Long term trend of summertime CO_2 uptake by land biosphere in Northern Eurasia

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Northern Eurasian ecosystem plays various important roles in global carbon cycle, especially serving as a substantial terrestrial carbon sink. The Arctic and the boreal region are vulnerable to climate change. Northern Eurasia is warming substantially faster than the global average (Groisman et al., 2017). The climate is changing much faster than the local vegetation can adapt. It is a vital task to monitor the impact of climate change to the ecosystems in Northern Eurasia.
Despite its importance, observational data in Siberia are very sparse. NIES has been conducting continuous measurements of atmospheric CO_2 in West Siberia since 2002 (Sasakawa et al., 2010). The area covers taiga, steppe and wetland biomes. The multi-year CO_2 records from JR-STATION (Japan-Russia Siberian Tall Tower Inland Observation Network) makes a great contribution to understand actual changes occurring in Northern Eurasian ecosystems.
In this study, we present a multi-year trend of terrestrial CO_2 flux from Northern Eurasia, estimated by atmospheric inverse simulation using a coupled model GELCA (Global Eulerian-Lagrangian Coupled Atmospheric model) (Shirai et al., 2017). Global monthly CO_2 flux distributions were estimated for the period 2002-2017 for 42 land and 22 ocean regions using the Observation Package data products (ObsPack GLOBALVIEWplus) which includes data from various types of atmospheric CO_2 direct measurements provided by large numbers of laboratories in the world. In addition, we used 9 tower observations from JR-STATION, to better constrain the area of interest.
As a Eurasia Boreal region consists of 4 sub-regions, annual estimates showed increasing sink after 2009. At a sub-region scale, southwestern Siberia and northeastern Europe showed significant increase of annual sink by adding JR-STATION data. When focusing on the mean seasonal variations, summer uptake increased in the west Siberia and northeastern Europe whereas it decreased in the northwest Siberia by adding JR-STATION data.
We focused on summertime (June-August) carbon uptake and investigated the long-term trend from 2002-2017. The anomaly from the 16-year average was calculated for each region and compared to 3 climate variables (NDVI, surface temperature, precipitation). The summertime carbon uptake in Eurasia Boreal showed an overall increasing trend in the 16 years with significant variations. NDVI showed a significant increase as well, suggesting that the increasing sink in Eurasia Boreal can be explained by the combination of warming climate and the fertilization effect. However, at a sub-region scale, the correlation between summertime carbon uptake and the climate variables was not significant. We would like to discuss about changing environment of land biosphere and its surroundings in Northern Eurasia to determine potential factors contributing to the long-term trend of summertime carbon uptake.

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