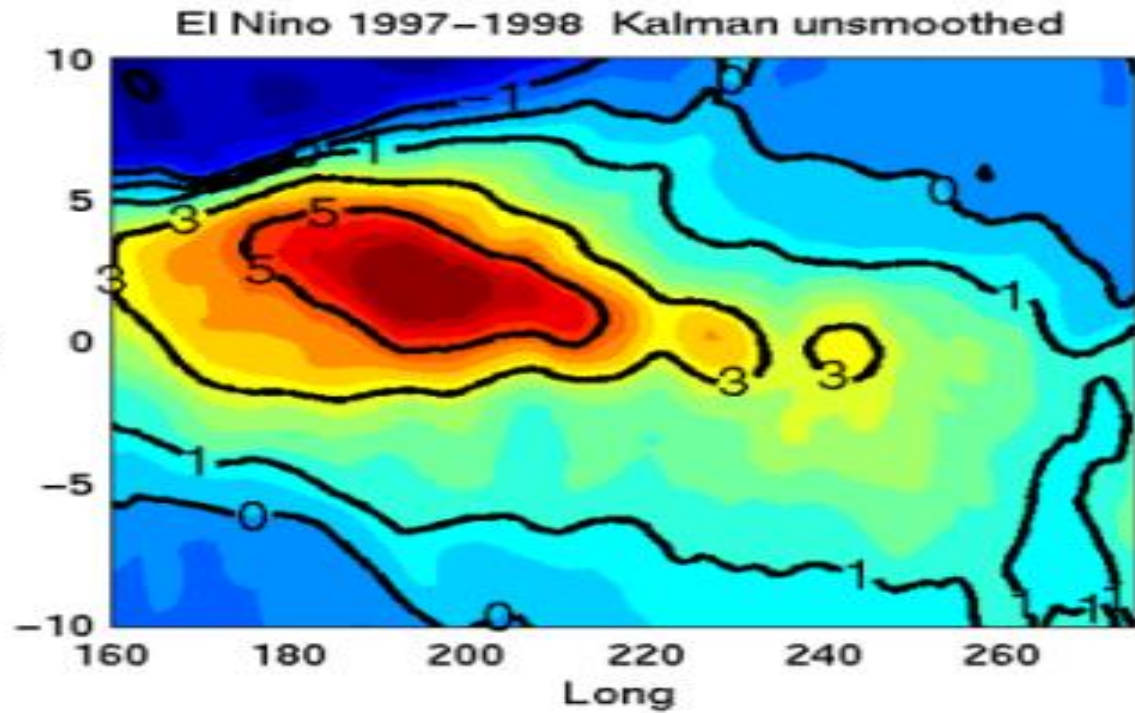
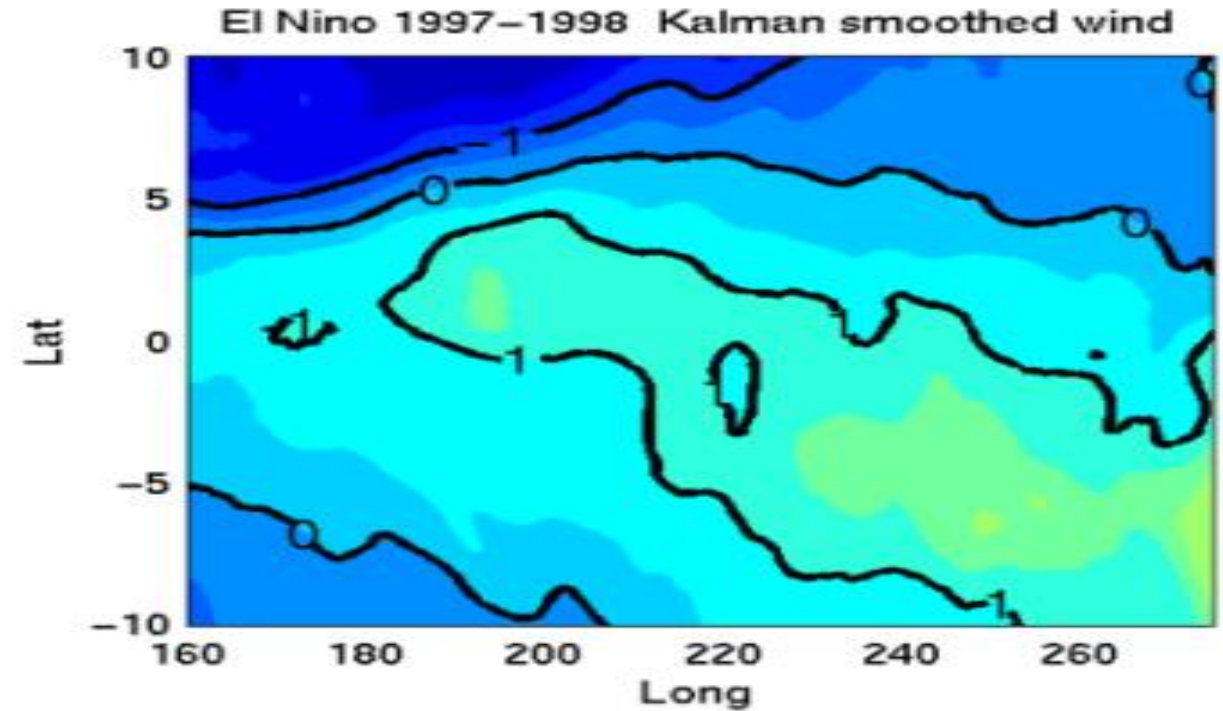


