Atmos. Chem. Phys. Discuss., 7, S2160–S2162, 2007
www.atmos-chem-phys-discuss.net/7/S2160/2007/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Volcanic effects on climate: revisiting the mechanisms" *by* H.-F. Graf et al.

H.-F. Graf et al.

Received and published: 30 May 2007

We thank the anonymous reviewers for their constructive comments that helped improving the manuscript!

Rviewer 2: 1) Table 1: we are sorry for the mistake and amended the caption. Bold numbers are now introduced. We indicate WVR for completeness and to show that there are no volcanic winters in WVR category. 2) a) We amended to "extending" b) We used t-test throughout the work and indicate in the text c) We amended the caption accordingly d) We include some references as requested

3) Tropospheric wave activity could contribute to improved wave propagation. This is right, but there are also improved wave propagation conditions in SVR, where there is LESS wave energy in the troposphere. Hence, we did not discuss this possibility. 4)

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amended reference as requested 5) amended caption of Figure 2 accordingly

Reviewer 4: Results suffer from insufficient sampling. That is definitively true since there are only 6 winters that can be considered volcanically disturbed during the time when 3D reanalysis data are available. However, also former analyses suffered from this restriction and the main purpose of the current work was to reassess the hypotheses put forward formerly. Our main conclusion is that the interpretation put forward previously (including the lead author of this paper) cannot be approved. Instead of less planetary wave energy propagating into the higher stratosphere in volcanically disturbed winters as suggested previously, there is actually more. This is a clear difference to the non-volcanic strong vortex episodes. We suggest in our paper that possibly the concurrent El Ninos contributed to ZWN1 enhancement in the troposphere. An additional investigation is under way at MPI to further investigate this using a coupled atmosphere-ocean model and results will be published later.

Specific remarks: 1. Why is the vertical component of EP flux so high in volcanic winters? This is a key question and so far our suggestion, based on the quoted literature, is that this is due to the concurrent El Ninos. 2. Vertical EP flux in the stratosphere is stronger in all volcanic winters and weaker (NOT stronger) in all non-volcanic SVR regimes than in non-volcanic winters. While the surface anomalies in temperature and circulation anomalies are similar after volcanic eruptions and in SVR, the mechanisms producing these effects should be different. Indirectly we can conclude that the waves (actually ZWN1) propagating into the higher stratosphere in volcanic winters must not break since otherwise they would lead to warming of the stratospheric polar vortex and anomalies of opposite sign than observed at the surface should develop. The alternative would only be wave reflection. 3. Fig. 3a does not contradict Fig.2 since, as described in the text (see also Li et al. 2007), Fig.2 represents the POTENTIAL of wave propagation, not the EP flux itself. 4. We feel that the sentence line 5 from bottom of section 2 is complete as is. 5. We slightly amended the initial sentence of section 3. 6. The bold characters were introduced in Table 1. Volcano winters are given in the text.

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We include WVR for completeness and to show that there are no volcano winters in the weak vortex category. 7. Figure 2 caption is complete, but we amended according the suggestion of Reviewer 2. 8. We changed colour of SDV in Fig.3.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 3941, 2007.

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