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Past and future scenarios of the effect of carbon dioxide on plant growth and transpiration for three vegetation types of southwestern France

J.-C. Calvet, A.-L. Gibelin, J.-L. Roujean, E. Martin, P. Le Moigne, H. Douville, and J. Noilhan
CNRM/GAME (Météo-France, CNRS), Toulouse, France

Abstract. The sensitivity of an operational CO_2-responsive land surface model (the ISBA-A-gs model of Météo-France) to the atmospheric CO_2 concentration, (CO_2), is investigated for 3 vegetation types (winter wheat, irrigated maize, coniferous forest). Past (1960) and future (2050) scenarios of (CO_2) corresponding to 320 ppm and 550 ppm, respectively, are explored. The sensitivity study is performed for 4 annual cycles presenting contrasting conditions of precipitation regime and air temperature, based on continuous measurements performed on the SMOSREX site near Toulouse, in southwestern France. A significant CO_2-driven reduction of canopy conductance is simulated for the irrigated maize and the coniferous forest. The reduction is particularly large for maize, from 2000 to 2050 (−18%), and triggers a drop in optimum irrigation (−30 mm y^{-1}). In the case of wheat, the response is more complex, with an equal occurrence of enhanced or reduced canopy conductance.

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