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Mesoscale circulations over complex terrain in the Valencia coastal region, Spain – Part 2: Modeling CO₂ transport using idealized surface fluxes

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Abstract. Vertical profiles of CO₂ concentration were collected during an intensive summer campaign in a coastal complex-terrain region within the frame of the European Project RECAP (Regional Assessment and Modelling of the Carbon Balance in Europe). The region presents marked diurnal mesoscale circulation patterns. These circulations result in a specific coupling between atmospherically transported CO₂ and its surface fluxes.

To understand the effects of this interaction on the spatial variability of the observed CO₂ concentrations, we applied a high-resolution transport simulation to an idealized model of land biotic fluxes. The regional Net Ecosystem Exchange fluxes were extrapolated for different land-use classes by using a set of eddy-covariance measurements. The atmospheric transport model is a Lagrangian particle dispersion model, driven by a simulation of the RAMS mesoscale model. Our simulations were able to successfully reproduce some of the processes controlling the mesoscale transport of CO₂. A semi-quantitative comparison between simulations and data allowed us to characterize how the coupling between mesoscale transport and surface fluxes produced CO₂ spatial gradients in the domain. Temporal averages in the simulated CO₂ field show a covariance between flux and transport consisting of: 1) horizontally, a CO₂ deficit over land, mirrored by a CO₂ excess over the sea and 2) vertically, the prevalence of a mean CO₂ depletion between 500 and 2000 m, and a permanent build-up of CO₂ in the lower levels.

[Final Revised Paper](#) (PDF, 4355 KB) [Discussion Paper](#) (ACPD)

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