Regional contributions to interannual variability of net primary production and climatic attributions

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1 Simulating the net primary production (NPP) of China

Climate change profoundly affects the interannual variability (IAV) of ecosystem net primary productivity (NPP) from multiple aspects. However, regional contributions to the national NPP IAV in China and the impacts of distinct climatic drivers are not well addressed. In this study, we investigated regional contributions to the national NPP IAV and quantified the contributions of nine climatic drivers to that in different regions based on a more comprehensive NPP estimated by the Carnegie-Ames-Stanford (CASA) model from 1982 to 2018.
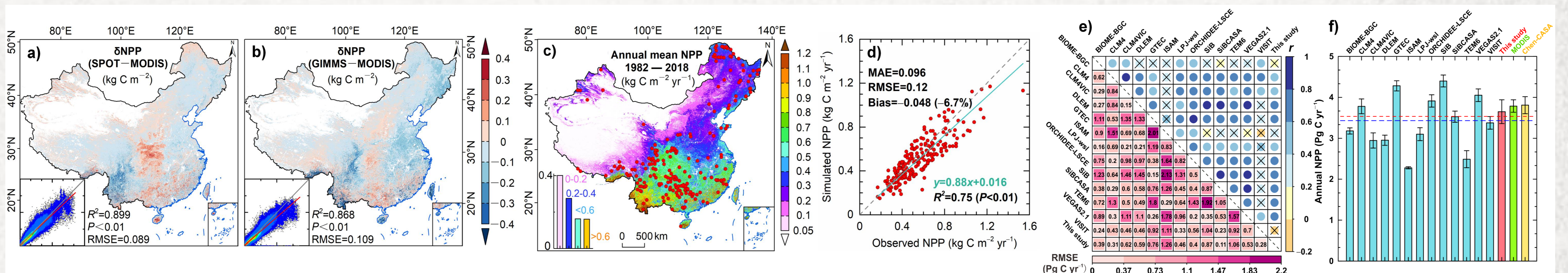
## 2 Detecting the spatiotemporal dynamics and interannual variability of NPP

The NPP in China illustrated an increasing trend of 15.2 Tg C yr^{-1} at the national scale during 1982 through 2018, and the mean absolute NPP IAV during the 37-year study period showed a descendant gradient from the southeast to the northwest with the highest values in the southwestern Yunnan, the southeastern Tibetan Plateau, and southeastern China.
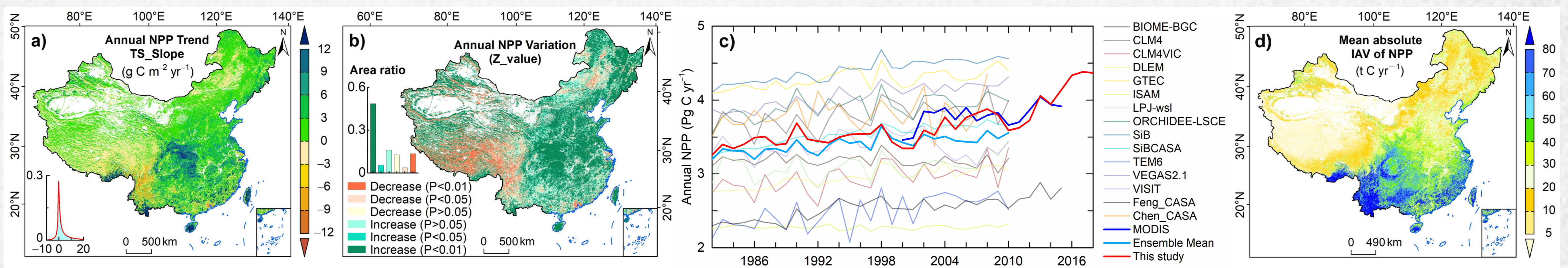
3 Partitioning the regional contributions to NPP IAV

We adopted the contribution partition method to quantify the regional contributions to the holistic NPP IAV over China at the grid-cell scale and the results indicated that:

- 76.5% and 23.4% of the grid cells positively and negatively contributed to the holistic NPP IAV over China, respectively.
- Our simulation and the thirteen Terrestrial Biosphere Models all verified that the humid ecosystems accounted for the largest fraction (~62%) of NPP IAV over China, followed by the semi-humid region (18%), the Tibetan Plateau (13%), the semi-arid region (5%), and the arid region (2%).
- Regions under the natural forest protection program contributed more than half (54%) to the country's total NPP IAV.
- Forest dominated the country's NPP IAV with a contribution of 51%, followed by grassland (23%) and cropland (23%).
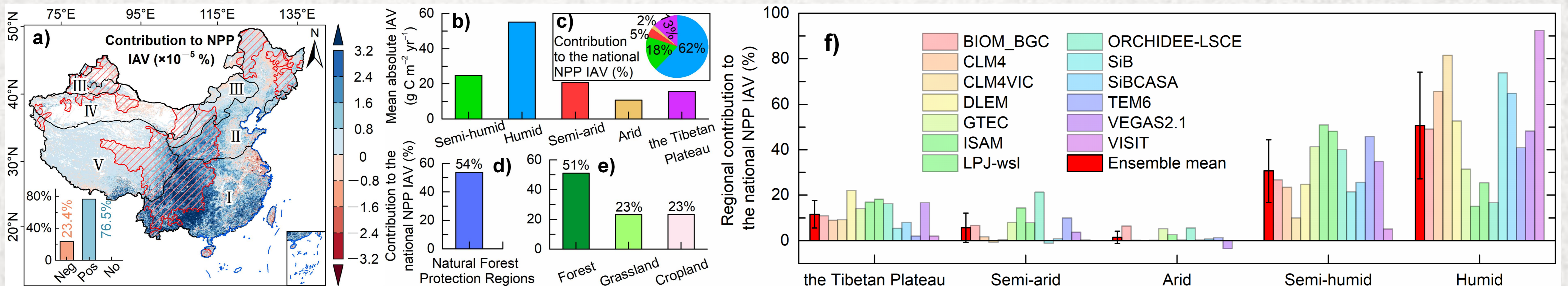
4 Quantifying the relative importance of climatic drivers to NPP IAV

We applied the Lindeman-Merenda-Gold method to quantify the relative importance of the nine climate change indices in affecting NPP IAV and achieved the following results:

- Normal and high precipitation amount (nP, HP), as well as high temperature days (HT) and daily temperature range (DTR) exerted the largest contributions to the national NPP IAV.
- DTR and HP was the major climatic drivers to NPP IAV in humid region, whereas NPP IAV in water-limited regions (i.e., semi-humid, semi-arid, and arid regions) were tightly associated with nP, HP, and HT.
- More attention should be paid to the negative impacts of low temperature events and potential drought on NPP IAV in humid region as well as that of HT in water-limited regions.

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