

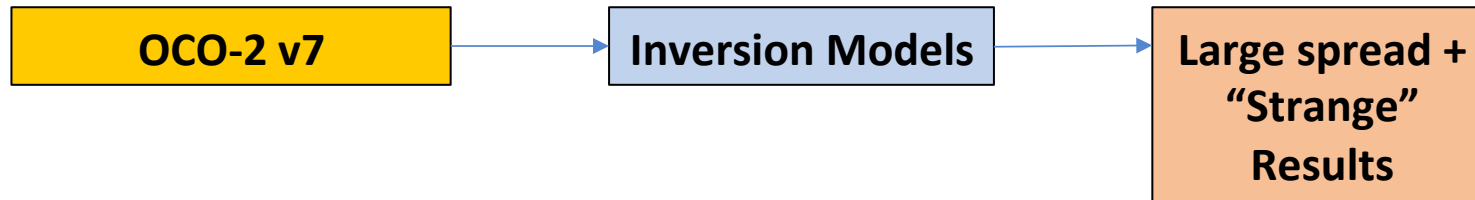
The Tropics in 2015 as Seen from OCO-2 and the Global In Situ Network

Sean Crowell, with contributions from

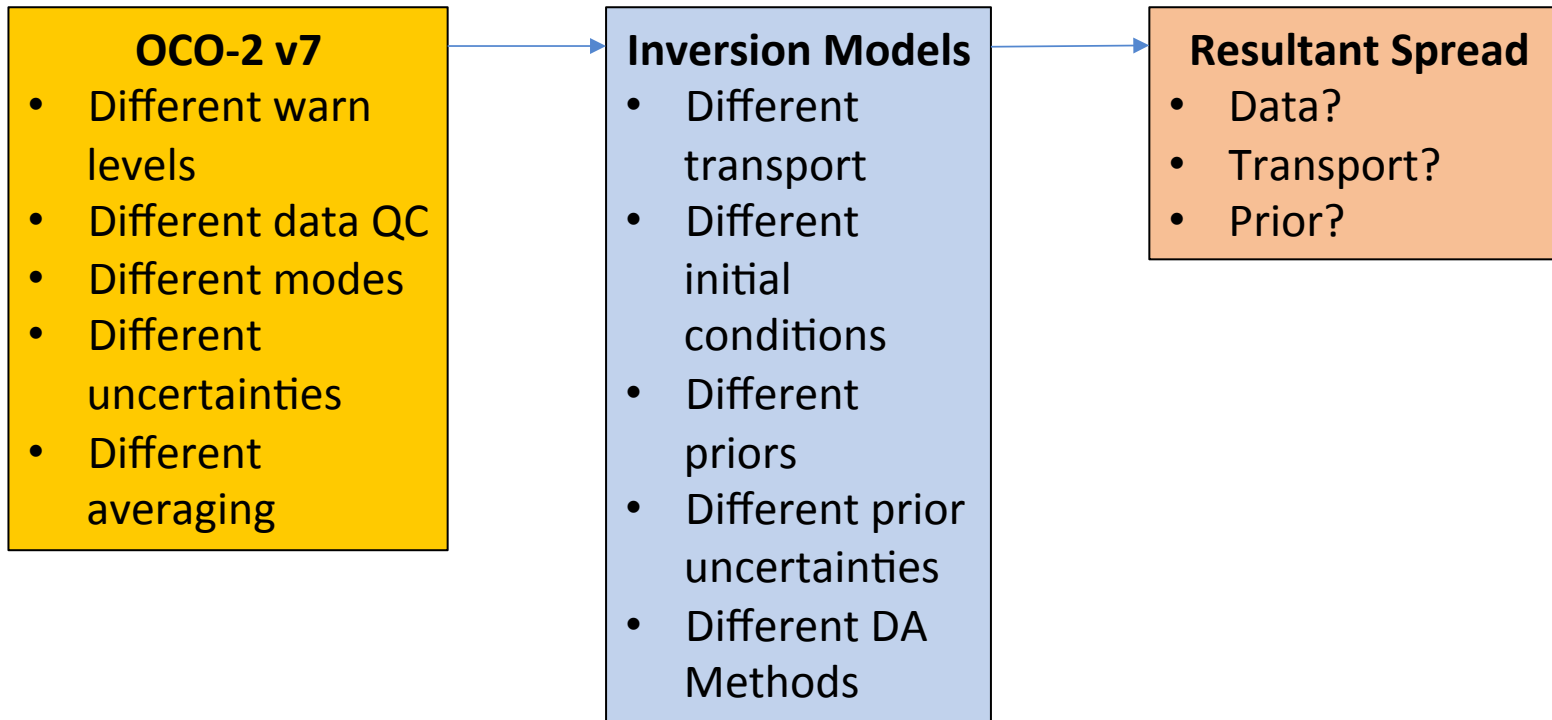
Andrew Schuh, Junjie Liu, Frederic Chevallier, Liang
Feng, Feng Deng, Andy Jacobson, Sourish Basu, David
Baker, John Miller, David Schimel, Kevin Bowman

