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Interactive comment on "Correlation between equatorial Kelvin waves and the occurrence of extremely thin ice clouds at the tropical tropopause" *by* F. Immler et al.

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We thank anonymous referee #3 for his/her detailed corrections and comments. We were asked to deliver a proof that the observed temperature anomalies were caused Kelvin waves. We will accomplish this within the revised version of the manuscript.

Based on the operational analysis data from the ECMWF we can show for both cases (STAR and ACLIT) that the observed temperature anomalies are associated with zonal wind anomalies while there is no related meridional wind component. The temperature anomalies lead the zonal wind anomalies by about a quarter wavelength. The waves are propagating eastward, almost symmetrically about the equator. Also, we will confirm that the wave parameters reasonably satisfy the dispersion relation of the Kelvin waves. Those are typical features of equatorial Kelvin waves. We will include a figure and a discussion of the the dynamical features of the lower tropical tropopause that are causing the temperature anomalies in the TTL in a revised version of the paper. Using high-resolution ECMWF data on temperature and wind we will proof that the temperature anomalies that are associate with the occurrence of thin cirrus in the TTL are caused by Kelvin waves.

This proof also responds to the first specific comment of the referee, since it is based on the ECMWF data (operational analysis) which are obviously capturing the Kelvin waves.

Concerning the second specific comment, we indeed look at the air parcels from a Langrangian perspective: As our trajectories in fig.4 show the air parcels that form the thin clouds in the TTL are diabatically heated, indicated by the increase in potential temperature and at the same time the temperature decreases. The latter is caused by the ascending motion due to the Kelvin wave. The forcing for this process is at least to some extent caused by the Kelvin waves: The dynamical cooling caused by the waves lowers the temperature below the radiative equilibrium and thus leads to an increase of the radiative heating. The clear sky radiative heating rate may increase by as much as 50 to 100% due to the wave (see Fuelgistaler, 2003, fig. 9) . This increase can be strongly enhanced if ice particles form in the rising air parcel since the ice-cloud absorb long-wave radiation and therefore enforce the heating (Corti et al, ACP, 2006). This supplies a positive feedback mechanism of the effect of Kelvin waves on the TTL.

References: Fueglistaler, S. & Fu, Q. Impact of clouds on radiative heating rates in the tropical lower stratosphere, Journal of Geophysical Research (Atmospheres), 2006, 111, D23202 Corti, T.; Luo, B. P.; Fu, Q.; Vömel, H. & Peter, T. The impact of cirrus clouds on tropical troposphere-to-stratosphere transport, Atmos. Chem. Phys., 2006, 6, 2539-2547

Interactive comment on Atmos. Chem. Phys. Discuss., 8, 2849, 2008.