Neutral Tropical African CO_2 Exchange Estimated From Aircraft and Satellite Observations

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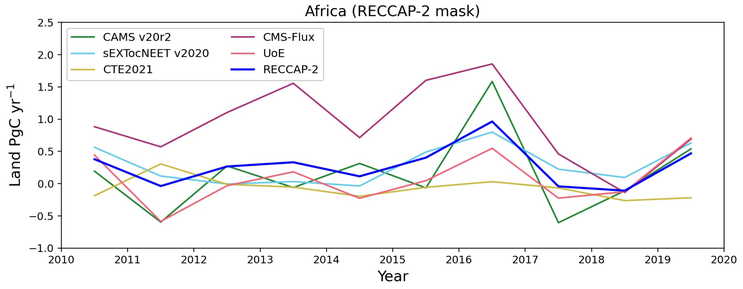
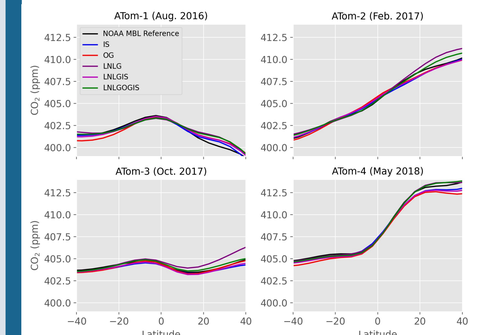
The African Carbon budget (2010-2019)

REgional Carbon Cycle Assessment and Processes Phase 2 (RECCAP2)

- **Africa's carbon sink capacity is decreasing**
  - ✓ 2001-2009: -0.14 ± 0.25 PgC yr^{-1}
  - ✓ 2010-2019: 0.27 ± 0.3 PgC yr^{-1} (0.11 ± 0.27 PgC yr^{-1})
- Adding OCO-2 data suggest a strong CO_2 source



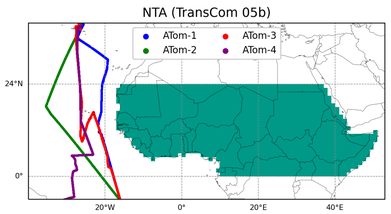
Methods: OCO-2 MIP and Atmospheric Tomography Mission (ATom)



NOAA–MBL and model MBL

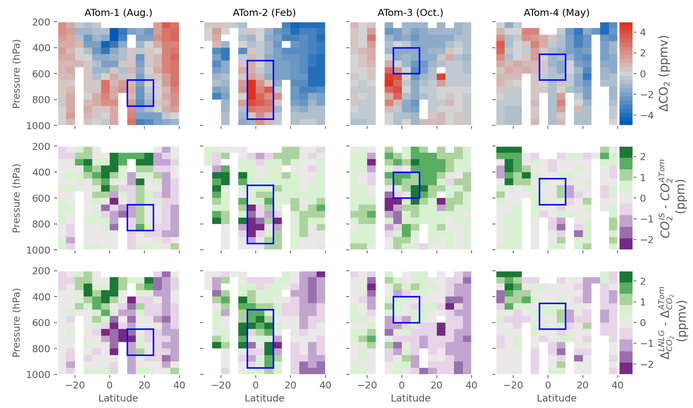
NOAA Marine Boundary Layer (MBL) reference: surface CO_2 weekly air samples from the cooperative air sampling network.

10 models x 5 experiments
1. In-Situ (IS)
2. Ocean Glint (OG)
3. Land Nadir Land Glint (LNLG)
4. LNLGOGIS
5. LNLGIS



