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HyMeX - Vegetation/atmosphere coupled processes in heat waves and droughts as simulated with the MORCE numerical plateform

Marc Stefanon[†]; Philippe Drobinski; Fabio D'Andrea; Nathalie De Noblet; Nicolas Viovy; Martial Mancip; Jan Polcher
[†] LMD / IPSL, France
Leading author: marc.stefanon@lmd.polytechnique.fr

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. 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. Three sets of MORCE simulations driven by ERA-INTERIM reanalysis over Southern France have been performed with a resolution of 15†km. The three sets of simulations correspond to "wet", "normal" and "dry" years regarding the soil moisture climatology. For each type of years, 3 sets of simulations have been performed: one with NOAH land-surface model, one with ORCHIDEE but SECHIBA module only and one with ORCHIDEE with SECHIBA and STOMATE modules. These simulations are inter-compared to improve our understanding of coupled mechanisms between soil vegetation and atmosphere on regional water cycle, which is a central aspect of the HyMeX program.