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Interactive comment on "Characterisation of the magmatic signature in gas emissions from Turrialba volcano, Costa Rica" *by* Y. Moussallam et al.

Anonymous Referee #1

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General comments

This manuscript reports the chemical composition and SO2 flux emitted from Turrialba volcano using a scanning ultra violet spectrometer, FT-IR and Multi-gas sensors and suggested the progressive dying up leading the eruption. Although the data reported by this manuscript are limited in number and overlap with the published data obtained only a week before, addition of such data is important in order to evaluate a short-term fluctuation of the gas emission and the major subject of this manuscript is different from the previous study, which aims to estimate the CO2 flux from the volcano. However, the discussion in this manuscript is poor in quality and sometimes misleading, in particular 1) comparison with the previous data are incomplete, 2) the estimate of the oxygen fu-

gacity is misleading, and 3) discussion of the current state is not supported by the data. Therefore the present manuscript is not acceptable for publication and resubmission of the manuscript after full reconsideration of the discussion is suggested.

Specific comments

1) Comparison with the previous studies

1-1) Conde et al. (2014)

The data given in this manuscript largely overlap with those obtained only a week before by Conde et al. (2014). Although their data are cited in the text, similarity and difference of these data sets are not fully discussed in the manuscript. In particular, the possible causes of the four-times difference of the SO2 flux and the five-times difference of the CO/SO2 ratio at 2012 vent. Although the large CO2/SO2 ratio of the 2012 vent is attributed to the large error of the FT-IR measurement, such a conclusion cannot be justified without a quantitative error evaluation. And similar evaluation should be performed for other data sets to quantify the errors of other data. It is also necessary to clarify the progress after Conde et al. (2014).

1-2) Conde et al. (2013) Int. J. Earth Sci., doi 10.1007/s00531-013-0958-5

Conde et al. (2013) reported the SO2 flux data during 2008-2012. This reference should be cited and discussed. In particular, they reported the high flux ($\sim$1500 t/d) before the Jan, 2010 eruption, which contradicts the discussion in the present study.

2) Oxygen fugacity estimation

The oxygen fugacity estimation is misleading. This method is applicable to the gasses, which discharged directly from magma to the atmosphere, such as those of lava lakes, as we can assume the gas composition quenching just after the discharge. Compositions of fumarolic gases, however, vary with outlet temperature and the condition of the magma degassing (such as oxygen fugacity of the magma) cannot be estimated. In particular, the H2/H2O and CO/CO2 ratios are commonly decreases with outlet tem-

perature and the decreasing trend is commonly the result of shift of chemical equilibrium under a control of the major redox pair of SO2/H2S, which is known as the gas buffer (Giggenbach, 1987, Applied Geochemistry, vol. 2, 143-161).

3) Current state of the degassing

The discussion is poorly supported by the data.

The low SO2 flux is suggested to be indicative of a preparation of eruptions. However, Conde et al. (2013) reported the increase of the flux several months before the 2010 eruption and several low flux periods regardless of the occurrence of eruptions; those observations disagree with the present conclusion.

The similarity of the 2008 gas composition and the 2013 gas composition is concluded based on the comparison of the S/CO2 and (HCl+HF)/CO2 ratios. However, other compositions, such as HF/HCl, H2/SO2 and CO2/CO ratios are different and the general similarity cannot be concluded.

The progressive drying is suggested based on the gas composition. Although the gas composition indicates the limited contribution of hydrothermal system, this does not suggest the progressive change as there is no composition data after the previous eruption.

Other comments

Table 3 and relating discussion are suggested to be removed, as they are not relevant to the major subject of this manuscript.

Fig. 3 is not necessary as any detail of the SO2 flux variation is not discussed in the text.

Interactive comment on Solid Earth Discuss., 6, 2293, 2014.