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Impacts of land use and climate change on regional net primary productivity

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Combined with recent historical climate data and two periods of land use data sets from remote sensing data, we test the net primary productivity (NPP) data sets in North China modelled by the satellite data-driven Global Production Efficiency Model (GLO-PEM) for detecting the widespread spatial and temporal characteristics of the impacts of climate and land use change on the regional NPP. Our results show that over the past 20 years, the mean annual temperature in the study region has remarkably increased by more than 0.064 oC, but over the same period, there has been a 1.49 mm decrease in annual precipitation and decrease in NPP by an annual rate of 6.9 TgC. The NPP changes in the study region were greatly affected by the average temperature and precipitation by ten-day periods as well as the seasonal temperature and precipitation in the study region. The correlation between seasonal NPP and seasonal precipitation and temperature is highly consistent with land cover spatially, and the correlation coefficient changes with the changes of vegetation types. The analysis reveals that the related areas in land use change only take up 5.45% of the whole studied region, so the climate changes dominate the impacts on the NPP in the whole study region (90% of the total). However, land use plays an absolute dominative role in areas with land cover changes, accounting for 97% of the total. From 1981 to 2000, the NPP in the whole study region remarkably reduced due to obvious precipitation decrease and temperature rise. Between two periods of land use (about 10 years), the changes in climate are predicted to promote a decrease in NPP by 78 (±0.6) TgC, and integrated impacts of climate changes and land use to promote a decrease in NPP by 87(±0.8) TgC.

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关键词： climate change; land use change; NPP; GLO-PEM; North China; Northeast China doi: 10.1360/gs040311