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Subterranean CO2 ventilation and its role in net ecosystem exchange with the atmosphere

Enrique P. Sánchez-Cañete (1,2), Penélope Serrano-Ortiz (1,2), Andrew S. Kowalski (2,3), Cecilio Oyonarte (4), and Francisco Domingo (1)

(1) Departamento de Desertificación y Geo-ecología, Estación Experimental de Zonas Áridas – CSIC, Ctra. Sacramento s/n, 04120, Almería, Spain (enripsc@eeza.csic.es), (2) Grupo de Física de la Atmósfera, Centro Andaluz de Medio Ambiente (CEAMA), 18006, Granada, Spain, (3) Departamento de Física Aplicada, Facultad de Ciencias, Universidad de Granada, Fuentenueva s/n, 18071 Granada, Spain, (4) Departamento de Edafología y Química Agrícola, Universidad de Almería, Carrera Sacramento s/n, 04120, Almería, Spain

The FLUXNET community investigates “net ecosystem exchange” (NEE) and interprets CO2 fluxes as a biological flux (photosynthesis and respiration), generally neglecting non-biological processes. These abiotic processes can temporally dominate the NEE in areas with carbonate soils [Kowalski, et al., 2008] when stored gaseous CO2 can be exchanged with the atmosphere through the venting of subterranean spaces. However, the implications of ventilation processes for regional CO2 budgets are still unknown. Here we analyze several episodes of soil CO2 discharge and its connection with ventilation processes that occurred during a dry period in a carbonate ecosystem, we also examine their determinants and implications for the NEE measured with an Eddy Covariance system.

During the dry season of 2009 in a subhumid shrubland, two sensors measured CO2 molar fraction in the soil (25 cm depth) and in a borehole penetrating 7 m into a bedrock outcropping. Ecosystem CO2 fluxes were measured using an Eddy Covariance system, with quality control and gap filling performed according to Serrano-Ortiz et al., 2009 and Reichstein el at., 2005 respectively. Results highlight important events where rapid decreases of the soil and borehole CO2 concentrations correlated very well with large emissions of CO2 measured with the Eddy tower. These events occurred when the friction velocity reached high values and thus they can be associated with ventilation processes.