and many others

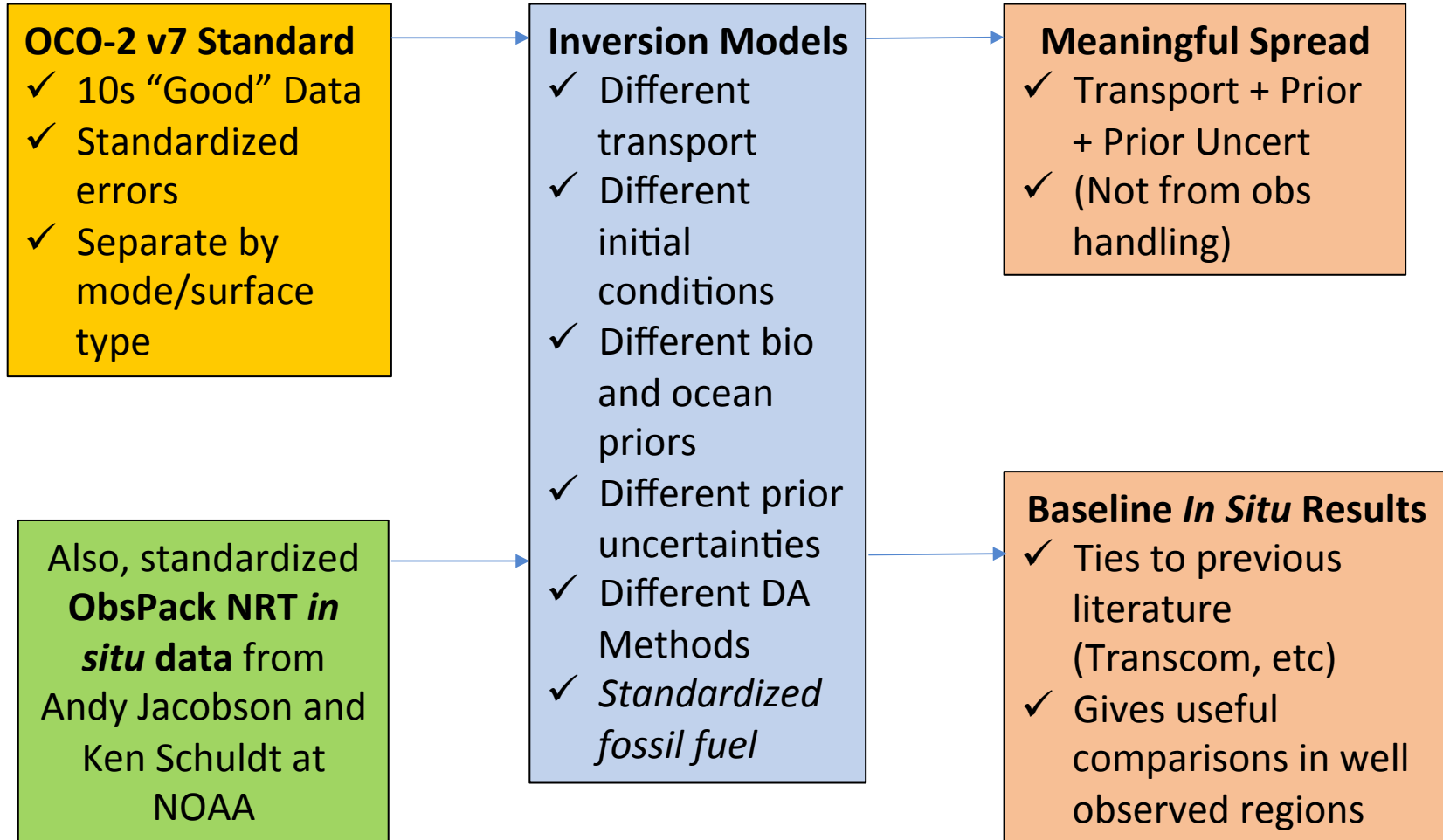
Initial OCO-2 Flux Inversion Efforts



Initial OCO-2 Flux Inversion Efforts



The OCO-2 Flux Model Intercomparison Project



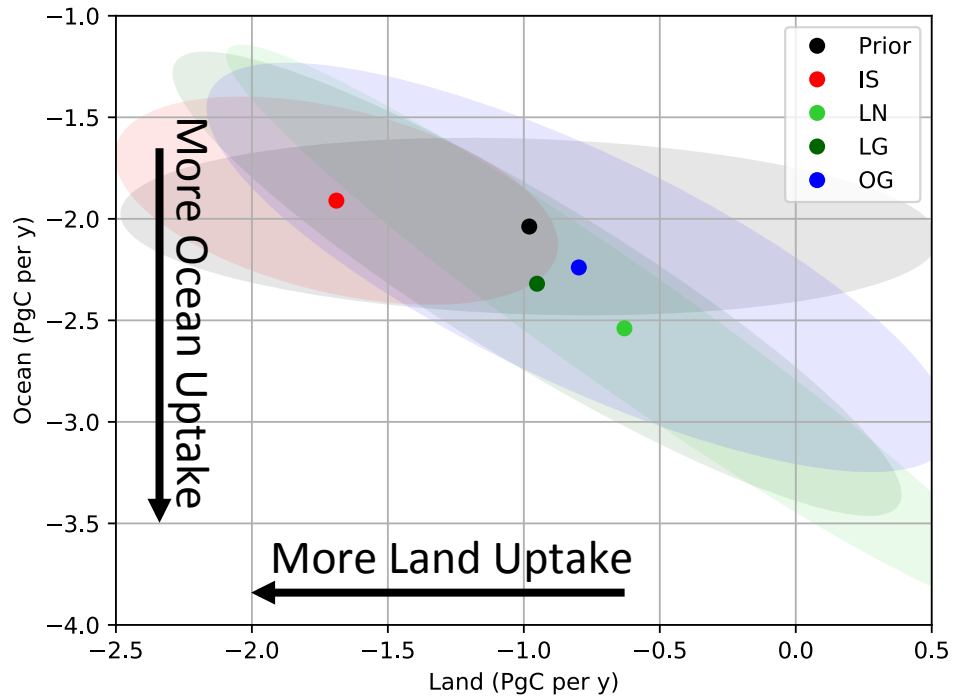
Email scrowell@ou.edu
to participate!