Importance of ocean circulation estimates that do not contain discontinuities for carbon/oxygen cycle studies

Filtered Estimate



Smoothed Estimate



The unrealistically large CO_2 flux during ENSO present in the filtered solution (left) due to anomalous vertical advection is corrected in the smoothed estimate (right) consistent with observations.

Mckinley, Galen A. 2002. "Interannual Variability of Air-Sea Fluxes of Carbon Dioxide and Oxygen." Civil Engineering. Massachusetts Institute of Technology. (Fig. 4.27, top left, $\text{mol/m}^2/\text{yr}$)

Ocean Carbon-cycle Model Intercomparison Project 3 (OCMIP-3)

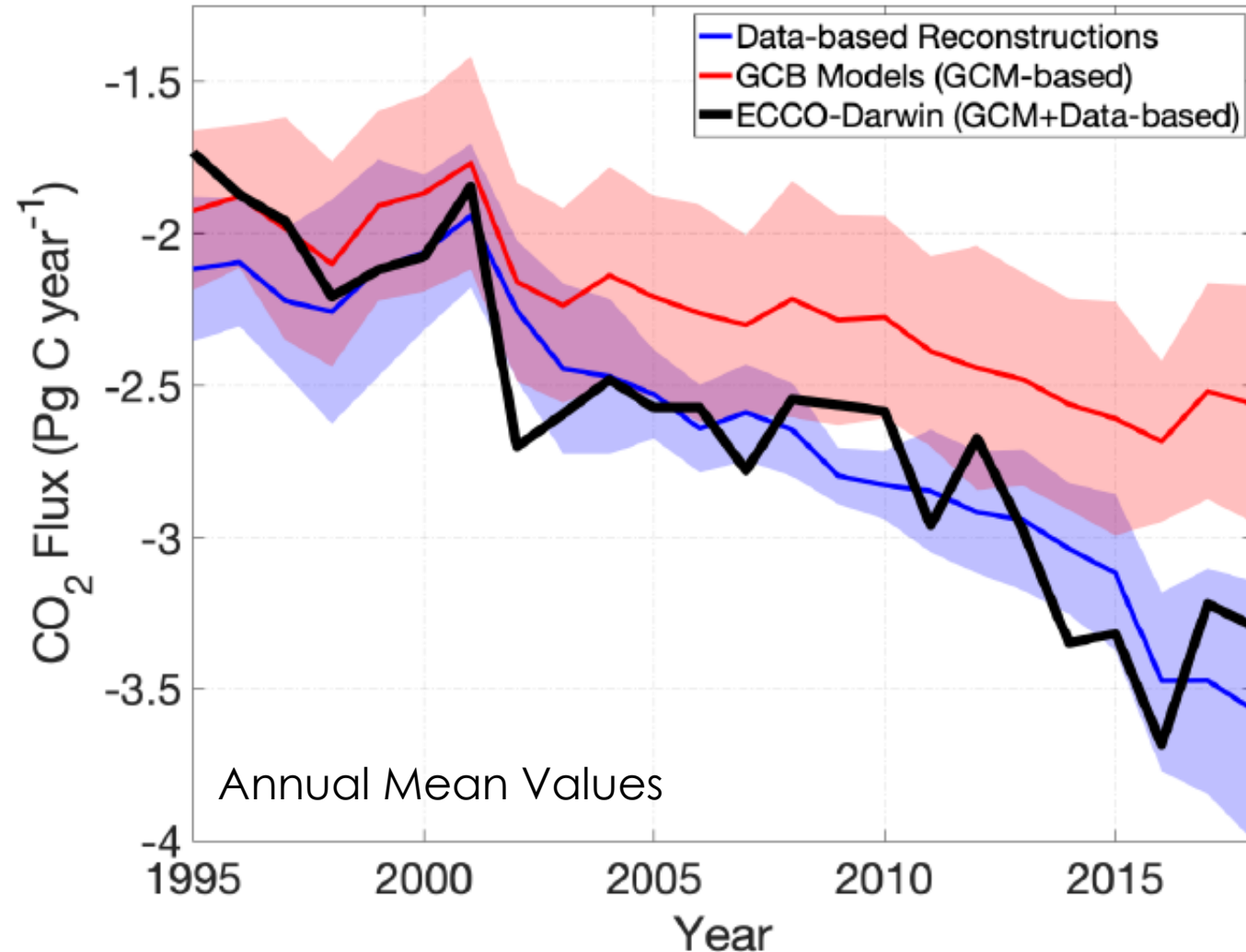
(Mikaloff Fletcher et al. 2006, 2007; Gruber et al. 2009)

Table 1. Evaluation of Model Skill Based on Comparisons Between CFC-11 Model Simulations and the GLODAP Gridded CFC Data Set^a

	Correlation	Normalized Std. Dev. ^b	Model Skill ^c	Inverse Anthropogenic CO ₂ Uptake, Pg C yr ⁻¹	Forward Anthropogenic CO ₂ Uptake, Pg C yr ⁻¹
BERN	0.89	1.04	0.81	2.05	N.A.
ECCO	0.96	0.89	0.91	2.01	N.A.
MIT	0.91	1.00	0.85	2.22	N.A.
