Geophysical Research Abstracts
Vol. 17, EGU2015-5246, 2015
EGU General Assembly 2015

Detecting soil moisture impacts on convective initiation in Europe

Christopher Taylor
Centre for Ecology and Hydrology, Wallingford, Oxon, United Kingdom (cmt@ceh.ac.uk)

Climate models suggest that soil moisture feedbacks on precipitation can play an important role in shaping the climate of some regions of the world. However, observational studies to evaluate models have produced a diverse range of conclusions, depending on scale, methodology, region etc. Our recent global study (Taylor et al, Nature 2012) showed that afternoon rain is more likely to develop over dry soils than nearby (50-100km) wetter areas. This is in contrast to typical global and regional models which favour a positive feedback. One key part of the feedback is the sensitivity of convective initiation to surface fluxes. Whilst some studies consider this in a purely one-dimensional sense, others have argued that spatial variability in fluxes plays an important role in convective triggering, via mesoscale circulations. In semi-arid Africa at least, there is an emerging observational and modelling consensus that it is the spatial heterogeneity of soil moisture which is the key to its influence on deep convective initiation.

This study presents the first comprehensive observational analysis over Europe linking convective initiation to soil moisture, based on satellite observations. It builds on our previous global analysis, which indicated over Europe a weak but significant favouring of afternoon rain over locally drier soil at the 50 km scale. Higher space and time resolution satellite datasets are employed in the current study, which can shed light on the dominant mechanisms responsible. Afternoon convective initiations are defined by rapidly cooling cloud-tops using Meteosat images available every 15 minutes. To minimise the impact of fixed triggers such as mountains and coastlines, the analysis is restricted to flat inland regions, which means that most of the 2962 cases are located in central and eastern Europe. Land surface conditions preceding the initiation are characterised by MODIS land surface temperature and ASCAT soil moisture data, whilst wind conditions are taken from ERA-Interim reanalysis. The results show that convective initiations are favoured on the downwind side of dry surfaces, close to wetter areas. The signal is clearest following dry periods and under light winds, consistent with forcing by a mesoscale circulation. Overall, the detected signal in Europe is weaker than in previous African analysis, but key spatial characteristics are essentially the same. This implies that the previous observation of afternoon rain favoured over drier soil in Europe is associated with heterogeneous soil moisture, rather than dry soil per se.