Short Comment on Wunderlich and Mitchell "Uncertainty and detectability of climate surface response to large volcanic eruptions" by Karsten Haustein

The manuscript is very interesting and deserves publication without a doubt. Identifying and disentangling the effects of volcanic eruptions on mid-latitude dynamics is a long-standing issue and the authors contribute in that they use reanalysis data to identify attributable signals in different regions at different lags. They then aim to scale the model response according to results of a regularized optimal fingerprint technique.

While the authors mention the potentially significant effect that ENSO can have for their analysis, an appropriate test of the ENSO impact has not been undertaken. Recent literature findings (Lehner et al 2016) suggest, however, that it is crucial to account for the effects of ENSO. This is particularly true as volcanic eruptions may well force ENSO into an El Nino state (e.g. Pausata et al. 2015) as briefly mentioned by the authors themselves as well. One of their main conclusions is, quote: "*The multi-model-mean shows an overestimation of the volcanic signal with a mean scaling factor of around 0.5. This means, that the cooling of the mean surface temperature is much less pronounced than suggested from the model simulations.*"

Failing to prove that the removal of ENSO won't have an effect on the scaling factor is something I find hardly reconcilable with the abovementioned statement. I would therefore ask the authors re-evaluate the scaling result in the light of newer results that have been published in the meantime.

I would like to provide some support for Lehner et al. 2016 by highlighting one of my own results that I produced recently (Figure 1). I used HadCRUT4-CW (Cowtan and Way 2014) and Berkeley Earth GMST, regressed onto the Multivariate ENSO Index (MEI), volcanic AOD (Crowley and Untermann 2013) and Sunspot Numbers (SSN). Four different 30-40 year overlapping intervals have been chosen in order to select periods where there is little change in trend in the anthropogenic forcing. This way, it is ensured that the signal is effectively removed. The volcanic contribution is then removed from GMST and compared with PMIP3 and CMIP5 data for the 1850-2015 period (red, pink, black and blue line in Figure 1). CMIP5 models are selected to match the reduced number of PMIP3 models. Using all CMIP5 models instead does not alter the result.

With the exception of Krakatoa in 1883, all other major eruptions (Agung, El Chichon, Pinatubo) are well captured in terms of magnitude in the models. I would therefore argue that a scaling factor of 0.5 can hardly be reconciled with these results. Again, it appears appropriate to repeat some of the tests with carefully corrected GMST data. Having done that, the paper conclusions should be much more robust than they appear to be at the moment.

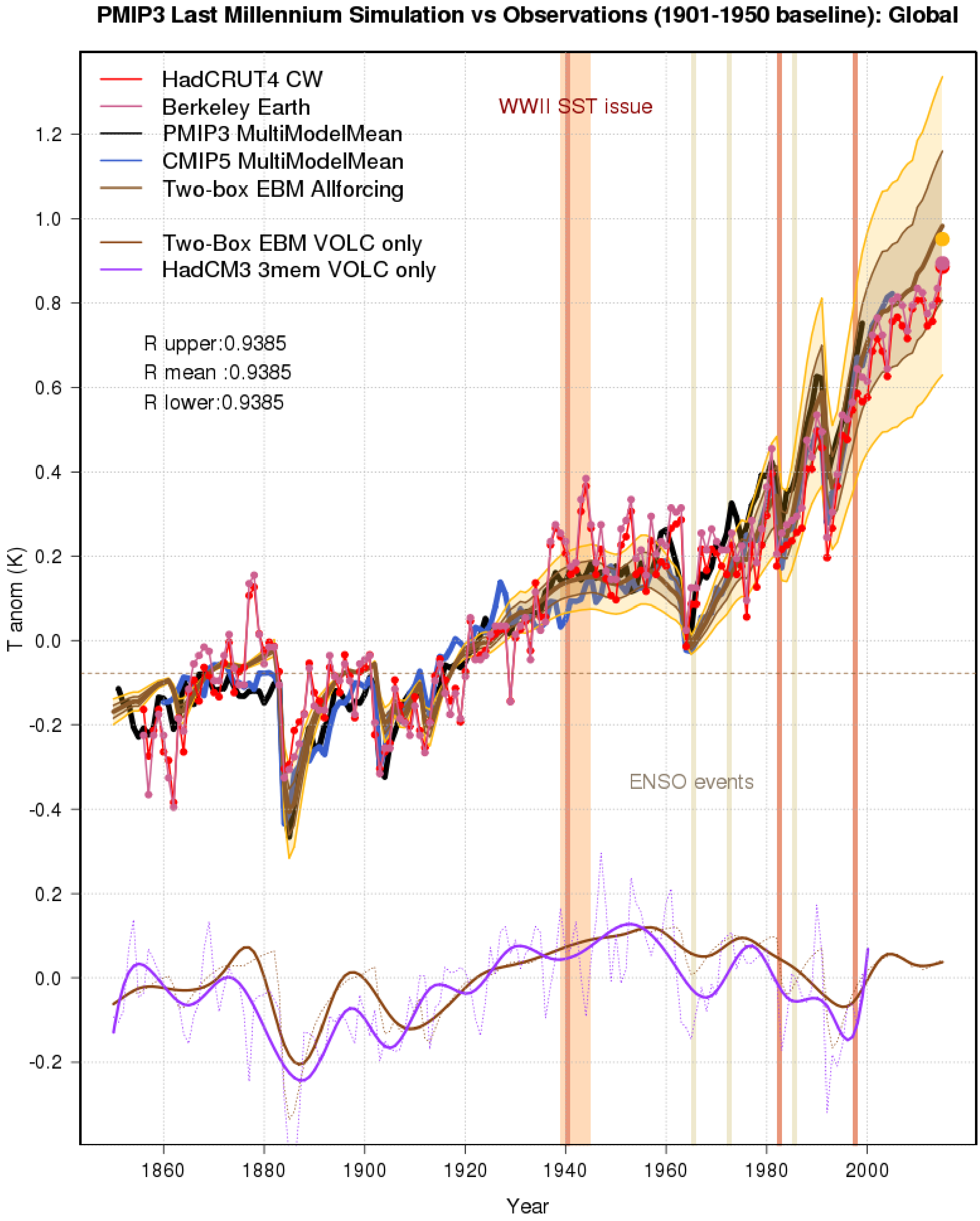

Figure 1: *Top panel: ENSO-corrected annual mean HadCRUT4-CW (red) and Berkeley Earth GMST (pink) timeseries (1850-2015) vs PMIP3 (black) and CMIP5 (blue) annual mean TAS. The 2015 mean temperature for HadCRUT4-CW, Berkeley Earth and GISS (yellow) is provided as a dot on the upper right hand side. The yellow shaded area refers to a range of sensitivities for a two-box Energy Balance Model (EBM) with the best estimate in brown. Bottom panel: Long-term volcanic response due to slow readjustment of the deep-ocean in model (HadCM3; purple) and EBM (brown).*

References

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