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Soil CO_2 efflux is lognormally distributed - Implications

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Soil CO_2 efflux is the second largest carbon flux in terrestrial ecosystems. Its understanding and its feedbacks with global change determine model prediction of the land carbon sink and the future of the earth system. For understanding, however, observations by the most widely applied chamber
methods need to be aggregated to larger times and space. This aggregation is hampered by a random error that characterized by occasionally large fluxes and variance heterogeneity that is not properly accounted for in the currently applied assumption of normally distributed fluxes.
Therefore, we explored the alternative assumption of lognormally distributed fluxes in aggregating one year of data of four neighboring automatic chambers at a Mediterranean savanna-type site. With the lognormal assumption, the problems in error structure diminished and more reasonable
confidence intervals were obtained. Hence in future, researchers should report aggregated fluxes with uncertainties based on the lognormal assumption. We show that at annual scale results based on the lognormal assumptions did not different from previously published results. However, our
findings suggest that model-data integration study should compare predictions and observations of soil CO_2 efflux at log scale. Further, the findings provide an additional perspective on the soil process that generates the random error. This study, provides methodology and guidance that will
improve the analysis of soil CO_2 efflux observations and hence improve the understanding of soil carbon cycle and climate feedbacks.