



Long term trend and interannual variability of land carbon uptake — the attribution and processes

Zheng Fu

Ecosystem carbon (C) uptake in terrestrial ecosystems has increased over the past five decades, but with large inter-annual variability (IAV). However, we are not clear on the attribution and the processes that control the long-term trend and IAV of land C uptake. Using atmospheric inversion net ecosystem exchange (NEE) data, we quantified the trend and IAV of NEE across the globe, the Northern Hemisphere (NH), and the Southern Hemisphere (SH), and decomposed NEE into carbon uptake amplitude and duration during each year from 1979-2013. We found the NH rather than the SH determined the IAV, while both hemispheres contributed equivalently to the global NEE trend. Different ecosystems in the NH and SH had differential relative contributions to their trend and IAV. The long-term trends of increased C uptake across the globe and the SH were attributed to both extended duration and increasing amplitude of C uptake. The shortened duration of uptake in the NH partly offsets the effects of increased NEE amplitude, making the net C uptake trend the same as that of the SH. The change in NEE IAV was also linked to changes in the amplitude and duration of uptake, but they worked in different ways in the NH, SH and globe. The fundamental attributions of amplitude and duration of C uptake revealed in this study are helpful to better understand the mechanisms underlying the trend and IAV of land C uptake. Our findings also suggest the critical roles of grassland and croplands in the NH in contributing to the trend and IAV of land C uptake.