

Comments on ms se-2014-62 - Characterisation of the magmatic signature in gas emissions from Turrialba volcano, Costa Rica – by Y. Moussalam and co-authors

### *General comments*

The ms reports new results on gas composition and gas fluxes during a reactivation stage of Turrialba volcano, in Costa Rica, characterized by high-temperature degassing from recently opened new vents (2010-2012). Gas composition and fluxes were derived from the combined use of direct (Multigas) and remote (open-path FTIR, scanning DOAS) gas measurements. Combined use of these different tools on volcanoes is relatively recent and promising. The data set features only a small time window of Turrialba's activity in March 2013 but is discussed in the framework of data collected since 1998, prior to the current unrest. Such results are of key interest to track the transitions from hydrothermal to magmatic activity at awakening volcanoes and hence mitigating eruption hazards. Overall, the ms is well presented and illustrated, the results are reasonably well discussed and their uncertainty is well taken into account in the interpretations (after previous revision). This study fully merits publication in SE.

### *Brief specific comments*

- Figure 3: avoid second decimal on kg/s numbers (left scales) given the experimental uncertainty on SO<sub>2</sub> fluxes.
- Figure 4a: may actually indicate two distinct gas components, with somewhat differing CO<sub>2</sub>/SO<sub>2</sub> ratio, in the mixed plume emissions from 2010 and 2012 vents measured with Multigas. The least prevalent component may have a higher C/S ratio (2012 vent?). Same observation in Fig. 4c.
- Figure 4d: given the high uncertainty on H<sub>2</sub>, this graph is not the best illustrative. Rather, why not showing H<sub>2</sub>O vs SO<sub>2</sub>?
- Figures 4a-d: indicate linear correlation coefficients
- Figure 6: in the whole text C-S relative proportions are prevalently discussed as CO<sub>2</sub>/SO<sub>2</sub> ratio. Moreover, carbon dioxide being the first exsolved magmatic gas compound, its increase relative to S and other species should be the most obvious indicator of increasing underground magma degassing at Turrialba. This is the typical signal detected in 2002 when fumarolic activity increased and SO<sub>2</sub> became first detected. Therefore, I suggest plotting CO<sub>2</sub>/S ratio, rather than S/CO<sub>2</sub>, in Fig. 6. Intermittent decreases in SO<sub>2</sub> release due to either lowered permeability of the volcanic system or enhanced S scrubbing should appear still more clearly.
- Oxygen fugacity computation: computation for the 2012 gas vent could be performed at the measured minimal temperature of 750-800°C rather than at 900-1100°C if shallow interactions with the hydrothermal system and host rocks are to be taken into account. Alternatively, using LogfO<sub>2</sub> from Masaya as analog may allow estimating a possible temperature of upraising magmatic gas at Turrialba.