25th International Congress on Modelling and Simulation, Darwin, NT, Australia, 9 to 14 July 2023
mssanz.org.au/modsim2023

Impacts of climate extremes on vegetation phenology and productivity in a transect along the Hu Line of China

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Abstract: Climate projections infer increased extreme events in the future which would alter terrestrial hydrologic functioning and ecosystem services. Understanding the responses of vegetation to extreme climates can provide prerequisite knowledge to mitigate climate change impacts. The relationships between climate extremes and vegetation phenology and productivity were examined for a transect along the geographically important Hu Line across China during 1988–2014. Results show that ecosystems in the middle region of the transect suffered most from frequent but relatively mild droughts. Advanced vegetation green-up and delayed dormancy thus prolonged growing season length (4.3 days/decade) were observed over the transect. No strong impact of extreme droughts on vegetation productivity was observed for any plant functional types, partly due to the timing of drought occurrences primarily in pre- and post-growing seasons while water supply to plants was likely not so limited during growth. Non-woody plants in the mid-to-high latitudes (37–55°N) were found to be more sensitive to climate extremes than woody plants in the low latitudes. Meanwhile, grassland in the relatively low-elevation areas (<1000 m.a.s.l) was more responsive than that in the high-elevation areas. Productivity above 45°N increased with drought severity which can be attributable to an intensified favorable environment during frequent and mild drought months with warmer temperature and increased solar radiation. The overall mild impact of climate extremes on vegetation may suggest the generally relative stability of the ecosystems along the Hu Line. However, with further deteriorating climate, the stable relationships between climate and ecosystems may be shifted starting from low-elevation grassland.

Keywords: *Climate extremes, drought, SPEI, vegetation optical depth, NDVI, Hu Line*