Motivating Questions

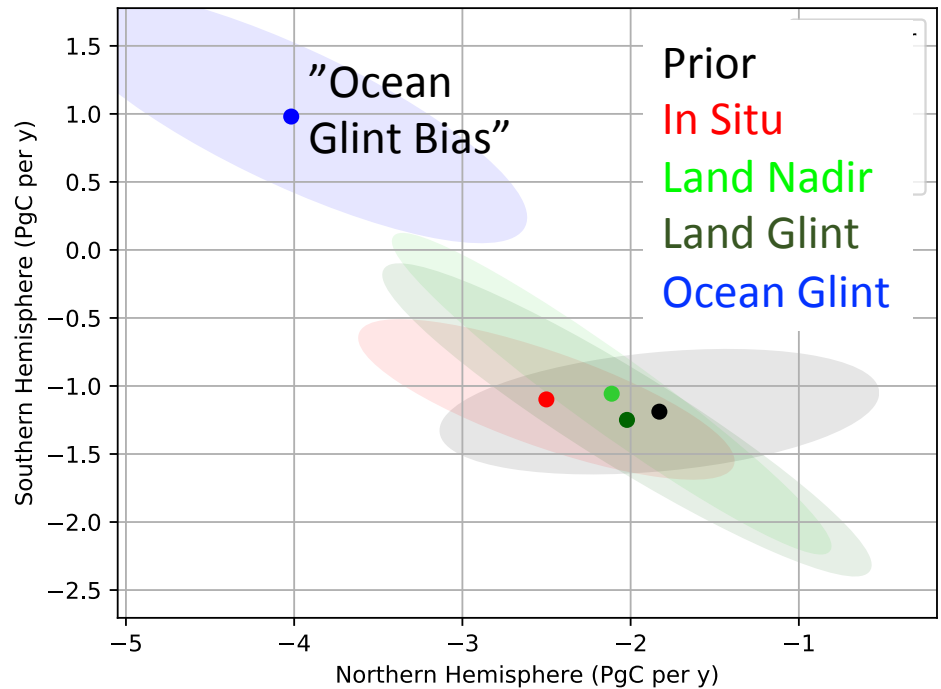
- Do OCO-2 data constrain fluxes that agree with *in situ* constrained fluxes at large scales?
- What about smaller scales?
- What new insight do we gain using OCO-2 data relative to the *in situ* network?

2015 Global Mass Balance (no FF)

Global Land vs. Ocean



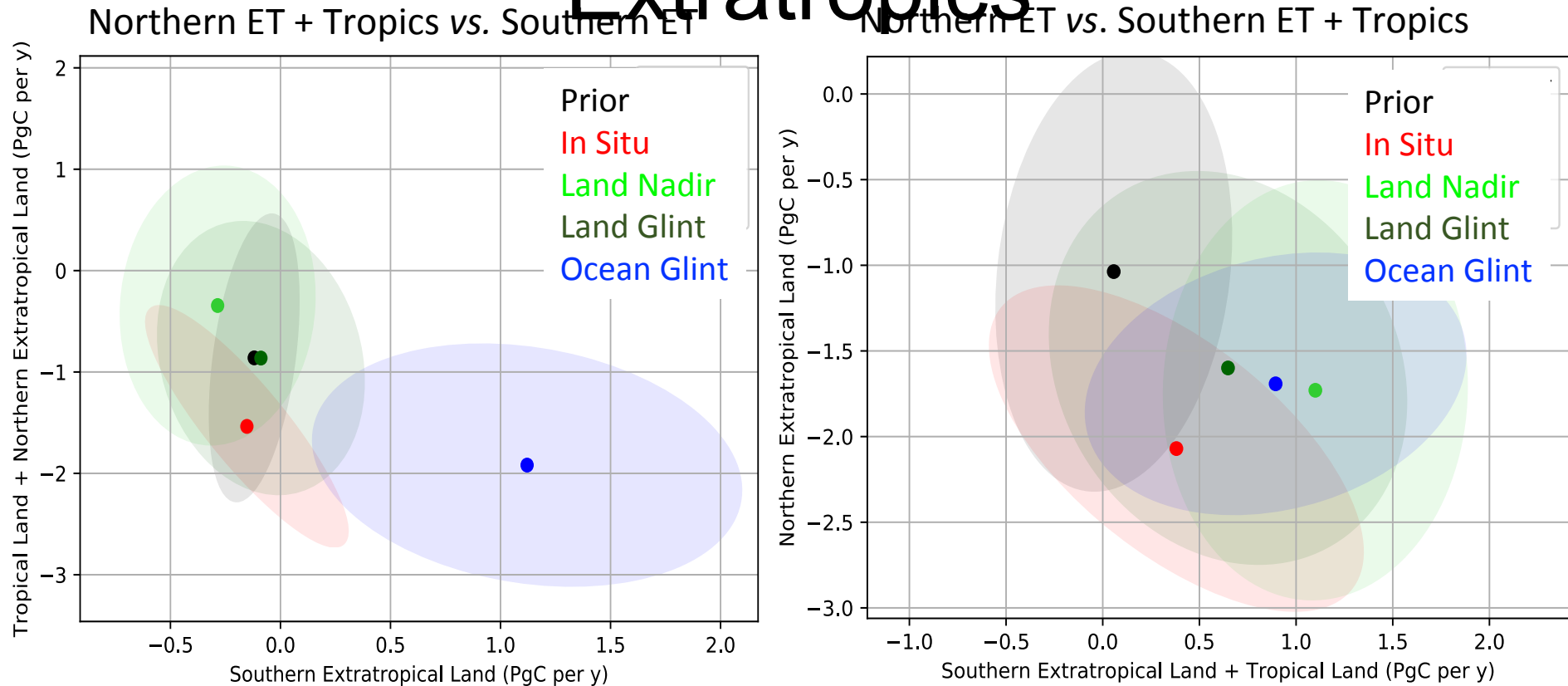
Northern Hemisphere vs. Southern Hemisphere



