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Legacy effects of spring temperature anomalies on seasonal productivities in northern ecosystems

Direct and lagged effects from spring temperature anomalies for the time-period 2001-2018 have been investigated for northern ecosystems (> 30°N). Three different data sets of Gross Primary Production (GPP) estimates (GOSIF, NIRvGPP and FLUX GPP) have been used in tandem with concurrent climate data to find significant correlations between spring growth and temperature anomalies and subsequent growing seasons.

Estimates show lagged effects from spring temperature (Tspring) anomalies are most pronounced in the summer season and affect the arctic plant production positively; spring warming possibly lessens the harsh climatic constraints that normally govern arctic grasslands and shrub-lands. Below the arctic circle, lagged effects are mainly negative; this strengthens the hypothesis that warm springs and increased vegetation in spring will increase transpiration rates and increase water demands, leading to increased water-stress in summer and autumn.

Soil moisture is the dominant control of summer vegetation growth in temperate regions. However, the signal of climate variables controlling vegetation growth also seems to differ depending on the methods used to estimate GPP, which highlights the importance of higher resolution datasets to fully understand the underlying mechanisms affecting plant production and plant phenology.

Keywords: Physical geography, Ecosystem analysis, Northern ecosystems, Legacy effects, Climate Change, Gross Primary Production

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