

## ***Interactive comment on “Monitoring crustal CO<sub>2</sub> flow: methods and their applications to the mofettes in West Bohemia” by Tomáš Fischer et al.***

### **Anonymous Referee #1**

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Monitoring crustal CO<sub>2</sub> flow: methods and their applications to the mofettes in West Bohemia By Tomáš Fischer, Josef Vlček, and Martin Lanzendörfer

General comments The manuscript is of principal interest for the scientific community, not only for the West-Bohemia area with their numerous CO<sub>2</sub> gas emission sites, but generally for other geothermal/volcanic areas because it proposes a possible observation technique of natural degassing sites like mofettes or CO<sub>2</sub> enriched mineral springs. I have no specific suggestions concerning the scientific content of the manuscript; however, some points should be improved before publication.

The authors document a comprehensive analysis and discussion of robust monitoring methods of CO<sub>2</sub> degassing sites which were compared during long-term monitoring periods. They invoke a simple but applicable installation of pressure sensors to reg-

ister the gas flow rate via a relative pressure ratio. The influence of the CO<sub>2</sub> gas bubbling process to the groundwater column in wells or mofettes was registered and can be converted into a gas flow rate as a reliable measuring technique. Influences of barometric pressure and ambient temperature are discussed. More experiences in the data evaluation and some improvements are necessary as mentioned at the end of the studies but the application on other areas of interest can be suggested. One of the most interesting aspects of this study is the relation to the earthquake swarm occurrence north of the gas emission sites and their triggering of gas flow anomalies. The results suggest a trigger process for gas flow anomalies only for earthquake swarms in a southern cluster. Swarms north of it show no influences to the gas emission. This result implies a seismotectonic influence to the gas migration which is important for the interpretation of gas flow anomalies discussed worldwide. This is an interesting paper that should be accepted for publication following consideration of the reviewers' comments which are marked here with the line numbers but they are all quite minor.

Specific comments 38: Fig. 1 : The map: the marked distribution of granite is not complete. And it is a questionable presentation: what is important: relief or lithology- I suggest only one of them. The northern most mofettes in Fig. 1 (latitude > 50.2)? They are really mofettes? Please check it.

56-62: at the end of these sentences, the authors should add here the sentences of the lines 73-81 for a better overview about the gas isotopic features. 61: what is the meaning of "... high 3/4 He ratios..." ? 65: similar as above: What is high gas flow ? , see also line 73 and 75: unclear. 67: "the ascent of gas" – Numerous studies show that the earthquake swarms are related to the ascent of gas? This assumption has no evidences in my opinion or please, indicates the references. 73 "gases produced" , this terminus is may be correct but not usual for the characterization of natural degassing sites, see also line 108 & 405 104: please add: (see Fig. 1) 110: what means "deep root" zone of mofettes? The origin of CO<sub>2</sub> is known. 201 "Within a few months" should be changed into " Within a few days..." ? 294 & 295: This explanation is may be correct

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for mineral springs with a continuous gas/water discharge. However, mofettes can be considered as gas dominated migration path. It means that the CO<sub>2</sub> will migrate as gas phase with over-pressure above the supercritical point. The water phase content will be of minor importance here. The groundwater horizons are the barriers and the beginning of the bubble creation which depends on the pressure ratios of gas and the water column if the maximal solubility in water is reached. This effect can be observed in submarine gas vents. 300: the driving force for gas flow is the hydraulic pressure gradient and the density contrast 354: the section 2.6: the interpretation with the barometric efficiency is an interesting approach. Because of “the many unknowns in this regards”, a simplified way could be helpful in this context. What about this comparison: show an additional graph with the result of pressure head (in mbar) minus the atmospheric pressure (in mbar). 387-391 these lines should be at the end of this section. 427&428: The authors claim the increase of gas discharge as anomalous effect of different reasons except the anomalies as “probably merely accidental” at two sites (Soos and Bublák) during the summer 2016. These anomalies occurred a few weeks after the gas flow increase at Hartoušov due to the drilling process and the influence to the hydraulic regime. An assumption or specific interpretation should be added. Please think about the fluid interaction of the deeper horizons in the area (Cheb basin). For example, the gas eruption at the drill site H11 in the year 1957 induce an anomalous gas discharge and variations in the water levels in Františkovy Lázně, about 2 km far. A reduced water table at the Hartoušov drill site could influence the hydraulic pressure regime in the nearby Cheb basin. This influence could trigger the ex-solution of CO<sub>2</sub> of the water table with a temporal delay at other locations (mofettes), similar to the atmospheric pressure effect. 464: Please take into account also that the strong drought period during the last summer reduces the level of the surrounding ground water table. This hydraulic pressure reduction induces an addition gas release as diffuse component and could reduce the total amount of gas discharge at the monitoring site. 477: because of missing evidences of this process, please add “... indicates the possible presence of...”

Technical comments CO<sub>2</sub> – should be written with 2 subscript The names of the references in the text should be outside the brackets, e.g. Fischer et al. (...), see line 68, 250, 259 a.s.o. 439: considered as an 493 “discharges” is a better term here than “emanations” 564 this reference is not mentioned in the text A few typesetting mistakes in the reference list The figure captions should be not in bold

All the 15 listed questions for the reviewer can be answered with: accepted or yes 1. Does the paper address relevant scientific questions within the scope of SE? 2. ...

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