NCAR	0.95	0.98	0.91	2.18	2.36
PRINCE-LL	0.90	1.18	0.80	1.85	1.90
PRINCE-HH	0.93	1.05	0.87	2.33	2.43
PRINCE-LHS	0.93	1.04	0.86	1.99	2.04
PRINCE-2	0.93	1.03	0.87	2.17	2.24
PRINCE-2a	0.91	1.05	0.85	2.25	2.35
UL	0.87	1.0	0.77	2.81	2.95
Mean	0.92	1.02	0.85	2.18	2.32

CFC-11 experiment using ECCO-v0 has highest correlation, lowest standard error, and highest model skill relative to observations.

Global-ocean CO₂ Sink



Globally-integrated air-sea CO₂ flux from **6 leading data-based reconstructions (blue)**, **9 Global Carbon Budget (GCB) hindcast models (red)**, and **ECCO-Darwin (black)**

- **Unlike GCB models**, ECCO-Darwin assimilates both physical and biogeochemical observations and hence is more consistent with data-based reconstructions
- **Unlike data-based reconstructions**, ECCO-Darwin solutions can be used to explore the individual processes that control ocean carbon sequestration
- **Diagnosing drivers of ocean carbon sources and sinks** is critical for understanding the future trajectory of the ocean carbon reservoir in a perturbed climate system