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Responses of terrestrial ecosystem productivity to wetting-drying alternations inside China

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Terrestrial ecosystem productivity (TEP) is one of the most important indices to quantify the net primary production (NPP), and the baseline capacity for promoting carbon sequestration, ecosystem services and food security. However, wetting-drying alternations can significantly change the TEP. In this study, the Carnegie-Ames-Stanford Approach (CASA) model was employed to estimate the annual and monthly NPP (the later also called net photosynthesis) based on NASA normalized difference vegetation index (NDVI) and a suite of climate parameters. Our synthesized and spatially interpolated NPP for China was then correlated to two advanced drought indices (Standard precipitation index, SPI, and Standard precipitation evaporation index, SPEI) during the period from 1982 to 2012 in order to study the relationship of wetting-drying alternations and the NPP. Our main findings are: (1) The TEP of China has ranged from 3.2 to 4.35 PgC per year, and increased gradually from 1982 to 2012. On the contrary, the overall drought (based on the SPEI) for China has became severer for the same period. The spatial distribution of drought and ecosystem is not co-located, which explains the inconsistence between the trends of NPP and SPEI. (2) Our correlation analyses show strong north-south difference with respect to the response of NPP to SPI/SPEI. Northern China NPP has statistically positive relationship with both drought indices, in particular at 6-month interval, while southern China has statistically negative correlation. (3) SPEI is the more effective and sensitive index to explain the relationship between wetting-drying alternation and NPP. (4) In China, the response period of TEP to wetting-drying alternations ranges from 3 to 6 months. The 3-month response zone is mainly located was in humid eco-system in southern China, while the 6-months response zone is mainly located in arid and semi-arid eco-system in northern China

Key words: Terrestrial ecosystem productivity; NDVI; NPP; SPI/SPEI; Spatial correlations