Geophysical Research Abstracts
Vol. 18, EGU2016-13304, 2016
EGU General Assembly 2016

The ambiguity of drought events, a bottleneck for Amazon forest drought response modelling

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Considering the important role of the Amazon forest in the global water and carbon cycle, the prognosis of altered hydrological patterns resulting from climate change provides strong incentive for apprehending the direct implications of drought on the vegetation of this ecosystem. Dynamic global vegetation models have the potential of providing a useful tool to study drought impacts on various spatial and temporal scales. This however assumes the models being able to properly represent drought impact mechanisms. But how well do the models succeed in meeting this assumption?

Within this study meteorological driver data and model output data of 4 different DGVMs, i.e. ORCHIDEE, JULES, INLAND and LPGmL, are studied. Using the palmer drought severity index (PDSI) and the mean cumulative water deficit (MWD), temporal and spatial representation of drought events are studied in the driver data and are referenced to historical extreme drought events in the Amazon. Subsequently, within the resulting temporal and spatial frame, we studied the drought impact on the above ground biomass (AGB) and gross primary production (GPP) fluxes. Flux tower data, field inventory data and the JUNG data-driven GPP product for the Amazon region are used for validation. Our findings not only suggest that the current state of the studied DGVMs is inadequate in representing Amazon droughts in general, but also highlights strong inter-model differences in drought responses. Using scatterplot-studies and input-output correlations, we provide insight in the origin of these encountered inter-model differences. In addition, we present directives of model development and improvement in scope of Amazon forest drought response modelling.