless whether the NAT was produced by mountain waves or weather-related disturbances.

This paper should be published with a discussion of possible weather-related disturbances to the vortex.

Technical corrections

page 10725 line 13: “of” is missing between “formation” and “progressively” line 28: “The magnitude of the applied freezing rates, however, have been discussed.” This sentence does not make sense to me. I do not understand its significance. Please elaborate this point a bit.

page 10733 lines 14-15: style suggestion, change to “These values are much smaller even than \bar{E} ”

Interactive comment on Atmos. Chem. Phys. Discuss., 5, 10723, 2005.

ACPD

5, S4606–S4608, 2005

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