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Transient simulations of the Mid-Holocene with MGV, the IPSL fast ocean-atmosphere-vegetation general circulation model

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A fast OAVGCM called MGV has been developed at IPSL to handle multi-millennial climate simulations. It couples the ocean and sea-ice OPA-LIM model to the atmosphere-vegetation LMDZ-ORCHIDEE model. The more affordable computing cost compared to the version of the IPSL Climate Model used for the IPCC has been obtained by decreasing the resolution of the atmosphere and vegetation components down to a mesh of 44 per 43 grid points in the horizontal. In ORCHIDEE, the carbon cycle is activated (STOMATE) as well as the dynamic vegetation (based on LPJ). On the other hand, the ocean carbon cycle and atmospheric chemistry are not taken into account yet due to their prohibitive additional computing costs. Two transient runs of the middle Holocene are carried out with the newly designed model. In one of them, the dynamic vegetation is not activated to assess this biospheric feedback on climate. The transient response of the climate system to solar forcings and gas concentrations is analysed with emphasize on changes in vegetation cover (such as the greening of the Sahara) and carbon fluxes. Lake extend (such as Lake Chad) and emissions of methane by wetlands are diagnosed using offline simulations with a refined version of ORCHIDEE recently developed at LSCE.