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Assessment of spatiotemporal patterns of gross primary productivity in the arctic and boreal ecosystems using multi-source products

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Since an increasing number of global gross primary productivity (GPP) products have become available and been applied in climate change research, there is an urgent need to compare their performance in capturing spatial and temporal variability, especially in the regions where the number of training data is limited or model parameters are of relatively larger uncertainty. Here, we investigated the spatial patterns of interannual trends and variations, and seasonal-cycle amplitudes of GPP in the arctic and boreal zones, and explored the differences across various GPP products during the overlapping period (2000–2010). We compared three main types of state-of-the-art GPP products, including simulations derived from terrestrial biosphere models of the Multi-scale Synthesis and Terrestrial Model Intercomparison Project using drivers under different scenarios, 3 datasets up-scaled from FLUXNET eddy covariance measurements based on machine-learning algorithms, and 2 semi-empirical or empirical remotely sensed products based on different satellite data. We also examined the differences of GPP variability across the main ecosystem types, mainly including tundra and taiga, and assessed the contributions of different ecosystems to the temporal variations of total GPP in this zone. The results showed all the products could capture the interannual and seasonal variability of GPP, but the spatial patterns varied largely, which was in-deep discussed. This study will benefit the usage of the GPP products in the carbon cycle research for the arctic and boreal ecosystems.