

Reviewer's comments for:

Periodicity in the BrO/SO₂ molar ratios in the volcanic gas plume of Cotopaxi and its correlation with the Earth tides during the eruption in 2015

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This paper by Dinger *et al.* entitled “Periodicity in the BrO/SO₂ molar ratios in the volcanic gas plume of Cotopaxi and its correlation with the Earth tides during the eruption in 2015” is an interesting study on periodic patterns of the BrO/SO₂ molar ratios in the volcanic plume from Cotopaxi volcano and their correlations to surface displacements induced by the Earth tides and to meteorological conditions. They analyze the time-series of BrO/SO₂ molar ratios in the volcanic plumes from Cotopaxi volcano and found that the ratio had a period of 13.7 days. They compare the period to the Earth tides and meteorological conditions. Finally, they found a good correlation between the BrO/SO₂ molar ratio and the N-S components of the ground displacement induced by the Earth tides and between the ratio and the relative humidity. They suggest that this correlation would be related to “excitation” of the magmatic system by the earth tides and list possible volcanological origins. The methods and the data are clearly presented and the results are convincing. The conclusions contribute to our understanding of periodic patterns of the volcanic gas emissions and the possibility of the impact of the Earth tides on the magmatic system. This article will be of interest not only to geochemists of volcanic gas emissions but also to volcanic geophysicists and other geophysicists in the surrounding disciplines. This paper is valuable to be published in this journal but needs some minor revisions of the following comments.

Major comments

1. This paper discusses the relation of BrO/SO₂ ratios and the displacements of host rocks or other magmatic systems induced by the Earth tides in Section 5.2.3 and Section 5.3. I cannot understand the image of the ground motions in the volcano that can influence the volcanic gas emissions especially ratios. The discussions about the Earth tide are divided into two sections in Discussion and it is difficult for readers to get the key points and the situations you mentioned. Please make it clear about the image of Earth-tide-induced displacements that can occur in the volcanic and magmatic systems, and then discuss about the situation of magmatic systems of Cotopaxi volcano. The influence of the Earth tides on the ratio of volcanic gas is also unclear. Please mention about it in Discussions. Here I list some papers about Earth tides and the volcanic activity that you did not cite: Sottilli *et al.*, 2007, Effects of tidal stress on volcanic activity at Mount Etna, Italy, GRL; Sottilli and Palladino, 2012, Tidal modulation of eruptive activity at open-vent volcanoes: evidence from Stromboli, Italy, Terra Nova.

2. About the magmatic system of Cotopaxi volcano, you only mentioned about the recent unrest and the plug formation in the conduit in Section 2.3. To discuss about the magmatic system in Discussion, I think you need to give us some information about the location and depth of the magma chamber. Are there any previous studies of geophysics (distributions of hypocenters, location and geometry of source of the ground deformation) on Cotopaxi volcano? If so, you should cite such kind of papers. And it would be better to write the details about the plug formation and its reliability.
3. In Section 3.2, you did not mention about the effect of volcanic ash in retrieval of the SO₂ and BrO column amounts. There is some dilution effect in scanning DOAS systems (e.g., Mori et al., 2006, GRL; Kern et al., 2010, BV) and the existence of volcanic ash can result in underestimation of the column amounts. Please mentioned about the problem in this section.

Minor comments

4. In general, the order of appearance of the figures does not match to the order of reference of the figures in the text. This can be confusing for the readers.
5. Page 1, line 6: “One strong aspirant ...” is in plural form. It should be in singular form.
6. Page 2, line 6: “... (COSPEC, M. M. Millan (1970))” Is it correct using parentheses in parentheses? The other citations have similar problems, so please check the style of the journal.
7. Page 3, line 27: “olique” is “oblique”, isn’t it?
8. Page 4, line 30: “... and composition (Gaunt et al., 2016) of ash emissions ...” should be “... and composition of the emitted ash (Gaunt et al., 2016) ...”
9. Page 9, line 6: “Figure 6” is Figure 5?
10. Page 10, line 26: “contrast, the O4 analysis requires ...” O4 should be O₄.
11. Page 16, line 6: “the Bro/SO₂ data ...” should be “the BrO/SO₂ data ...”.