Solid Earth Discuss., 6, C1134–C1137, 2014
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Solid Earth
Discussions
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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 #4

Received and published: 12 October 2014

This manuscript presents results on chemical composition of gas emissions from Turrialba Volcano (Costa Rica). The experiments are performed by means of a DOAS scanner, FT-IR spectrometer and MultiGas instrument. I do believe that the joint use of these instruments is producing a synergistic effect. All major volcanic gas species H2O, CO2, SO2, HCl, CO, H2 are evaluated and treated as a magmatic signal in the gas emissions and further results are used to estimate the evolution of the magmatic-hydrothermal system. This approach may be considered as prospective for studying other volcanoes as well. The manuscript is well structured and presented, the results are concise and discussed in details. Thus I propose the manuscript for publication in SE after a minor revision.

General comment:

There are a few publications presenting results about SO2 fluxes emitted by Turrialba Volcano evaluated by means of DOAS scanners (Conde - DOI 10.1007/s00531-014-1040-7, Conde - DOI 10.1007/s00531-013-0958-5, Conde in Geophysical Research Abstracts, 2014, and Master thesis of A.M.M. Rivera – MTU 2011). The data in these publications are obtained by NOVAC scanners. The thorough analysis of these publications reveal that SO2 emissions of Turrialba Volcano are subject to fast and strong fluctuations. The last publication of Conde is based on measurements performed also in March 2013 and there is big discrepancy between SO2 fluxes reported there(about 800 t/day) and in the manuscrip under review (about 250 t/day). The accuracy of SO2 flux evaluation depends on many circumstances and a correct comparison of two results is not possible if they are unknown. For example we have to know: (1) geometrical factors (distance to plume, angle width of plume, increment of scanning angle) determining how well the plume is crossed; (2) aerosol transmission of the plume (determined by the ratio of signals at about 360 nm registered inside and outside the plume); (3) max and mean values of the registered SO2 column amount within the plume; (4) the fitting window used; (5) rough estimate of SO2 column amount error (based on standard deviation of retrieved column amount outside the plume); and at last but not at least (6) rough estimate of the impact of scattering effects. The last one is the most favourable questions asked by reviewers but there is no way to provide scientifically convincing answer. The only one possiblity available at the moment is to try to use results of Kern (2010 Bull of Volc.) like a look-up table, i.e. to find a scenario considred there which is most likely matching your experimental conditions and thus to provide some rough estimate. I recommend to provide detailed description of the performed DOAS experiments and thus to convince the reader in the authenticity of the reported SO2 fluxes. Outside the scope of the review I would like to notice that it could be great if volcanological society maight introduce some standard of reporting SO2 fluxes and corresponding measuring conditions. Thus it will be easy to compare results obtained by different authors with different instrumentations. For example, it seems it's

well known that NOVAC SO2 data correlate with the used wind speed (see attached figure) but this fact is not explained up to date.

Minor comments:

(1) Provide detailed description of the used gas sensors in MultiGas instrument and their accuracy.

(2) Comment the usage of Figure 3. It proves that reported SO2 flux confident intervals reflect the error of measurements but not the natural variability of the volcanic emission during the experimental period. Improve axes captions.

(3) In scatter plots CO2 vs SO2 (Figure 4) use only CO2 concentration of volcanic origin. The intercepts there correspond to atmospheric CO2 content and probably the systematic errors of your mesurements but they do not influence the correlation analysis.

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

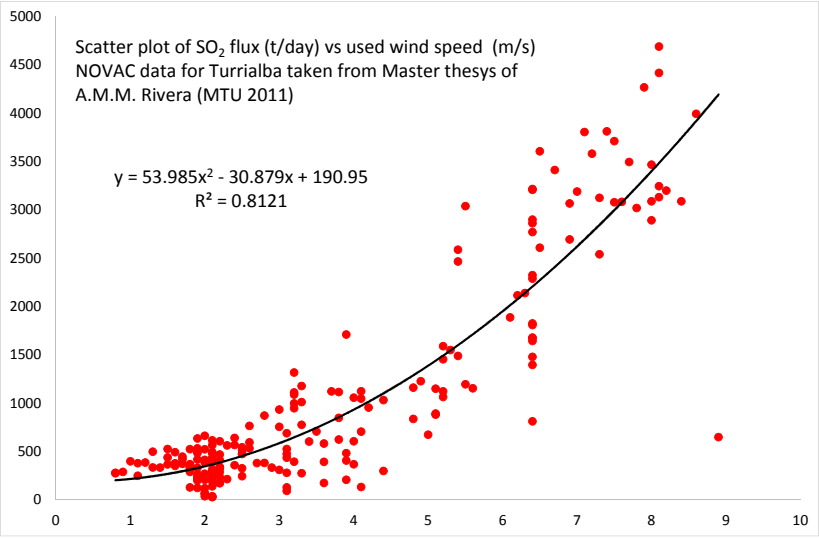

Fig. 1.