



European carbon balance and its constituent fluxes in 1980-2003: Analysis using bottom-up and top-down estimates

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Regional climate anomalies may become more frequent in a changing climate, lead to sudden carbon release or uptake by land ecosystems and therefore contribute to increased variability in atmospheric carbon dioxide concentrations. We analyze European carbon balance, its constituent fluxes and their uncertainties for 1980-2003. Especially we focus on carbon balance in 2003, when Europe experienced a strong summer drought. We investigate the changes in the European carbon balance during the drought year 2003 as compared to a 'baseline average' (1998-2002) and to the 20-year average (1980-2000). Spatial patterns and magnitude of changes in carbon balance are investigated with three ecosystem process models (BIOME-BGC, LPJ, ORCHIDEE) as well as with one diagnostic model (MOD17+). The abilities of the models to simulate constituent carbon fluxes are analyzed using direct observations of annual net primary productivity (NPP) and net ecosystem production (NEP). The carbon balance estimates using bottom-up methods are compared with top-down estimates using atmospheric inversions based on CO₂ concentration measurements. The uncertainties in the carbon balance estimates associated with different sources of input data to the models are discussed.