

## ***Interactive comment on “Increasing CO<sub>2</sub> flux at Pisciarelli, Campi Flegrei, Italy” by Manuel Queisser et al.***

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The ms is very interesting and merits to be published in Solid Earth discussions. There is just one major point and few minor ones that should be answered by the authors. The main point regards the statement done in the ms that the proposed method is in some way alternative of the classical methods based on the accumulation chambers to monitor the CO<sub>2</sub> emissions because, according to the authors, the measurement "... accounts for all possible CO<sub>2</sub> vents and diffuse degassing ..... to obtain a quantitative picture of CO<sub>2</sub> degassing" In my opinion the proposed method based on "...laser remote sensing spectrometer...." (LARSS) is a very useful additional method to have an almost complete picture of CO<sub>2</sub> degassing from an hydrothermal site but the method, at least at this stage of development, can not substitute the accumulation chamber

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measurement. LARSS can in fact detect and measure the CO<sub>2</sub> emitted by vents, I am not sure that it can reliably measure a real diffuse emission. Diffuse degassing over large areas, such as at Solfatara and Pisciarelli, give rise in fact to some more complex structure than a single plume. So, low level anomalies, that can contribute significantly to the total CO<sub>2</sub> release are probably not detectable and quantifiable by LARSS. In addition the method measure the CO<sub>2</sub> concentration close to the ground (because the background can not be the sky but the ground) where, for example, the wind field is strongly affected by the interaction of the air with the terrain that implies a reduction in the wind speed etc. This aspect should be a little discussed. Furthermore another aspect of the accumulation chamber method is the possibility to draw detailed maps of the emission areas (and their variation during time), that can not be done with LARSS.

Minor points

- Page 1 line 25 and 28 Substitute d'Auria with D'Auria.
- Page 2 line 4. "...feeding the overlying ~ 1.5 km deep hydrothermal reservoir.." There is any convincing prove of the depth of the hydrothermal reservoir, I suggest to write more generally "...feeding the overlying hydrothermal system(s)...."
- Page 2 line 19 ".....Caliro et al., 2014....." Caliro et al., 2014 did not chose any specific depth for magma degassing but they presented a series of different scenarios including degassing fro the 8 km deep (200 Mpa) magma.
- Page 2 line 24 I suggest to substitute alternative with additional.
- Page 2 line 27-29 The cited works refer mainly to the emission of the vent of Pisciarelli. The diffuse degassing eventually included in these measurements is at least incomplete (see main point). I suggest to focus your considerations on the vent emission (that now at Pisciarelli is by far the main way of emission)
- Page 3 line 27-28 " ... The plume speed is retrieved by digital video tracking of the plume of condensed water vapor as described in Queißer et al. (2016).. " Ok, the speed

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of the plume is measured and it is assumed constant in the plume. Is this assumption reasonable? In my opinion, the colder peripheral zones of the plume should move at a speed lower than the central hot zone. Furthermore a further reduction of the wind speed should be expected in the zones where the plume is just above the terrain (at low height from the ground). In other words I think that this of the speed is still a central parameter with many uncertainties... could you add some discussion about the problem of assuming a constant wind speed?

- Page 4 line 8 Please define what is Delta/beta

- Discussion and Conclusion I agree mostly with you, but I don't think that the Pisciarelli measurements alone could be very indicative without years of monitoring chemical and isotopic compositions of the fumaroles, seismicity and ground deformation. I suggest you to read (and in the case to cite) the most recent paper on Campi Flegrei unrest where the different signals from geochemical and geophysical technique are compared and discussed also in the frame of a physical model of the system (Chiodini et al., 2017). The paper shows further evidence on the pivotal role of the heating of the hydrothermal system in the present dynamic of the caldera. (Chiodini, G., Selva, J., Del Pezzo, E., Marsan, D., De Siena, L., D'Auria, L., Bianco, F., Caliro, S., De Martino, P., Ricciolino, P., and Petrillo, Z., 2017, Clues on the origin of post-2000 earthquakes at Campi Flegrei caldera (Italy): Scientific Reports, doi:10.1038/s41598-017-04845-9)

- References: check the citation of Cardellini et al., 2016, there is an error in the name of one of the coauthors (Giovanni, G. instead of Chiodini, G.)

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