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NH31A-3852 **Long-Term Soil Gas Surveys in the Northern Part of the Modena Province Pre, During and After the 2012 Seismic Sequence**

Session Interdisciplinary Study of Pre-earthquake Processes: Observation, Validation, Modeling, and Forecasting II Posters

Three geochemical surveys of soil gas (CO_2 and CH_4 flux measurements, He, H_2, CO_2, CH_4 and C_2H_6 concentrations) and isotopic analyses ($\delta^{13}C–CH_4$, $\delta D–CH_4$, $\delta^{13}C–CO_2$) were carried out as part of a feasibility study for a natural gas storage site in the Modena Province (Northern Italy), during the 2006-2009 period. In May-June 2012, a seismic sequence (main shocks of ML 5.9 and 5.8) was occurred closely to the investigated area. Chemical and isotopic analysis were repeated in May 2012, September 2012, June 2013 and July 2014.In the 2006-2009 period, at the pre-seismic conditions, chemical composition of soil gas showed that the southern part of the studied area is CH_4-dominated, whereas the northern part is CO_2-dominated. Relatively anomalous fluxes and concentrations were recorded with a spotted areal distribution. Anyway, CO_2 and CH_4 values are within the typical range of vegetative and of organic exhalation of the cultivated soil.

2012-2013 soil gas results show CO_2 values essentially unvaried with respect to pre-earthquake surveys, while the 2014 values highlight an increasing of CO_2 flux in the whole study area. On the contrary, CH_4 values seem to be on average higher after the seismic sequence, although with a decreasing trend in the last survey (2014).

Isotopic analysis were carried out only on samples with anomalous values. The $\delta^{13}C\text{-}CO_2$ value suggests a prevalent shallow origin of CO_2 (i.e. organic and/or soil-derived) probably related to anaerobic oxidation of heavy hydrocarbons. Methane isotopic data ($\delta^{13}C\text{-}CH_4$) indicate a typical biogenic origin (i.e. microbial hydrocarbon production) of the CH_4, as recognized elsewhere in the Po Plain and surroundings.

Obtained results highlight a different CO_2 and CH_4 behaviour before, during and after the seismic events. These variations could be produced by increasing of bacterial (e.g. peat strata) and methanogenic fermentation processes in the first meters of the soil. No hints of deep degassing can be inferred for the study area after the earthquake, as suggested by isotopic analysis.

These achieved outcomes constitute the starting point for subsequent geochemical surveys, in order to assess the temporal variations and to better understand the geochemical processes related to the seismic sequence.

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