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| Title: | Spatio-temporal variability of XCO2 over Indian region inferred from Orbiting Carbon Observatory (OCO-2) satellite and Chemistry Transport Model |
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| Abstract: | Investigation of spatio-temporal variability of column-averaged dry-air mole fraction of CO2 (XCO2) over the Indian region using remote sensing satellite measurements is of interest due to the sparseness of ground-based observations. In this study, we utilized OCO-2 satellite retrievals in conjunction with an atmospheric chemistry-transport model (ACTM) simulations for a set of known (bottom-up) and optimized (top-down) flux for the period September 2014 to December 2018. Results showed the highest XCO2 during the pre-monsoon season, due to prevailing seasonal-high temperatures and drier soil conditions that resulted in increased respiration and suppressed photosynthesis. In contrast, a reduction in XCO2 during the monsoon season is found as precipitation increased soil moisture and moderated the air temperature, driving vegetation growth by which photosynthesis exceeded respiration by the land biosphere. Model - observation differences of XCO2 have shown the overestimation (underestimation) during monsoon (pre-monsoon) especially over the central India region, which might be due to underestimation of the modeled peak-to-trough biospheric fluxes. Analyses of the latitudinal distribution of XCO2 averaged over Indian landmass shows a clear increasing trend and seasonality. An enormous increase in XCO2 of about ~12 ppm during 2015–2018 is estimated from OCO-2, which is in good agreement with model-simulated XCO2 (optimized flux case) and consistent with the global growth rate from surface observations. The time series and seasonal cycle of XCO2 have also been examined using model simulations over different parts of the Indian region and agreed well with those from OCO-2. Over the northern regions, especially over the Indo Gangetic Plain, the peak-to-trough seasonal cycle amplitudes of 2–3 ppm are twice than those in the southern and oceanic regions,~1–1.5 ppm. An annual total CO2 flux of −397 ± 99 TgC/yr is estimated by the inversion and that is consistent with the XCO2 measurements. |
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