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Atmospheric Chemistry and Physics Discussions

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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1. Referee # 2 suggested to include a discussion on "'cloud lofting"' to the conclusion of our manuscript. Based on an interpretation of the backward trajectory that we provided in fig.4 he points out that cloud lofting [Corti et al.(2006)] may play a crucial role to the formation and persistence of TTL cirrus and that our study may be the first observational evidence for this mechanism.

   We completely agree with this point of view. Therefore, in a previous publication [Immler et al.(2007)] which was based on the same data and methods, we have discussed the formation of TTL cirrus in great detail using backward-trajectories. Our results support the concept of cloud lofting as lined out by [Corti et al.(2006)] and this was explicitly stated in the conclusions of this earlier publication. The

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current study focuses on the relation between Kelvin waves and cirrus. Depending on their phase, Kelvin waves cool the tropopause and thereby destabilize the TTL, fostering general updraft, ice formation and dehydration. The general mechanism of ascent and dehydration in the TTL was described in the publications mentioned above. We think of the role of Kelvin waves to enforce this mechanism (depending on phase) rather than adding an additional mechanism to the picture. We understand the remark of referee #2 in the sense that this relation should be expressed more clearly.

We actually did not attempt to explain the rising potential temperature by clear air radiative heating, the effect of clouds on the heating is taken into account by the trajectory model (I.e. the underlying radiative transfer model) that was used. This model is discussed in more detail in [Immler et al.(2007)] and [Krüger et al.(2008)].

2. Several studies [Fueglistaler et al.(2005), e.g.] have demonstrated that the stratospheric water vapour concentration is related to the minimum temperature of the tropical tropopause averaged over air parcel's trajectories. Kelvin wave activity influences this minimum temperature. Our study shows that the cold phase of the Kelvin waves coincides with cirrus occurrence indicating dehydration of air. Most likely the air parcel at this point experiences its minimum temperature on its way to the stratosphere. In this sense the waves act like a dehydration pump.

3. The algorithm that determines the cloud range is explained in detail in [Immler et al.(2007)].

We thank referee 2 for his helpful comments and will try to improve our manuscript accordingly.

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