- In the median, OCO-2 implies a 1 PgC smaller uptake on land than the in situ network, but the spread is large. Recent OSSE work by Basu et al suggests the North vs. South spread (right) can be explained by transport model differences.
- Posterior spread among OCO-2 inversions > in situ constrained spread: possibly due to large differences in ocean prior uncertainties.

Wide spread among OCO-2 inversions is the reason for our MIP!

2015 Land Fluxes: Tropics vs. Extratropics



- OCO-2 land observations suggest a weaker tropical land sink for 2015 than in situ data
- Tropical land is a source in most inversions, but OCO-2 suggest a larger source than that of in situ data, and imply an *almost certain source*
- In situ fluxes are highly correlated between bands, but correlations are almost non-existent for OCO-2 fluxes – column observations connected to the ocean fluxes

Wide spread among OCO-2 inversions is the reason for our MIP!

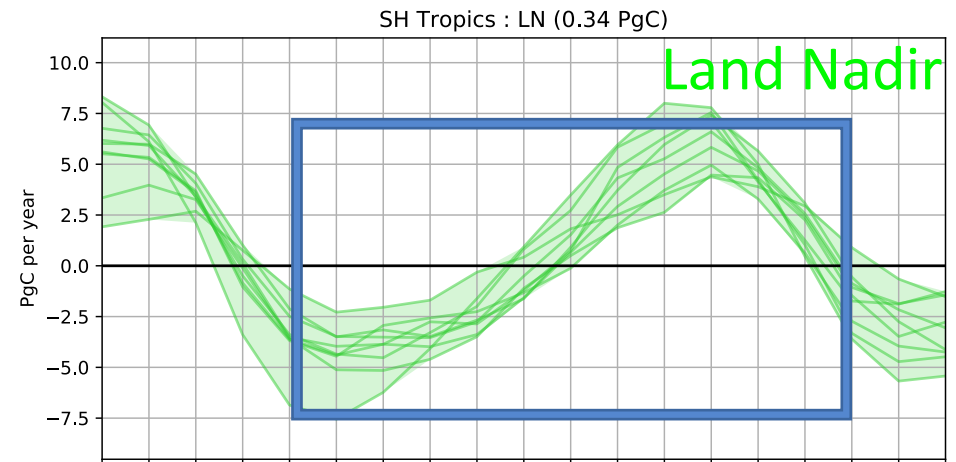
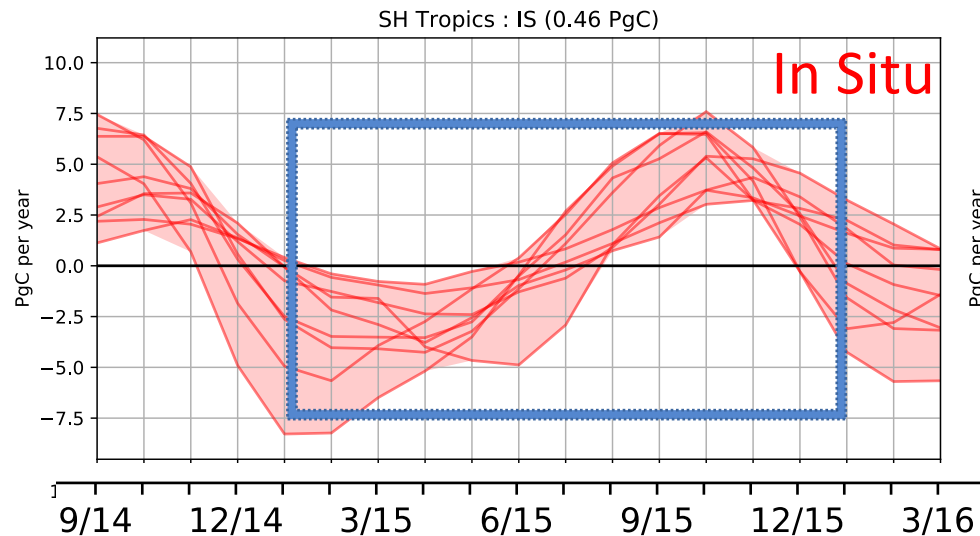
Motivating Questions

- Do OCO-2 data constrain fluxes that agree with in situ observations at large scales?

