Constraining the North American Carbon Sink with CO_2 measurements from the NOAA/ESRL Aircraft Program

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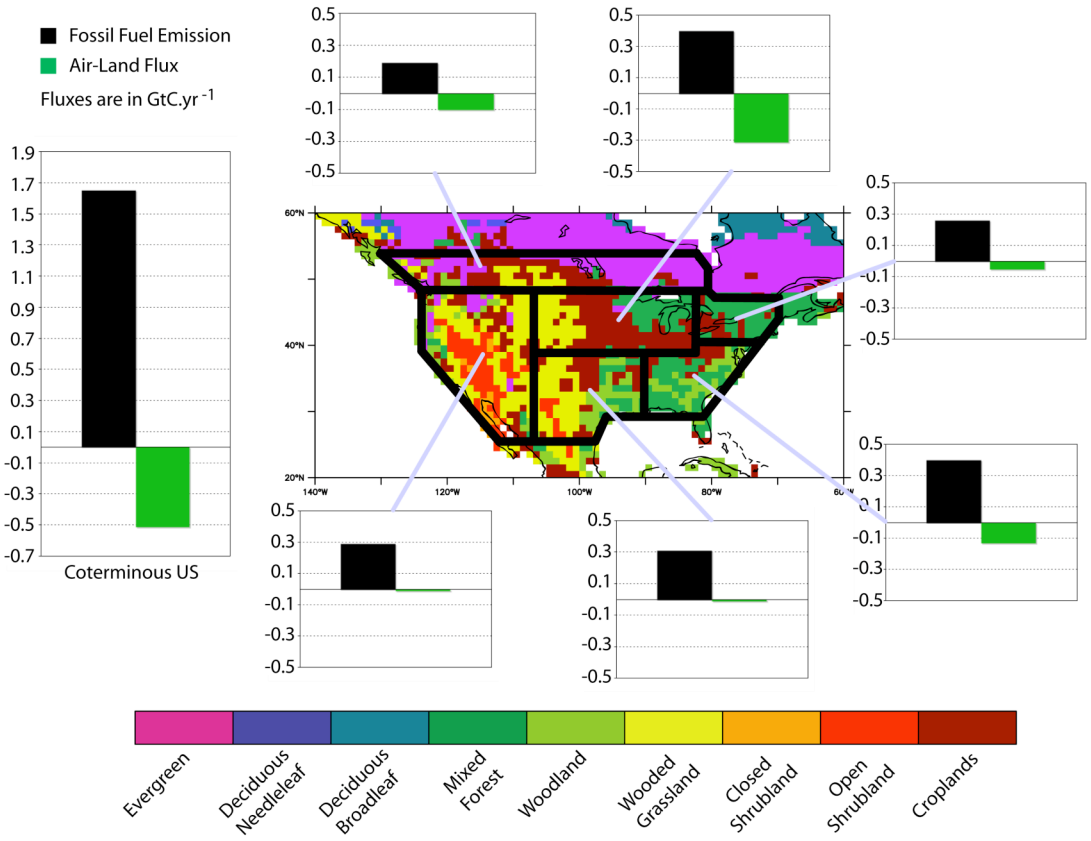
Profiles of CO_2 mixing rations collected from the NOAA/ESRL Aircraft Program are unique in their ability to constraint estimates of the North American carbon sink. This three dimensional dataset which reaches as far north as 65°N and as far south as 27°N between 500m and 8000m above ground level provides a valuable picture of the seasonal changes in CO_2 mixing rations over North America which does not rely on vertical and horizontal transport estimates typically used for inverse estimates of the North American carbon sink. The timing, amplitude and spatial distribution of CO_2 mixing ratios up to 8000 m at 19 aircraft profiles sites throughout North American not only provides an excellent benchmark for inverse flux estimates but also provides the opportunity for an independent estimates of the North American carbon sink when coupled with mean wind climatologies. Here we present a novel budgeting approach to estimate land-to-atmosphere fluxes. This approach circumvents most of the weaknesses of traditional atmospheric inversion, by relying mostly on CO_2 vertical data and wind distribution. We find a moderate sink of 0.51 ± 0.39 GtC.yr^{-1} compared to other estimates for the period 2004-2006, with the highest uptake occurring in the South-East deciduous region, the agricultural mid-west states and the South of the boreal region.



Vegetation map and estimates of fossil fuel emissions and air-land fluxes in North America