The Prospects for Top-down Atmospheric Flux Inventories for CO_2 and CH_4

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Atmospheric CO_2 and CH_4 measurements complement bottom-up greenhouse gas (GHG) inventories by providing an integrated constraint on the exchanges of these gases between land and ocean surfaces and the atmosphere (including anthropogenic emissions) and their trends over time. While CO_2 and CH_4 fluxes inferred from atmospheric measurements are not as source-specific as the data sources typically used in inventories, they include contributions from sources that are often omitted or poorly characterized by bottom-up inventory methods. At global scales, atmospheric concentrations of CO_2, CH_4 and other well-mixed GHGs are well characterized by precise, ground-based, *in situ* measurements from surface and airborne systems. Recent advances in space-based remote sensing methods are providing new opportunities to augment the resolution and coverage of the ground and airborne measurements with estimates of the column-averaged CO_2 and CH_4 dry-air mole fractions (XCO_2 and XCH_4). These XCO_2 and XCH_4 estimates are less precise and accurate than the *in situ* measurements, but can provide near-global coverage at spatial scales as fine as a few km. These ground-based, airborne, and space-based atmospheric CO_2 and CH_4 estimates are now being assimilated into atmospheric transport models to estimate CO_2 and CH_4 fluxes on scales spanning individual large power plants to nations. The long-term objective of these efforts is to develop top-down global inventories that (i) reduce uncertainty of national emission inventory reporting, (ii) identify additional emission reduction opportunities and provide nations with timely and quantified guidance on progress towards their emission reduction targets, and (iii) track changes in the natural carbon cycle caused by human activities and climate change. This presentation will summarize ongoing efforts by the OCO-2 Science Team and its partners in the measurement and modeling community to create a prototype atmospheric inventory by 2021 that can support the 2023 global stocktake mandated by the Paris Agreement.

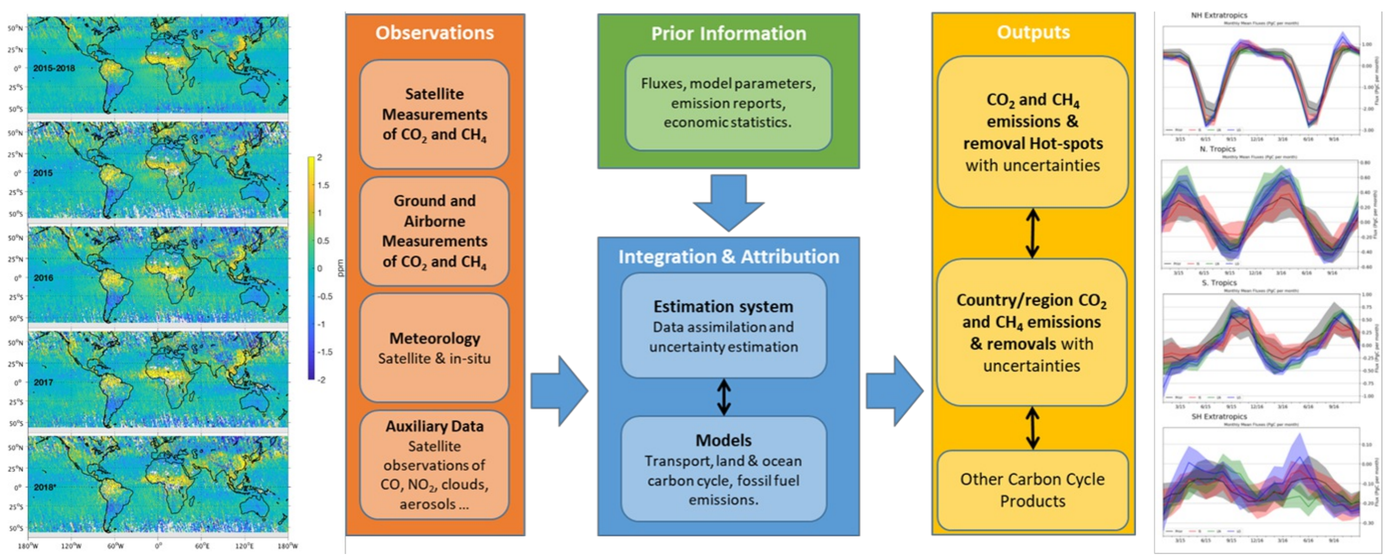

Figure 1. A system-level approach for generating a top-down atmospheric CO_2/CH_4 inventory.