# Effect of subsoil ventilation processes on net ecosystem $CO_2$ exchange: consequences for semiarid carbonate ecosystem carbon balances

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Climate change may alter soil ecosystem functioning, as assessed via the net carbon ecosystem exchange (NEE) with the atmosphere, assumed to be related to the balance of biological processes of photosynthesis (gross primary production) and ecosystem respiration. Recent studies in carbonate ecosystems show a contribution of subsoil ventilation (VE) to NEE through $CO_2$ emissions to the atmosphere. However, both the overall importance of such $CO_2$ exchange processes and their drivers remain unknown. Several dry-season episodes of net $CO_2$ emissions to the atmosphere, measured by Eddy covariance towers in South East Spain, along with soil and borehole $CO_2$ measurements, will be presented. Results highlight important events where rapid decreases of underground $CO_2$ molar fractions correlate well with sizeable $CO_2$ release to the atmosphere. As a general hypothesis, a significant fraction of respired $CO_2$ can be stored in the vadose zone and emitted afterwards by subsoil ventilation (VE) via changes in atmospheric pressure or wind speed, contributing to NEE. The importance of VE in our study sites (up to 23% of annual NEE) indicates that this process could shift some ecosystems from annual C sinks to sources. These findings have relevance both for the rules for the applicability of the Eddy covariance technique and for flux-partitioning and gap-filling models used by the FLUXNET community of Eddy towers, which require adaptation to explicitly account for such processes in semiarid carbonate ecosystems.