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Annual coupled drought and net primary productivity over global

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We use a recently developed drought index, standardized precipitation evapotranspiration index (SPEI), and NPP from a biogeochemical model to investigate the impact of droughts on NPP interannual variability during 1997-2006 over the globe. We find that NPP and SPEI are coupled in-phase at the global scale and most mid-latitude regions, but importantly operate in anti-phase in boreal Eurasia and boreal North America. Slight and intensive droughts play different roles on NPP in Europe where temperature and radiation limit NPP and vegetation growth. However, no significant relationship is found over the tropical wet areas. We attribute the distinct spatial variation in these relationships to the diversity of radiation-temperature-water relationships of terrestrial ecosystems across the various regions. Large-scale land surface soil moisture from microwave satellite observations supports qualitatively our results on water limitation of terrestrial ecosystems. Our results demonstrate that drought is one of crucial factors in the terrestrial carbon cycle, and that analysis of the impact of drought needs to take this spatially and temporally non-uniformity into account.