Implications of overestimated anthropogenic CO_2 emissions on East Asian CO_2 sources and sinks estimations

*Tazu Saeki[1], Prabir K. Patra[1]

1. Japan Agency for Marine-Earth Science and Technology

Measurement and modelling of regional or country-level carbon dioxide (CO_2) fluxes are becoming critical for verification of the greenhouse gases emission control. One of the commonly adopted approaches is inverse modelling, where CO_2 fluxes (emission: positive flux, sink: negative flux) from the terrestrial ecosystems are estimated by combining atmospheric CO_2 measurements with atmospheric transport models. The inverse models assume anthropogenic emissions are known, and thus the uncertainties in the emissions introduce systematic bias in estimation of the terrestrial (residual) fluxes by inverse modelling. Here we show that the CO_2 sink increase, estimated by the inverse model, over East Asia (China, Japan, Korea and Mongolia), by about 0.26 PgC yr^{-1} (1 Pg = 10^{12} g) during 2001-2010, is suggested as an artifact of the anthropogenic CO_2 emissions increasing too quickly in China by 1.41 PgC yr^{-1}. Independent results from methane (CH_4) inversion suggested about 41% lower rate of East Asian CH_4 emission increase during 2002-2012. We apply a scaling factor of 0.59, based on CH_4 inversion, to the rate of anthropogenic CO_2 emission increase since the anthropogenic emissions of both CO_2 and CH_4 increase linearly in the emission inventory. We find no systematic increase in land CO_2 uptake over East Asia during 1993-2010 or 2000-2009 when scaled anthropogenic CO_2 emissions are used, and that there is a need of higher emission increase rate for 2010-2012 compared to those calculated by the inventory methods. High bias in anthropogenic CO_2 emissions leads to stronger land sinks in global land-ocean flux partitioning in our inverse model. The corrected anthropogenic CO_2 emissions also produce measurable reductions in the rate of global land CO_2 sink increase post-2002, leading to a better agreement with the terrestrial biospheric model simulations that include CO_2-fertlization and climate effects.

Keywords: East Asian Carbon Budget, Fossil Fuel Emission, Terrestrial Biospheric Uptake