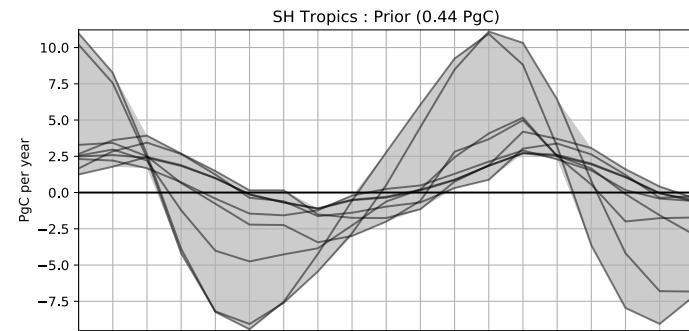
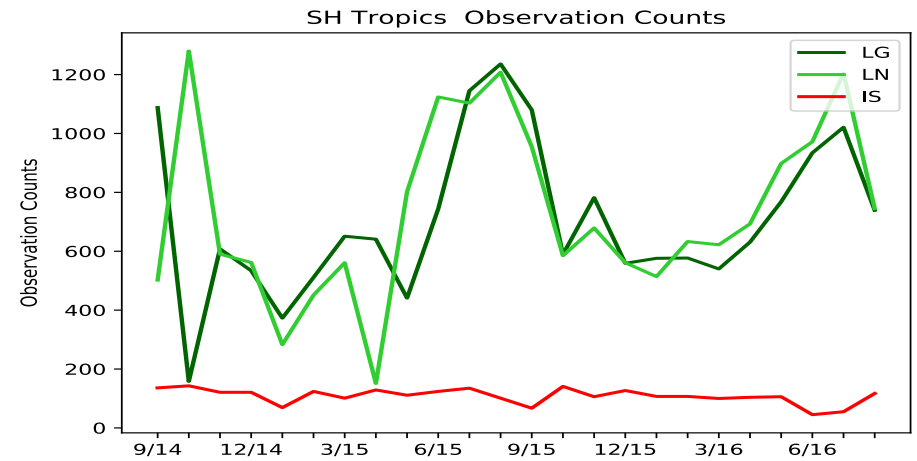
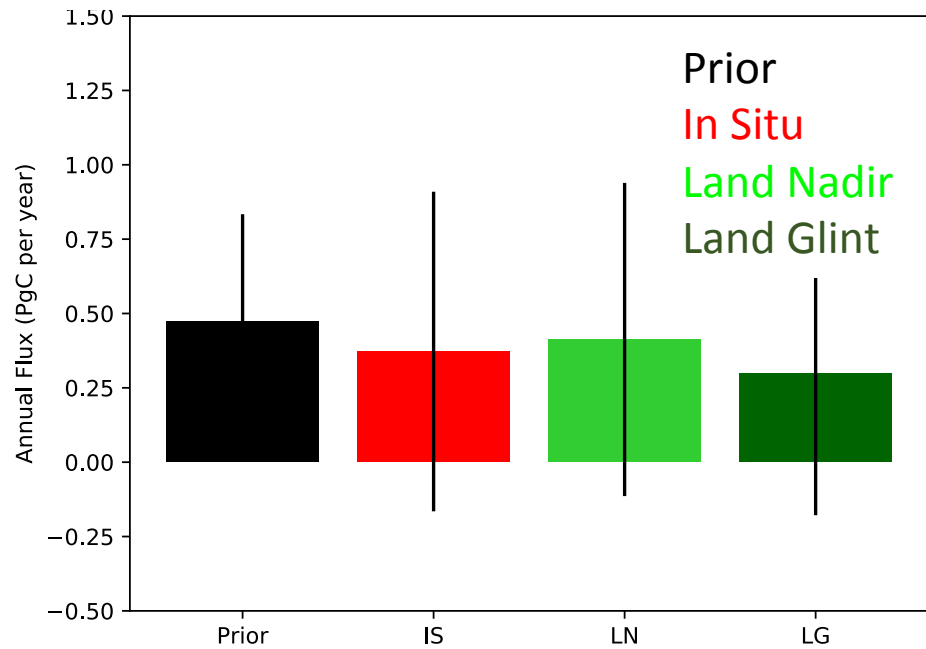
Yes, within the confidence set by the ensemble spread.
There are hints of weaker sinks and/or sources arising from OCO-2 observations relative to in situ data.

- What about smaller scales?
- What new insight do we gain using OCO-2 data relative to the in situ network?

