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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Measurement report: Immediate impact of the Taal volcanic eruption on atmospheric temperature observed from COSMIC-2 RO measurements" *by* Saginela Ravindra Babu and Yuei-An Liou

Anonymous Referee #2

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Author's have used COSMIC -2 RO data to show the effect of the Taal volcanic eruption on the atmospheric temperature and humidity. The report is interesting to see the effect due to eruption, however, its quantification is generally complicated processes due to other dominated atmospheric process especially in the tropopause region. Authors reported a typical formation of the multiple tropopauses due to warming (at 15.5 km and 16.5 km) from a volcanic eruption. However, such temperature inversions can also be due to cirrus clouds occurrence or due to planetary wave propagation. Thus, to ascertain that such effects are only due to Taal eruption, authors need to rule out

other possibilities for the formation of an inversion occurring just below the tropopause. Authors have claimed the tropospheric warming and drying following the eruption that needs a proper justification. They have provided possible reason is due to the formation of the sulphate aerosols in the troposphere. However, I doubt that sulphate aerosol can persist for about one month in the troposphere as it has small residence time. Further, authors found that cold point tropopause has been warmed by 1K after the eruption, but it appears within the standard deviation and hence cannot be significant warming. My detailed comments are listed below.

40: Earth's lower atmosphere→ troposphere or surface will be more appropriate here 50: is it tropospheric warming or cooling? 71-74: Why only altitude and latitude dependent but not longitude? 113 Estimate→ Estimates 132 SO2 column?

135: exists

160: has→ had played

165: active→remained active throughout 13 January 169: varied→ will vary

171-172→ To see temperature structure on 13 Jan. . ..COSMIC-2 RO data is used.

196: Why the temperature profiles far away from the eruption site is warmer than the temperature profile closer to the site?

201 is mention of "radius" here and elsewhere necessary? I think within $\pm$5 latitude and longitude itself make sense.

225 The word "noticed" has been used several times throughout the manuscript, authors may consider using some different words such as observed, found, detected etc. Figure 3a: are these red dots represents occultation points?

250: How to be sure that the bending anomalies detecting cloud top are volcanic cloud top, not the convective cloud top. Since occultations lie mostly away from volcanic plume (Figure 3a).

251: cloud

279: I do not see $\sim$ 1K significant warming in the CPT temperature. The temperature change by $\sim$ 0.5 K (upper limit 201.1K-201.7K and lower limit 185.9K-186.3K) before and after the eruption and are within the standard deviation.

Fig6: It would be clearer if the data presented are shown for one week before and after the eruption. Mark a vertical line on the day of eruption and show the anomalies for the 6 Jan-19 Jan taking 13 Jan as eruption date.

Fig6a: As plumes become very week after 13 Jan, why positive temperature anomalies (at 16-17 km) are present throughout the month with maximum warming on 19-24 Jan? I would have expected higher positive temperature anomalies on 14-16 Jan too. Do you not think that positive temperature anomalies are the part of the stronger anomalies seen on 12 Jan or before?

310 Then again,

315: What about warming seen on 12 Jan?

316-17: It is not true. 19-24 Jan is the warmest when compared to remaining days.

320-24: which figure do you refer here (Fig 6).

325-328: One should expect cooling in the troposphere, not warming. If the warming in the troposphere is due to upper tropospheric anticyclone, then it must not be linked to warming due to volcanic ash. How do you claim that warming between 5-20 km is significant?

333: Which both locations authors refer here? Both locations: Do you mean west and east Pacific region?

Fig 7. Why a large decrease in RH is noticed between 10-15 km? How RH profiles appear before and after the eruption? This could an interesting part to examine why troposphere has been dried after the eruption. I suggest to authors to show the plots

before and after the eruption.

355-360: Authors explained that the formation of the sulphate would have decreased the RH. They further claimed a decrease in temperature also accounted due to formation of the sulphate. My understanding is that sulphate aerosol residence time is very less in the troposphere and it will quickly get deposited to the surface. But authors show that they remain persistent for about a month (Fig 6a) which have significantly dried the troposphere.

435 small-scale

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