

## ***Interactive comment on “Long-range transport of volcanic aerosol from the 2010 Merapi tropical eruption to Antarctica” by Xue Wu et al.***

**Anonymous Referee #3**

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The paper contains a comparison between results of trajectory calculations for long-range transport of volcanic aerosol and a satellite derived qualitative quantity for aerosol, the aerosol cloud index (ACI). It might be of interest for ACP but it needs a lot of improvements to be useful.

### **1 General comments**

It is often not clear what is from previous work or the actual study. Concerning the comparison and for model validation it would be much better to use the actual observations of  $\text{H}_2\text{SO}_4$  aerosol and  $\text{SO}_2$  given in Günther et al., 2018 (ACP!) instead of the aerosol

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cloud index which cannot distinguish between PSCs and volcanic aerosol (e.g. Fig. 1) and where also important definitions are not provided. The figures are difficult to understand and contain too many frames. There are also several times contradictions between text and figures. The remarks on the interactions with the QBO should be corrected and shortened.

### **2 Specific comments**

Abstract: Please correct or remove the statements on QBO. Most of the calculations are for polar summer without vortex. Please mention the aerosol cloud index explicitly if you like to keep the main focus on it, just saying aerosol observations is misleading here.

Introduction, L48: This might have some effect on ozone depletion in the next ozone hole season (2011).

Section 2.1: Include more details on ACI from the Griessbach paper if you like to use this, including their Eq.3. The second paragraph is messy concerning the wavelength.

Section 2.3: Is the reanalysis ERA Interim (mentioned too late)?

Section 3.1: Figure 2 and the text are in contradiction to each other and the given reference (Surono).

Section 3.2, L256ff: Effect on late spring or summer circulation?

Section 3.3: Figure 3 is difficult to read and interpret, especially in connection with the zonal wind (Singapore data). There is also some contradiction to Fig. 6 which does not contain  $\text{ACI} < 7$  in the regions of interest. Comparing Fig. 5 and 6 is like comparing apples and oranges. Here the clear poleward plume shown in Günther et al., 2018 would be much more useful.

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Section 4, line 403: It might be of interest to compare the sulfate input from Merapi to the Antarctic lower stratosphere with the contribution of the Puyehue-Cordon Caulle eruption in June 2011.

### 3 Technical corrections

Please correct the plenty typos and grammar errors. In line 444 it should be 2011. Use consistent units. Don't use words like 'data', 'observed' for model results.

Figure 2, caption: Strange units. Is the time UTC or local? Longitude and latitude range for integration?

Figure 4: For what latitude range is frame f? It would be more useful to provide data for 100hPa instead of 30hPa.

Figure 5: The labels are too small and the color scale is for large portions out of range.

Figure 6, caption: Spell out ACI.

Figure 7, caption: Is aerosol load here equal to ACI (without unit)?

Figure 10: Labels missing.

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