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Dynamical effects of vegetation on the 2003 summer heat waves

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The land surface model (LSM) in regional climate models (RCMs) plays a key role in energy and water exchanges between land and atmosphere. The vegetation can affect these exchanges through physical, biophysical and bio-geophysical mechanisms. It participates to evapo-transpiration process which determines the partitioning of net radiation between sensible and latent heat flux, through water evaporation from soil throughout the entire root system. For seasonal timescale leaf cover change induced leaf-area index (LAI) and albedo changes, impacting the Earth's radiative balance. In addition, atmospheric chemistry and carbon concentration has a direct effect on plant stomatal structure, the main exchange interface with the atmosphere. Therefore the surface energy balance is intimately linked to the carbon cycle and vegetation conditions and an accurate representation of the Earth's surface is required to improve the performance of RCMs. It is even more crucial for extreme events as heat waves and droughts which display highly nonlinear behaviour.

If triggering of heat waves is determined by the large scale, local coupled processes over land can amplify or inhibit heat trough several feedback mechanism. One set of two simulation has been conducted with WRF, using different LSMs. They aim to study drought and vegetation effect on the dynamical and hydrological processes controlling the occurrence and life cycle of heat waves

In the MORCE plateform, the dynamical global vegetation model (DGVM) ORCHIDEE is implemented in the atmospheric module WRF. ORCHIDEE is based on three different modules. The first module, called SECHIBA, describes the fast processes such as exchanges of energy and water between the atmosphere and the biosphere, and the soil water budget. The phenology and carbon dynamics of the terrestrial biosphere are simulated by the STOMATE module. STOMATE essentially simulates processes as photosynthesis, carbon allocation, litter decomposition, soil carbon dynamics, maintenance and growth respiration, and phenology. Finally, the long-term processes, including vegetation dynamics, fire, sapling establishment, light competition, and tree mortality are simulated according to the global vegetation model LPJ.

Two MORCE simulations are performed at 15-km grid resolution, driven by ERA-INTERIM for 2002-2003. The first, called CTL, was conducted using an LAI prescribed after that of year 2002. The second simulation called MORCE, uses LAI explicitly calculated. These simulations are inter-compared to provide an estimate of the dynamical vegetation contribution to the two distinct heat wave during the summer 2003.