Data-driven synthesis on terrestrial CO_2 budget changes in Asia

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Observational data provides a good constraint on understanding terrestrial CO_2 budget in a quantitative way. In recent years, more and more observation data (both satellite and ground observation) are being available, therefore, effective use of these data is an important step to improve our understandings of terrestrial CO_2 budget. In this presentation, we will show our recent progresses on the data-driven synthesis of terrestrial CO_2 budget in Asia. Topic includes (a) data-driven terrestrial CO_2 budget comparison in Asia as a continental scale case, and (b) satellite data analysis of large fire events in Southeast Asia in 2015 as a regional scale case.
The first part synthesizes results of data-driven top-down and bottom-up estimations of terrestrial CO_2 budget in Asia. We used an empirically upscaled estimation of terrestrial CO_2 budget using AsiaFlux data and remote sensing data (bottom-up approach) and GOSAT Level 4A product (top-down approach). The differences of the two estimation were explained by different definition of them in Siberia and East Asia. The empirically upscaled estimation is 'net ecosystem productivity', which is a difference of gross primary production and ecosystem respiration, and GOSAT L4A is land-atmosphere net CO_2 fluxes, which includes fire, dissolved inorganic carbon export through river, and land use changes. The Southeast Asia region shows large differences between the two estimations, implying the requirement of further research.
The second part focuses on analysis of forest fire in Southeast Asia. In 2015, an intense El Nino occurred, resulting in extremely low rainfall, anomalous fire were reported in Indonesia and countries in the tropical Asia. Using multiple satellite-based data, such as aerosol optical index, land surface temperature, active fire counts, and vegetation index, the large scale massive fire event in 2015 were analyzed. We clearly detected anomalous climate and fire occurrence in Southeast Asia during August to October from MODIS active fire counts, and aerosol optical index. These data shows strong anomalous patterns compared with the normal year. We analyzed the cause of more frequent fire events in El Nino years, and found that persistent negative anomalies in precipitation is most strongly correlated with fire frequency at interannual time scales.
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