Development of the ECCC's National Scale Carbon Flux Inversion Modelling System

J. Kim[1], M. Neish[1], E. Chan[2], D. Chan[1], M. Ishizawa[2], S. Polavarapu[1], S. Curasi[2], A.E. Andrews[3], L. Hu[3], and D. Worthy[1]

[1]Environment and Climate Change Canada (ECCC), Toronto, Ontario, Canada; 416-739-4928, E-mail: jinwoong.kim@ec.gc.ca
[2]Climate Research Division, Environment and Climate Change Canada (ECCC)
[3]NOAA Global Monitoring Laboratory (GML), Boulder, CO 80305

Canada is the second largest country in the world, with various ecosystems in the Arctic and boreal forest zones. In the coming years, Canada may experience a changing balance between warming, CO_2 fertilization, drought, and shifting disturbance regimes in boreal forests, as well as the changes in greenhouse gas (GHG) emissions as permafrost thaws in response to climate change. Thus, the Environment and Climate Change Canada (ECCC) National Carbon flux Inversion System (ENCIS) was proposed to provide quantitative information on GHG fluxes over Canada from national to provincial scales using atmospheric GHG measurements (e.g., Fig. 1a), as well as to address scientific questions with respect to the carbon cycle in Canada. Although the goal is to quantify the sources and sinks of GHG within provinces and on a national scale, this is a challenging task due to model transport errors and observation sparsity on regional scales. Here, we present the ENCIS development and its application to regional CO_2 inversions for Canada. The ENCIS is a regional-scale inversion modelling system which uses a Bayesian inversion approach described by NOAA's CarbonTracker-Lagrange. The system utilizes multiple transport models, prior fluxes, and background CO_2 components to estimate the uncertainties in the optimized biospheric fluxes. The performance of the inversion system is assessed by performing a set of observing system simulation experiments. In addition, we will also present our flux estimates over Canada using real observations (Fig. 1b).

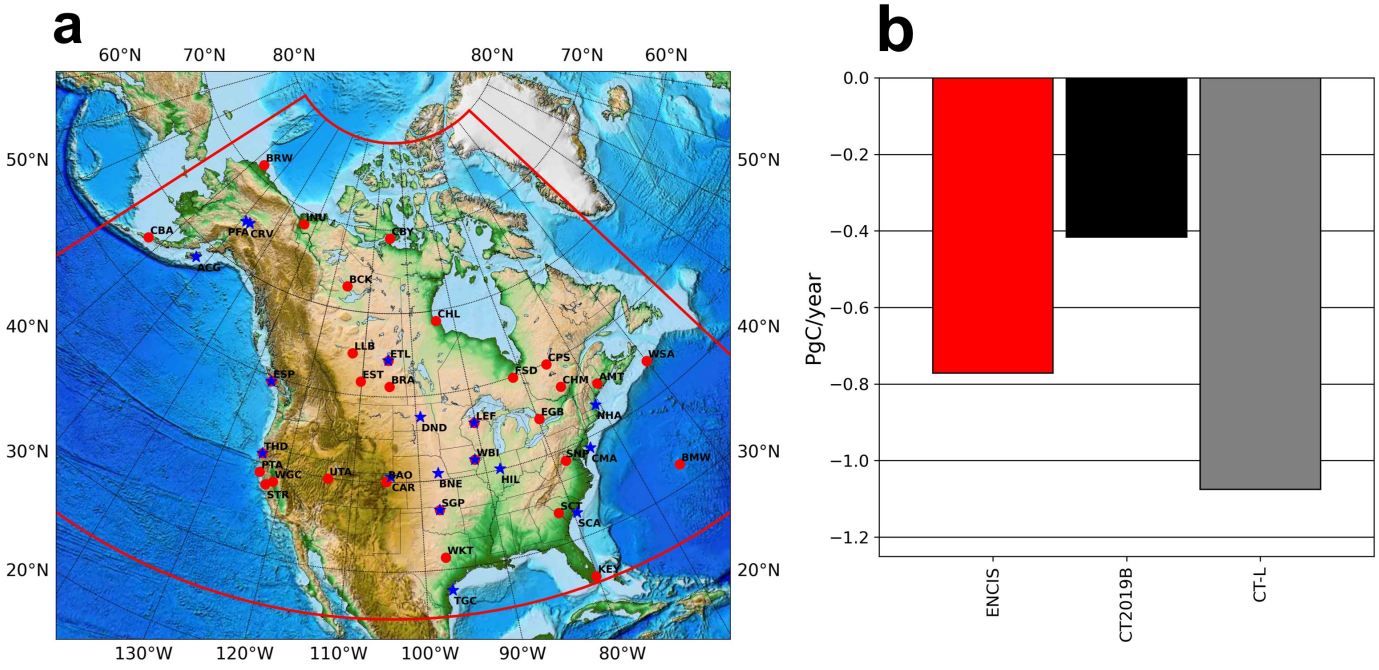

Figure 1. a) The inversion domain of the ENCIS (red solid line) and the observation network used in the experiment (red dot: surface site, blue star: aircraft profile sites). b) A first look at the annual biospheric CO_2 flux estimate over Canada for 2014 (PgC yr^{-1}) from an ensemble of experiments with real observations (red), NOAA's CT2019B (black), and CarbonTracker-Lagrange (grey).