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Biological and geological carbon sources in a steppe ecosystem in the SE of Spain

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Widespread recognition of the importance of soil CO_2 efflux as a major source of CO_2 to the atmosphere has led to active research. A large soil respiration database and recent reviews have compiled data, methods, and current challenges. However, some processes of soil CO_2 production and transport have not received enough attention. In the current soil respiration literature it has mostly been assumed that soil CO_2 efflux is the result of biological processes (i.e. soil respiration) but recent studies demonstrate that pedochemical and geological processes, such as geothermal and volcanic CO_2 degassing, are potentially important in some areas. We carried out a study in the SE of Spain that showed that wind was the main determinant of the net ecosystem carbon balance with anomalous CO_2 fluxes that could not be attributed to biological activity alone and hypothesised the presence of a geo-CO_2 source given that the site was located over an tectonic fault in an ancient volcanic area (Rey et al., 2012a). After proving the existence of a geological CO_2 source (Rey et al., 2013b), we developed a methodology using parameters of the boundary layer to derive biological (FBIO) and geological (FGEO) components and then partitioned FBIO into gross primary productivity and ecosystem respiration (Rey et al. 2013). We estimated that ca 50% of the carbon emitted annually came from geological sources. Thus these sources can be very important in some regions and confound our estimates of the CO_2 exchange attributed to biological activity. This study highlights the need to improve our understanding of the processes involved in ecosystem and soil CO_2 efflux and to standardise current methodologies among the scientific community. The complexity of the CO_2 production and transport mechanisms will require a much better interdisciplinary integration (Rey 2014). This should be a research priority given the importance of this flux in the global carbon budget.