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# Assessment of Impact of Hydroclimatic Disturbances on Terrestrial GPP Extremes of India Under Land Use and Climate Change

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Gross primary productivity (GPP) plays a vital role in the carbon storage potential of ecosystems. Climate change (CC), land use and cover change (LUCC), elevated $CO_2$ concentrations ($eCO_2$), and Nitrogen deposition (Ndep) are the main driving forces of GPP. Climate extremes are expected to negatively impact ecosystem carbon uptake (Du et al., 2018, Sci. Total Environ.). The knowledge of impacts of hydroclimatic disturbances (temperature, precipitation, soil moisture, drought, fire emission) on the GPP extremes is still limited for the Indian ecosystems. This study aims to quantify the GPP extremes and assess the drivers of these extremes across Indian ecosystems.

The study considers fourteen terrestrial biosphere models (TBMs). These TBMs are DLEM, ISAM, LPJ-wsl, ORCHIDEE-LSCE, BIOME-BGC, CLM4, CLM4VIC, CLASS-CTEM-N, GTEC, Sib3, SibCASA, TEM6, VISIT, and VEGAS2.1, which took part in the Multi-scale Synthesis and Terrestrial Model Intercomparison Project (MsTMIP). We consider these models' GPP ensemble values from 1981-2010 for four cases: CC, CC+LUCC, CC+LUCC+$eCO_2$, and CC+LUCC+$eCO_2$+Ndep. This multi-model ensemble approach predicts better estimates as it captures uncertainty better than a single model (Schwalm et al., 2015, Geophys. Res. Lett.). We also consider an observation-based model by Jung et al. (2011) along with these ensembles. We use a 3-D contiguous (Zscheischler et al., 2013, Ecol. Inform) statistical approach to assess the spatiotemporal pattern of extreme GPPs in India and in its six meteorologically homogeneous regions. We also diagnose the size distribution and attribution of these negative extreme GPP events to each of these drivers individually and multiple drivers in a compounded way.