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Predictability of Tropical Vegetation Growth

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Though many researches have examined the sensitivity of tropical terrestrial ecosystems to various environmental factors, the predictability of tropical vegetation growth has remained to be explored. Using latest fine spatial resolution remote-sensing Enhanced Vegetation Index (EVI) and sea surface temperature (SST) indexes from different ocean basins, we examined the predictability of tropical plant dynamics in response to SST and established empirical models with optimal parameters for the hindcast prediction. Three evaluation metrics were employed to assess model performance, including correlations between historical and predicted values, percentage of correctly predicted signs in EVI anomalies, and percentage of correct signs for extreme EVI prediction. Our findings reveal that three regions, mainly over arid or semi-arid areas, were associated with strong influences of SST on EVI. For example, the eastern South America was primarily controlled by the Atlantic Ocean SST index, with a leading time of 2-4 months. In terms of the correlations between predicted and observed EVI anomalies, 70.26% (South America), 80.48% (Africa), and 76.27% (SE Asia) vegetated areas were diagnosed to be significant ($p<0.05$). At about 60% chances, the statistical models could correctly predict the sign of EVI anomalies, and the predictability increased to nearly 100% when EVI was extremely abnormal. These results enhanced the prediction of tropical terrestrial ecosystem, especially at seasonal to annual scales. Moreover, the statistics-based metrics will facilitate the benchmarking of Earth system models regarding the response of tropical vegetation growth to key oceanic drivers.