Atmos. Chem. Phys. Discuss., 15, C3969–C3971, 2015
www.atmos-chem-phys-discuss.net/15/C3969/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Global temperature response to the major volcanic eruptions in multiple reanalysis datasets" *by* M. Fujiwara et al.

Anonymous Referee #3

Received and published: 23 June 2015

In this manuscript the authors analyze the temperature response to major volcanic eruptions in nine reanalyses datasets. After regressing the reanalysis temperature fields to eliminate the effects of QBO, solar cycle, and ENSO, the authors analyze the time series of global temperature residuals and the zonal mean temperature residuals during the year following the eruptions of Agung, El Chichon, Pinatubo, and Fernandina.

General comments.

- The idea behind this study is interesting and worth to be explored, but I think that the analyses of the reanalyses datasets should be more detailed. Most of the manuscript is a description of the figure, and does not address the reasons

for discrepancies, which makes impossible to assess which reanalyses system is doing a better job during specific time series.

- It would be useful to include a figure/table showing the observational systems assimilated by each reanalyses dataset and the period of time in which they were assimilated. Such figure would help interpreting the changes in temperature residuals. Does any of the periods used to analyze the volcanic response include the addition/removal of an observing system? Would this invalidate the analyses for the response to that particular volcano?

- Given the change in temperatures simply due to the inclusion of additional datasets, would it be more appropriate to divide the data record in periods with a specific set of instruments (i.e. no instrument is added/dropped) and perform separate regression analyses for each period?

Specific comments.

- Fig 4: the high top models and low top models differ quite a bit from each other in terms, for instance, of altitude of the maximum. Is there a specific reason behind that distinguish the behavior of high- and low-top models?

- page 13325 L 11: 20CR shows "unknown warming signals" in 1989/1990. There is no hypothesis about the origin of these signals?

- page 13326 L18-20: As for the previous comment, why would ERA40 show a 1K warming not present in the other reanalyses? What causes that warming? Is it overestimation of the volcanic signal, wrong dynamics? No hypothesis?

- page 13327 L 21: "the former MAY correspond. . ." Why MAY? It should be possible to check in the lat-lon data, correct?

- page 13328 L2: Could the opposite response in the case of Fernandina be due to lingering effects of Agung in the three years before the Fernandina eruption?

  page 13328 L5: are aerosol heating rates included in the reanalyses output? If so, the cause of the warming could be checked.

- page 13328 L 9: the structure in the residuals similar to the QBO response could be due to aerosol-induced effects in dynamics (e.g. Aquila et al. (2014) in the case of a tropical geoengineering aerosol injection). However, why would it be present only in the case of Fernandina? Any hypothesis?

- page 13329 L20: 20CR shows no QBO signals in the temperature fields or has no QBO at all? If 20CR assimilated only surface pressures, either the underlying model has a way of generating the QBO or there is no QBO at all in the model

Aquila, V., Garfinkel, C. I., Newman, P. A., Oman, L. D., Waugh, D. W. (2014). Modifications of the quasibiennial oscillation by a geoengineering perturbation of the stratospheric aerosol layer. Geophysical Research Letters, 41. http://doi.org/10.1002/(ISSN)1944-8007

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 13315, 2015.