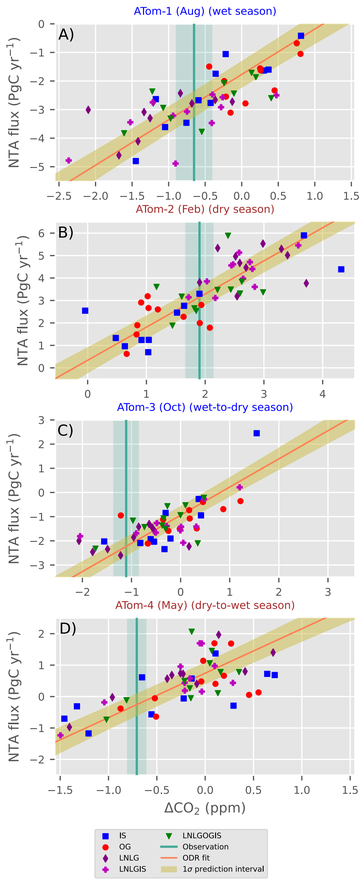
Northern Tropical Africa

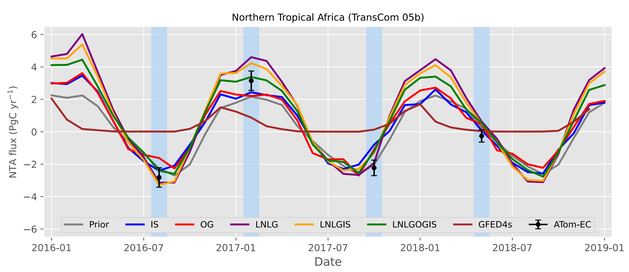
Tropical Atlantic ATom ΔCO_2

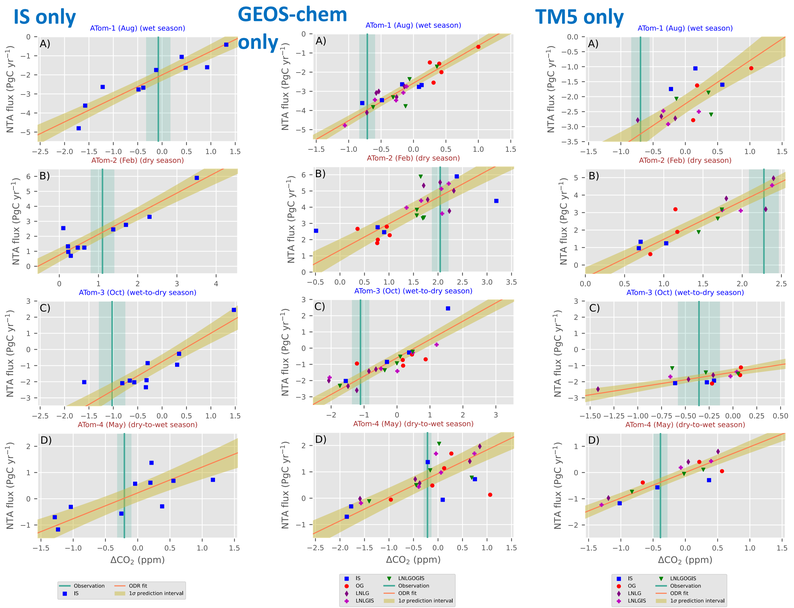


$\Delta CO_2 = CO_2$ (ATom, mod) – CO_2 (NOAA–MBL, mod)

Emergent Constraints



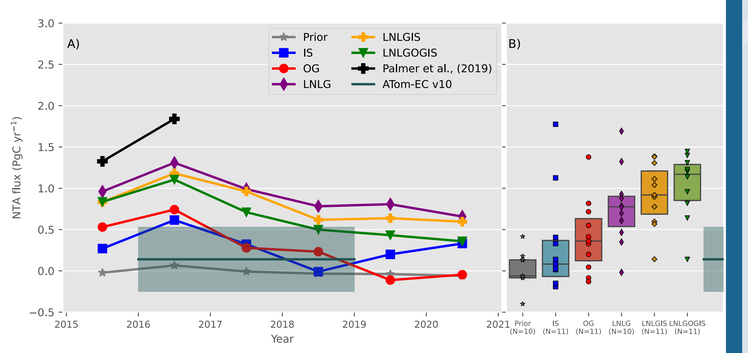




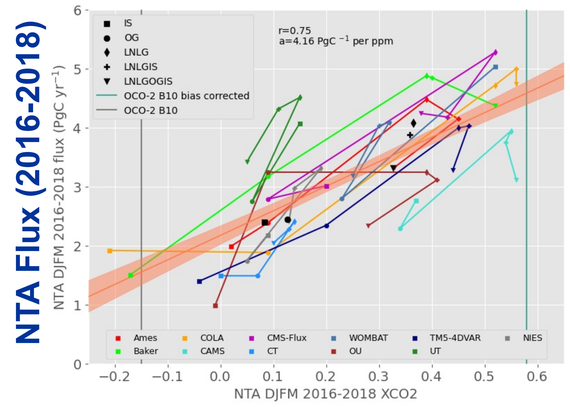
2016-2018 Annual Means

Northern Tropical Africa (NTA) annual means (2016-2018)

- ✓ 0.14 ± 0.39 PgC yr^{-1} (N=54)
- ✓ 0.08 ± 0.33 PgC yr^{-1} (N=10, IS)
- ✓ 0.27 ± 0.36 PgC yr^{-1} (N=3x5, TM5 only)
- ✓ 0.8 ± 0.43 PgC yr^{-1} (N=5x5, GEOS-chem only)



- ❖ Inversions using satellite observations overestimate annual emissions from northern tropical Africa (NTA) by approximately 1 PgC yr^{-1}
- ❖ This slope implies that a flux error of 1 PgC yr^{-1} could result from an XCO2 bias of +0.75 ppm if entirely within DJFM, or +0.25 ppm if the bias persisted all year.
- ❖ Satellite CO_2 observations imply a strong sink during the wet season over NTA



NTA Flux (2016-2018)

OCO-2 XCO2

ACKNOWLEDGMENTS

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