



## **A New Approach to Investigate the Impacts of Climate Change on the Net Primary Production (NPP) in China**

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A new approach of the conditional nonlinear optimal perturbation (CNOP), which is the natural generalization of the approach of the linear singular vector, is adopted to investigate the response of the net primary production (NPP) of the terrestrial ecosystem to nonlinear climate change in China. A popular dynamical global vegetation model, Lund-Potsdam-Jena DGVM, is employed in this study. The CNOP represents a kind of nonlinear parameter perturbation, i.e., temperature perturbation. The NPP influenced by the CNOP-type temperature perturbation is compared with that influenced by a linear-type temperature perturbation.

The results demonstrate that the NPP is augmented in southern and northeastern regions in China, and the NPP is reduced in arid and semi-arid regions in China with the CNOP-type perturbation. The variation of the NPP with the linear-type perturbation is similar to that with the CNOP-type perturbation. However, the varied extent of the NPP due to the linear-type perturbation is smaller than that due to the CNOP-type perturbation. This maybe result from the different impacts of the different temperature changes on the gross primary production (GPP) and the automatic respiration (AR) in China. For instance, in the southern China, the GPP increases, and the AR decreases owing to the CNOP-type perturbation. However, the GPP and the AR decrease owing to the linear-type perturbation. The numerical results suggest that it is an important mechanism about the impact of the CNOP-type perturbation on the NPP in China.