Geophysical Research Abstracts
Vol. 18, EGU2016-3951-1, 2016
EGU General Assembly 2016

Exploring the 'divergence' problem using a simple process-based model of tree growth

Guangqi Li (1), Sandy P. Harrison (1), and I. Colin Prentice (2)

(1) School of Archaeology, Geography and Environmental Sciences (SAGES), Reading University, Reading, UK, (2) AXA Chair of Biosphere and Climate Impacts, Grand Challenges in Ecosystem and the Environment, Department of Life Sciences and Grantham Institute – Climate Change and the Environment, Imperial College London, Silwood Park Campus, Buckhurst Road, Ascot SL5

There has been an apparent change in the sensitivity of tree rings to temperature in northern extratropical regions since the 1980s – a phenomenon often referred to as the divergence problem. Several potential explanations have been suggested to explain the decoupling between ring width (or density) and temperature, including exceedance of limiting temperature thresholds with global warming, changes in light availability with global dimming, the increasing importance of soil or atmospheric drought as a limitation to tree growth, or the CO_2 'fertilization effect'. Here we use a simple, process-based tree-growth and carbon allocation model to explore these hypotheses. While changes in light availability and drought contribute to explain the declining influence of temperature on tree growth, the most important factor is changes in carbon allocation to roots and mycorrhizae in response to increasing [CO_2] and the demand for increased nutrients to support photosynthesis. The magnitude of the increase in below-ground allocation, and hence the relative importance of this mechanism versus climate in controlling tree radial growth, appears to be influenced by nutrient and water availability. The potential importance of changes in carbon allocation challenges the use of statistical models for climate reconstructions from tree rings during intervals when [CO_2] was different from historical values.