

Carbon cycling in the North American coastal ocean: a synthesis

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Background:

An accurate quantification of carbon fluxes in the coastal ocean and across its boundaries with the atmosphere, land, and the open ocean is important for assessing the current state and projecting future trends in ocean carbon uptake and coastal ocean acidification, but this is currently a missing component of global carbon budgeting.

Methods:

Available research relevant to carbon budgets for North American coastal waters by region is presented and a carbon budget for the North American Exclusive Economic Zone (EEZ) is derived. Climate-driven trends in coastal carbon fluxes and coastal ocean acidification are also discussed.

Results:

- The North American EEZ acts as a sink of $160 \pm 80 \text{ Tg C yr}^{-1}$, although this flux is not well constrained.
- The Arctic and sub-Arctic, mid-latitude Atlantic, and mid-latitude Pacific portions of the EEZ account for 104, 62, and $-3.7 \text{ Tg C yr}^{-1}$, respectively, while making up 51 %, 25 %, and 24 % of the total area, respectively.
- A carbon export of $151 \pm 105 \text{ Tg C yr}^{-1}$ to the open ocean is estimated.
- The increasing concentration of inorganic carbon in coastal and open-ocean waters leads to ocean acidification.

Significance: Coastal margins are critically important in contributing to carbon budgets and in the societal benefits they provide and further efforts to improve assessments of the carbon cycle in these regions are paramount.

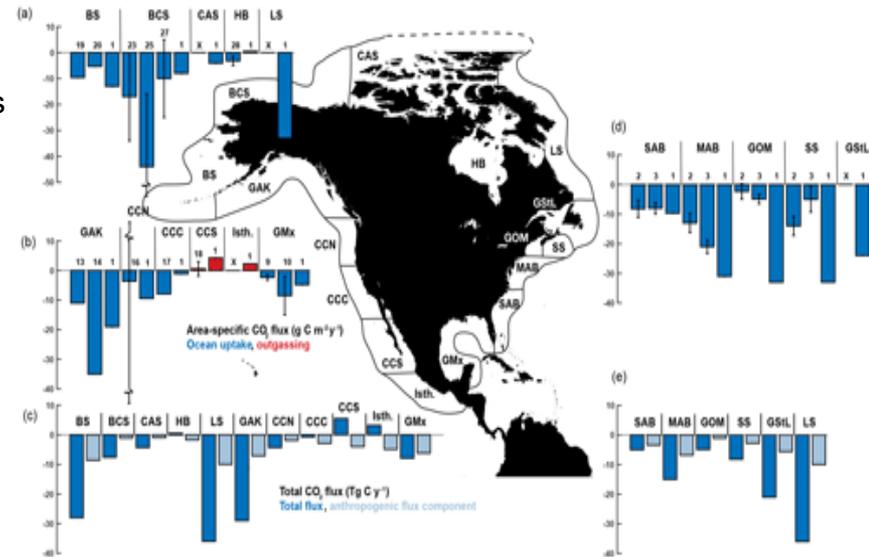


Figure: North American continent with EEZ decomposition (indicated by black outlines). Selected area-specific regional CO_2 flux estimates are shown in comparison to the global model estimates (referred to as 1) in (a, b, d) (see Fig. 2 in paper for reference key). “X” indicates that no regional estimate is available. Total CO_2 flux estimates from the global model and the anthropogenic components are shown in (c, e). Subregion abbreviations are MAB – Mid-Atlantic Bight, GOM – Gulf of Maine, SS – Scotian Shelf, GSIL – Gulf of St. Lawrence and Grand Banks, LS – Labrador shelf, HB – Hudson Bay, CAS – Canadian Arctic shelf, BCS – Beaufort and Chukchi seas, BS – Bering Sea, GAK – Gulf of Alaska, NCCS – northern California Current System, CCCS – central California Current System, SCCS – southern California Current System, Isthmus – American isthmus, GMx – Gulf of Mexico and Yucatán Peninsula, SAB – South Atlantic Bight.