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Uncertainties Introduced by an Atmospheric Model in a Regional Carbon Flux Study

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The CarboEurope Regional Experiment Strategy (CERES) aims to produce aggregated regional estimates of the carbon balance and to improve our process understanding of the major controls of CO_2emissions and uptake at the regional scale. An intensive measurement campaign was performed in South West France, in the months May and June 2005. A multiple constraint approach is applied. Several aircraft sampled the CO_2 concentrations and fluxes over the area in and above the boundary layer, while fixed stations observed the fluxes and concentrations at high precision. Inverse models will relate concentrations measured in the atmosphere with ground based measurements and subsequently reduce the uncertainties in surface CO_2 flux estimates. The amount of uncertainty reduction depends to a large extent on the errors and uncertainties introduced by the used atmospheric modelling system. In this study a sensitivity analysis of the transport model B-RAMS-3.2 is performed. Several ensembles of forward simulations are presented to assess the uncertainty range of the model. The sensitivity to initial and boundary conditions of soil moisture, CO_2 concentration, wind velocity and temperature is tested. Further, the land use type classification is varied to estimate the transport model sensitivity to the amount of land use classes and their aggregation. The influence of different parameterizations included in B-RAMS is assessed. Comparison of model results and observations indicate the optimal parameterizations and parameter settings in B-RAMS for the conditions during the CERES campaign. Moreover, this study gives an estimate of the transport error and its covariance introduced by the settings in the atmospheric model.