

## ***Interactive comment on “Impact of the eruption of Mt. Pinatubo on the chemical composition of the stratosphere” by Markus Kilian et al.***

**Anonymous Referee #2**

Received and published: 28 April 2020

### **1 General Comments**

The paper tries to separate the effects of aerosol heating and aerosol chemistry on ozone. It is, however, an odd concept to nudge temperatures and winds to observations in the region where temperature and dynamics changes due to aerosol should be analysed (page 5 and 6). This must have consequences for the results. To get some feeling for the introduced artifact it would be good to perform a sensitivity simulation with nudging only up to about 100hPa to get the tropospheric wave forcing but the unperturbed effects of calculated radiative heating due to Pinatubo aerosol on stratospheric dynamics, QBO nudging based on the Singapore data might be on for this case. The manuscript might be published after revision.

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### **2 Specific comments**

Page 1, line 5: The use of CCMI slang hides the problem with nudged temperatures up to 10hPa.

Page 1, line 10f: Separate between aerosol and ozone heating (see section 4.1), please reword for clarity.

Page 2, line 8: Don't forget to mention the terrestrial infrared.

In the introduction references to earlier studies with EMAC on Pinatubo are missing.

Page 4, line 6: Is the assumed distribution monomodal or how many modes are included?

Page 5, line 17: 2011 is perturbed by the medium size volcanic eruption of Nabro and therefore not background. Where are the data from? SAGE died in 2005.

Page 7, line 18: More details please, NIR, IR. Transport effect on ozone heating?

Page 9, section 4.2: Why is 1993 not addressed? In this year were the largest effects on total ozone in midlatitudes in observations but also in Fig. 5. It would be also good to compare with observations here (e.g. TOMS).

Page 10, line 1: This appears to be in contradiction to Fig. 4.

Page 10, line 31: You may mention PSCs here.

Page 12: There are several ways to separate the catalytic ozone destruction cycles. You may discuss the meaning of  $\text{HO}_2+\text{NO}$  for aerosol perturbed lower stratospheric ozone.

Figures 10 and 11 might be merged, as well as Figs. 12 and 13. It should be also better to show a common pressure level in the lower stratosphere in tropics and extratropics (Figs. 9 to 13) instead of 30 and 20hPa. What is included in  $\text{O}_x$ ? Please define, the

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Chapman cycle alone cannot explain the curves for the lower stratosphere.

Page 17, line 27: There should be also PSCs lower down, at least to 80hPa.

Section 4.5: H<sub>2</sub>O is very sensitive to uncertainties in the parameterized satellite data and gap filling in the lowermost stratosphere, please discuss. This section is difficult to understand.

Page 21, line 3: Here the artificial heating/cooling from nudging can cause artifacts.

Page 22, line 9ff: Here the sensitivity study without temperature nudging between 10 and 100hPa should be discussed. This paragraph is too tentative now.

### 3 Technical corrections

Page 1, line 8: better "background" here.

Page 1, line 23: "photolysis of O<sub>2</sub>".

Page 2, line 16: "reduction" instead of "loss".

Page 3, line 27: Is this the correct meaning of the acronym? There are several versions around in the literature, also it differs from the abstract.

Figures 1 and 2: Better use a logarithmic color scale instead of the scale with the arbitrary jump by one order of magnitude at 10 $\mu\text{m}^2/\text{cm}^3$ .

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Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-147>, 2020.