Reply to: Anonymous Referee #2
On the manuscript: “Characterisation of the magmatic signature in gas emissions from Turrialba volcano, Costa Rica”

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 SO2 fluxes.
CHANGED second decimal removed

- Figure 4a: may actually indicate two distinct gas components, with somewhat differing CO2/SO2 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.
ADDED: “A possible hint of this contamination can be seen in Fig. 4a and to a lesser extent in Fig. 4c where two dissimilar component with differing CO2/SO2 ratio can be observed.”

- Figure 4d: given the high uncertainty on H2, this graph is not the best illustrative. Rather, why not showing H2O vs SO2?
Showing the large error on the H2 measurement is important as we latter dismiss the use of the H2O/H2 couple to estimate the oxygen fugacity value based on this high uncertainty.

- Figures 4a-d: indicate linear correlation coefficients
ADDED: R2 values on regression lines of all scatter plot

- Figure 6: in the whole text C-S relative proportions are prevalently discussed as CO2/SO2 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 SO2 became first detected. Therefore, I suggest plotting CO2/S ratio, rather than S/CO2, in Fig. 6. Intermittent decreases in SO2 release due to either lowered permeability of the volcanic system or enhanced S scrubbing should appear still more clearly.
Figure 6 CHANGED accordingly (Fig. 6 is now Fig. 7)

– 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

LogfO2 from Masaya as analogue may allow estimating a possible temperature of upraising magmatic gas at Turrialba

Agreed, the paragraph has now been changed accordingly, an additional figure (new Fig. 6) has been added to fully describe the fO_2-Temperature relationship at the measured CO2/CO content.

Paragraph now reads: "Since the temperature of the magma is unknown we computed the oxygen fugacity corresponding to a range of possible equilibrium temperature (Fig. 6). Using the minimum temperature of 800°C measured at the 2012 vent as equilibrium temperature would yield a fO2 values of 2.4 log unit above the QFM buffer, while if a higher equilibrium temperature with the suspected andesite to basaltic-andesite magma of 900°C to 1000°C would yield a fO2 values of 2.8 to 3.1 log units above the QFM buffer."

ADDED: "Using the fO_2 values for Masaya as a proxy to that of Turrialba would conversely yield an equilibrium temperature of ~600 to 800°C. As of now the system remains underdetermined but the fO_2 of the magma can be constrained to 1.5 to 3 log units above the QFM buffer with reasonable confidence. "