Session: B2 Oral presentation

Development and seasonal predictability of European summer heat waves

Robert Vautard [†]; Benjamin Quesada; Pascal Yiou; Pascale Braconnot; Jean-Louis Dufresne
[†] LSCE-IPSL CEA/CNRS/UVSQ, France
Leading author: robert.vautard@lsce.ipsl.fr

Heat waves such as those encountered in 2003 in Western Europe or in 2010 in Eastern Europe induce severe impacts on ecosystems, health and in the energy sector. The drivers of such extremes are favorable persistent weather regimes, possibly due to SST anomalies inducing atmospheric teleconnexions, but also in-situ drought that allow more incoming energy to be transformed into sensible heat fluxes instead of latent heat fluxes than in wetter soil conditions. Using a composite analysis of observations and ERA40 reanalysis data, we show that heat waves reaching Central to Northern Europe, which induce a rather exceptional water-limited evapo-transpiration regime, are generally preceded by a drought in Southern regions. This condition is found necessary necessary to amplify the local feedbacks connected to sensible heat fluxes. Regional simulations using the MM5 model then help detailing the mechanisms of drought and heat development and propagation. We also show that summertime hot days - defined as having a maximal temperature within the upper 10% centile - are not likely to develop if spring season is too wet in Mediterranean areas. By contrast, a southern drought does not always lead to a high number of hot days or a heat wave. This regional pattern of heat waves development and seasonal predictability is also investigated in a multi-model ensemble of CMIP3 simulations and new historical CMIP5 simulations from the IPSL global climate model for the 1960-2000 period. The regional mechanisms of the intra-seasonal evolution of heat waves is also investigated in new CMIP5 climate scenarios as simulated by the global IPSL model.