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On using radon-222 and CO_2 to calculate regional-scale CO_2 fluxes

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Abstract. Because of its ubiquitous release on land and well-characterized atmospheric loss, radon-222 has been very useful for deducing fluxes of greenhouse gases such as CO_2, CH_4, and N_2O. It is shown here that the radon-tracer method, used in previous studies to calculate regional-scale greenhouse gas fluxes, returns a weighted-average flux (the flux field *F* weighted by the sensitivity of the measurements to that flux field, *f*) rather than an evenly-weighted spatial average flux. A synthetic data study using a Lagrangian particle dispersion model and modeled CO_2 fluxes suggests that the discrepancy between the sensitivity-weighted average flux and evenly-weighted spatial average flux can be significant in the case of CO_2, due to covariance between *F* and *f* for biospheric CO_2 fluxes during the growing season and also for anthropogenic CO_2 fluxes in general. A technique is presented to correct the radon-tracer derived fluxes to yield an estimate of evenly-weighted spatial average CO_2 fluxes. A new method is also introduced for correcting the CO_2 flux estimates for the effects of radon-222 radioactive decay in the radon-tracer method.

Final Revised Paper (PDF, 700 KB) Discussion Paper (ACPD)

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