Geophysical Research Abstracts
Vol. 13, EGU2011-10181, 2011
EGU General Assembly 2011
© Author(s) 2011

Can stable isotopes and radon measurements explain the contribution of geogenic carbon to soil CO2 efflux of a karst environment?

Gregor Plestenjak (1), Nives Ogrinc (2), Janja Vavpotič (2), Mitja Ferlan (1,3), Klemen Eler (1), and Dominik Vodnik (1)

(1) Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia (gregor.plestenjak@bf.uni-lj.si), (2) Jožef Stefan Institute, Ljubljana, Slovenia, (3) Slovenian Forestry Institute, Ljubljana, Slovenia

Several studies showed that abiotic processes could contribute to the ecosystem carbon exchange measured on short time scales, beginning with high rates of net CO2 release or uptake measured over ecosystems by Eddy covariance method. The two main abiotic interpretations for these »anomalous« measurements are weathering processes and subterranean cavity ventilation. Eddy covariance measurements of NEE, Rs and Reco at Podgorski kras, Slovenia also revealed unexpected contribution of CO2 emissions from soil, which were especially prominent in winter time and in short periods after rain events. Therefore we aimed to estimate the contribution of different sources of soil CO2 (biogenic, geogenic) to the soil CO2 efflux.

In 2008 and 2009 we performed regular measurements of soil respiration (Rs), soil moisture and temperature, which were paralleled by sampling of soil gas for isotopic analyses. Fluxes under different plant cover were relatively high when compared to similar ecosystems (annual respiration from 1460 to 1500 g C m-2 y-1). It was also estimated that organic sources represent between 67 to 80% of the total CO2 efflux during warmer periods from May until October in 2008 and 2009. However, during the winter this contribution is lower ranging between 46 and 60%.

In order to estimate the contribution of CO2 derived from cavities we performed georadar measurements within the eddy tower footprint to survey the structure of karstic bedrock. Two plots were selected, one with homogeneous bedrock and the other with nonhomogeneous bedrock, where cavities are present. On these new plots we made periodical measurements of Rs, soil CO2 and soil 222Rn measurement as a proxy of ventilation to estimate outgassing of subterraneous CO2 to atmosphere. Beside periodical samplings we introduced continuous measurements of 222Rn and CO2 on two locations (cave entrance, soil above the homogeneous bedrock) that gave us an idea on a direct contribution of CO2 from the caves. Results from a half year measuring period (from may 2010) revealed only weak correlation between soil CO2 and Rn concentration (R2=0.33). Comparisons of the sites that differ in homogeneity of the bedrock indicate that the contribution of subterraneous CO2 to the CO2 flux through the soil profile without direct connection to the cavities is minor. Measurements at the cave entrance, however, prove tight relation between CO2 and Rn concentration (R2=0.84) and indicate significant degassing when temperature and air pressure gradients are present. It is therefore likely that cave CO2 enriches the ecosystem respiration directly by ventilation from gas transducing cracks and vents.