Geophysical Research Abstracts
Vol. 17, EGU2015-12560, 2015
EGU General Assembly 2015

Exploring the control of land-atmospheric oscillations over terrestrial vegetation productivity

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Vegetation dynamics play an important role in the climate system due to their control on the carbon, energy and water cycles. The spatiotemporal variability of vegetation is regulated by internal climate variability as well as natural and anthropogenic forcing mechanisms, including fires, land use, volcano eruptions or greenhouse gas emissions. Ocean-atmospheric oscillations, affect the fluxes of heat and water over continents, leading to anomalies in radiation, precipitation or temperature at widely separated locations (i.e. teleconnections); an effect of ocean-atmospheric oscillations on terrestrial primary productivity can therefore be expected. While different studies have shown the general importance of internal climate variability for global vegetation dynamics, the control by particular teleconnections over the regional growth and decay of vegetation is still poorly understood.
At continental to global scales, satellite remote sensing offers a feasible approach to enhance our understanding of the main drivers of vegetation variability. Traditional studies of the multi-decadal variability of global vegetation have been usually based on the normalized difference vegetation index (NDVI) derived from the Advanced Very High Resolution Radiometer (AVHRR), which extends back to the early ’80s. There are, however, some limitations to NDVI observations; arguably the most important of these limitations is that from the plant physiology perspective the index does not have a well-defined meaning, appearing poorly correlated to vegetation productivity. On the other hand, recently developed records from other remotely-sensed properties of vegetation, like fluorescence or microwave vegetation optical depth, have proven a significantly better correspondence to above-ground biomass.
To enhance our understanding of the controls of ocean-atmosphere oscillations over vegetation, we propose to explore the link between climate oscillation extremes and net primary productivity over the last two decades. The co-variability of a range of climate oscillation indices and newly-derived records of fluorescence and vegetation optical depth is analyzed using a statistical framework based on correlations, bootstrapping and Empirical Orthogonal Functions (EOFs). Results will enable us to characterize regional hotspots where particular climatic oscillations control vegetation productivity, as well as allowing us to underpin the climatic variables behind this control.