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Identifying and understanding vegetation productivity swings in response to ENSO dynamics to improve land surface modeling capability in quantifying extreme events across Australia and East Asia

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In this study we quantified linkages between climate and vegetation productivity response across large areas in Australia and East Asia, and carried out more detailed analysis for areas and intervals with extreme productivity swings.
We first quantified teleconnections between large scale atmospheric oscillations over the western Pacific and vegetation productivity across Australia, Southeast and East Asia. For this purpose we analyzed remotely sensed vegetation productivity (estimated from MODIS vegetation index time series) in response to the Southern Oscillation Index (SOI). This resulted in a spatially explicit representation of extreme vegetation productivity response to regional climatic variability.
For areas and intervals with strong vegetation productivity swings we then investigated the spatial-temporal relationship of remotely sensed vegetation productivity with temperature and rainfall grids as well as with productivity responses predicted by the Australian CSIRO Atmosphere Biosphere Land Exchange (CABLE) model. By conducting this study across various spatial-temporal scales and variable aggregations, we identified geographic areas and intervals with strong vegetation productivity swings related to SOI atmospheric oscillations and attributed these swings to changes in regional temperature and precipitation grids. The final step of quantifying the space-time correlation between extreme swings in remotely sensed vegetation productivity and land surface model predictions provided insight into model capacity and sensitivity.
We identified large ENSO drought-related crop productivity declines for Eastern Australia, continental and insular Southeast Asia and, temporally offset, in northeastern China. The largest divergence between extreme remotely sensed vegetation productivity drops and CABLE-predicted productivity occurred over ground water dependent ecosystems.