Geophysical Research Abstracts
Vol. 17, EGU2015-3830-1, 2015
EGU General Assembly 2015

Mitigation of the Negative Effect of Extreme Events on the Land Surface by Vegetation Species Interaction

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The increasing demand for ecosystem services, in conjunction with climate change, are expected to significantly alter the terrestrial ecosystems and, by consequence, the energy, water, and carbon fluxes between land and atmosphere. In order to evaluate the potential severity of the sustainability issues that we will face in the near future, there is a need for a better understanding of the relationships between the land surface characteristics, and the energy, carbon and water cycles. Several studies have highlighted that vegetation species respond differently to extreme environmental conditions, such as drought and heatwaves. In turn each specie affects differently the land surface and boundary layer. Species diversity might therefore have a beneficial effect on ecosystem functioning: complementarity among species for resources use might increase ecosystem performance.

Most of the studies performed so far on vegetation interactions are based on observations. Here we use the JULES (Joint UK Land Environment Simulator) land surface model to understand the processes involved in species interactions, a mechanism which is difficult to study in situ. We assess the importance of the representation of species interactions in climate modelling for its role on land atmosphere interactions and feedback, as well as its potential importance for climate impact studies and its mitigation aspect. This study is restricted to temperate Europe.

Our results show that the carbon and water cycles are affected by species interactions. The effect of species mixing however varies spatially and depends on the species that are interacting. Some species benefit, other suffer from mixing, depending on vegetation type and environmental condition. It is therefore not straightforward to promote species mixing to mitigate the negative effect of climate change.