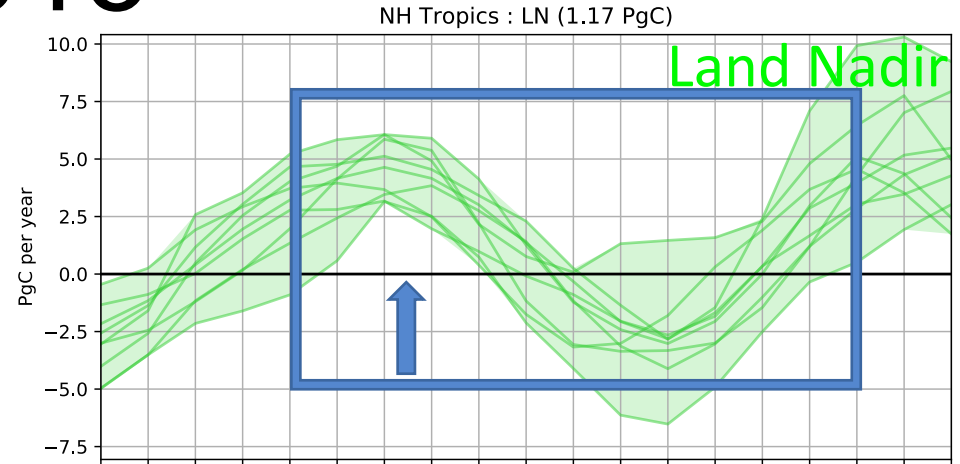
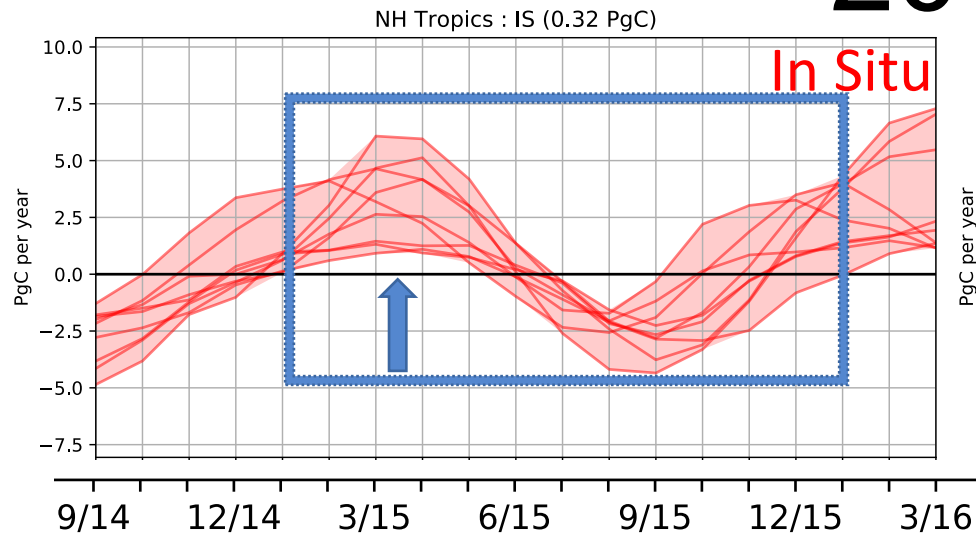
Southern Hem. Tropics for 2015



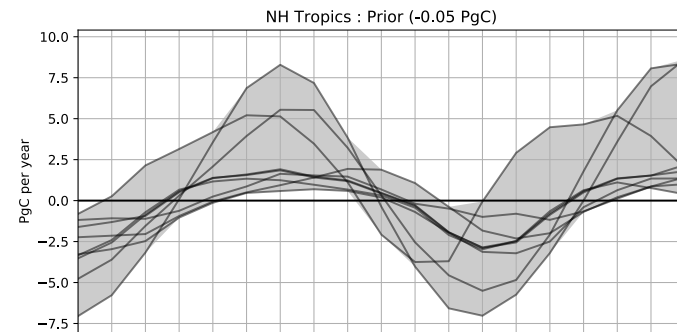
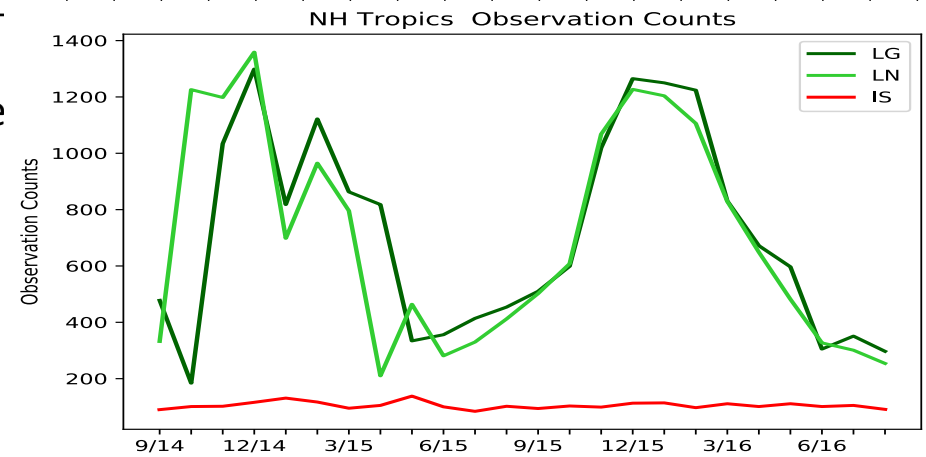
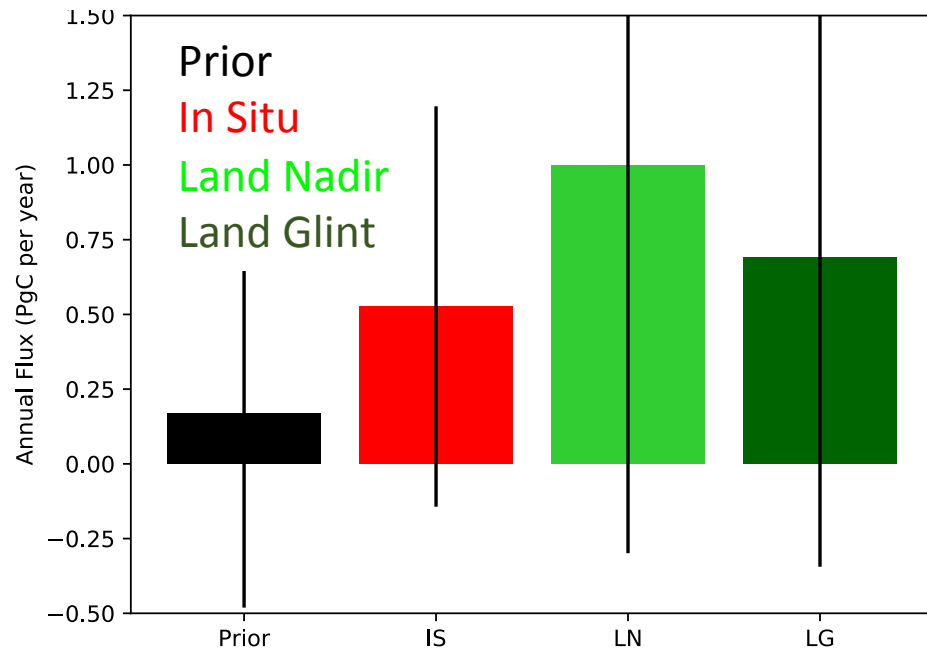
2015 SH Tropics Ensemble Mean Flux & Range



