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Arctic tundra greening and browning (2007-2013) based on satellite-observed solar-induced fluorescence and normalized difference vegetation index

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More accurate evaluation of the state of Arctic tundra vegetation is important for our understanding of Arctic and global systems. Arctic tundra greening had been reported with increasing vegetation cover and productivity in many regions, but browning has been also reported based on satellite-observed Normalized Difference Vegetation Index (NDVI) recently. Here we demonstrate a satellite-based method of estimating tundra greenness trend. A more direct indicator of greenness (spatially downscaling solar-induced fluorescence, SIF) was used to analyze the spatial-temporal patterns of Arctic tundra greenness trends based on ordinary least square regression (2007-2013). Meanwhile, two other greenness indices were used for the comparison, which were two NDVI products: GIMMS NDVI3g, and MOD13Q1 (Collection 6). The yearly maximum value of SIF and two types of NDVI data were used for greenness trend analysis. Generally, the result showed that Arctic tundra was not consistently greening, browning also existed. For the greenness trends of spatial pattern, the results showed that most parts of the Arctic tundra below 75ºN was browning (-0.0098 mW/m2/sr/nm/year) using SIF, whereas spatially heterogeneous trends (greening and browning) were observed based on the two NDVI products. For the greenness trends of temporal pattern, the yearly maximum greenness value of Eurasia Arctic tundra is higher than Northern America and the whole Arctic tundra according to three greenness indices. From 2010, the Arctic tundra was greening based on MOD13Q1, whereas is browning using GIMMS NDVI3g. However, the Arctic tundra was obviously browning using SIF data. This study demonstrates a way of investigating the variation of Arctic tundra vegetation via new satellite-observed data.