Northern Hem. Tropics for 2015

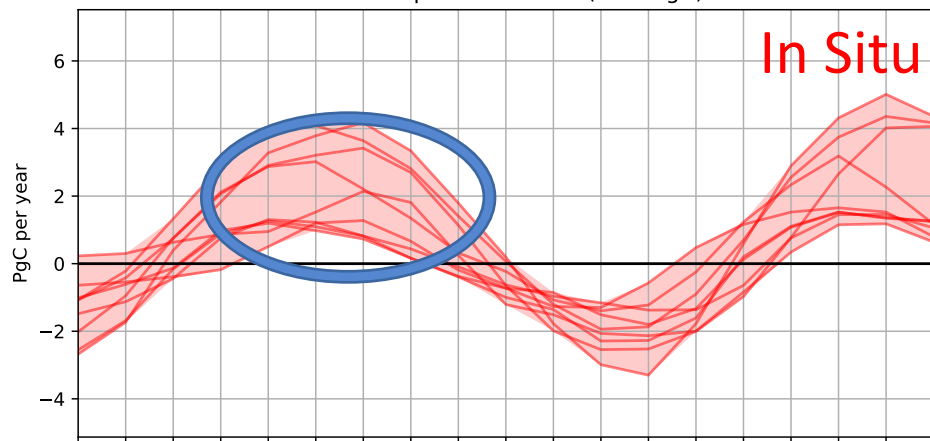


1) 2015 NH Tropics Ensemble Mean Flux & Range

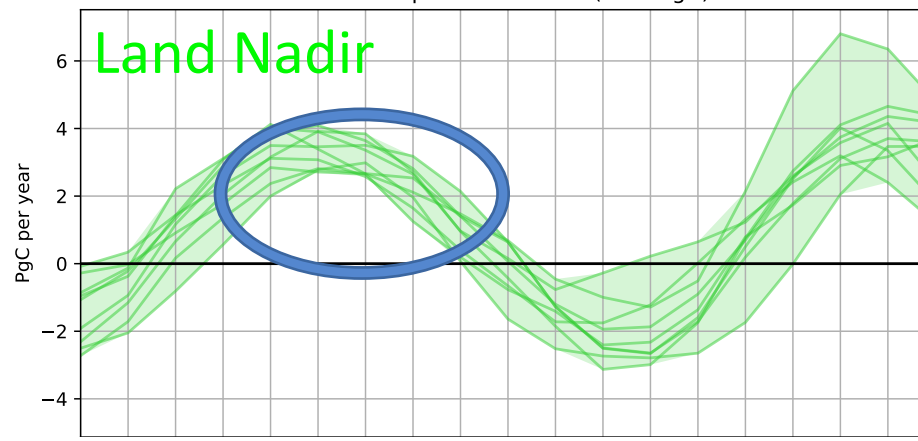


North Tropical Africa for 2015

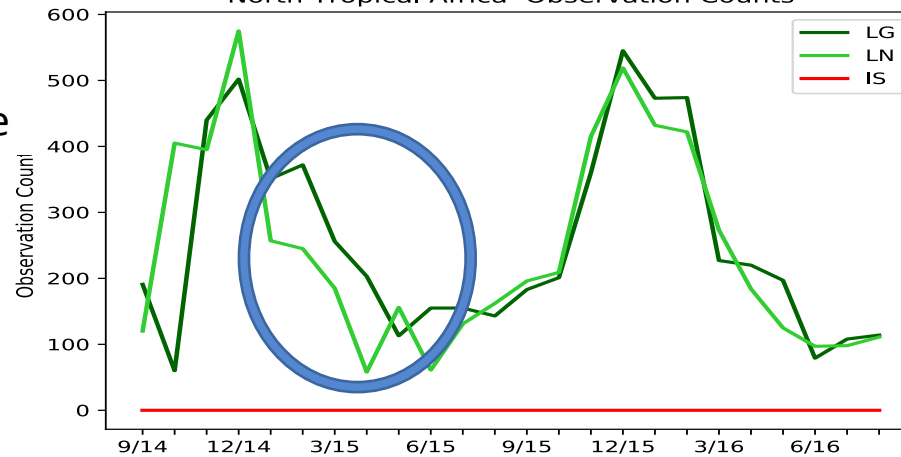
North Tropical Africa : IS (0.07 PgC)



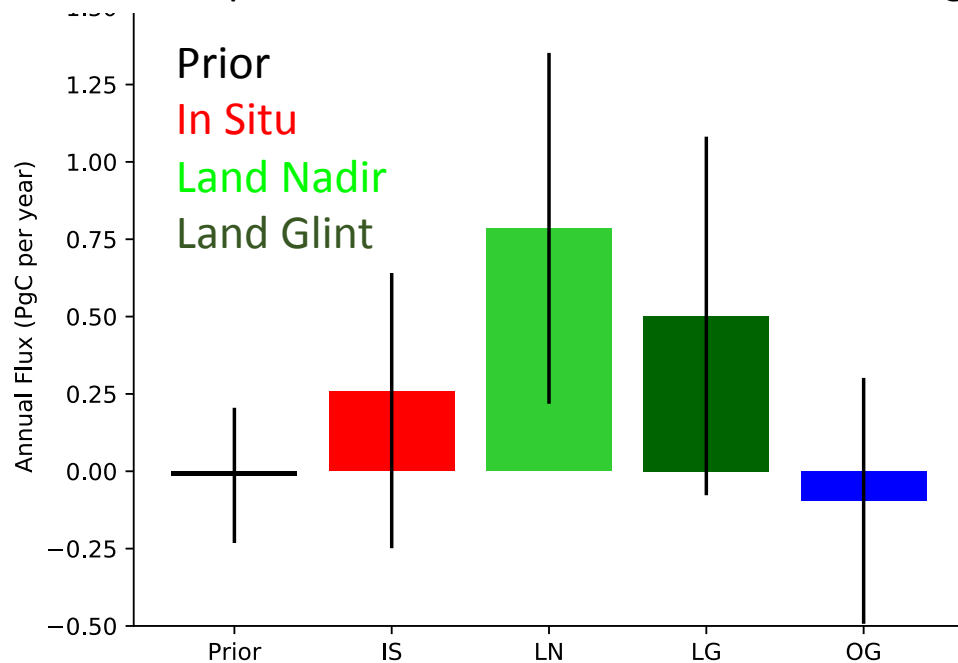
North Tropical Africa : LN (0.75 PgC)



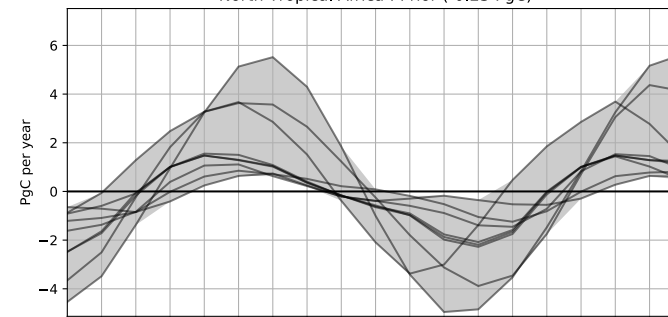
North Tropical Africa Observation Counts



2015 N Tropical Africa Ensemble Mean Flux & Range



North Tropical Africa : Prior (-0.23 PgC)



Motivating Questions

- Do OCO-2 data constrain fluxes that agree with in situ observations at large scales?

Yes, within the confidence set by the ensemble spread. There are hints of weaker sinks and/or sources arising from OCO-2 observations relative to in situ data.

- What about smaller scales?

OCO-2 and IS agree for the southern tropics, and but OCO-2 sees more outgassing for the northern tropics.

- What new insight do we gain using OCO-2 data relative to the in situ network?

We have robust agreement on the seasonality of satellite derived fluxes due to less reliance on transport. Differences between LN and LG flux estimates for Africa make interpreting the overall picture complicated

Summary and Next Steps

- In situ observations and OCO-2 see the same large scale features in the carbon cycle (*within the uncertainty of the ensemble*)
- OCO-2 has information about the tropics above and beyond the *in situ* network
 - Less dependence on transport -> more robust estimates
- Top down flux estimates require a mixed transport ensemble to avoid overconfidence in results
- To Do:
 - Evaluation of ensemble spread
 - Evaluation of ensemble against independent data
 - Examine El Nino impacts inferred from OCO-2 vs. In Situ
 - OCO-2 + *in situ* (+ GOSAT + ...) inversions