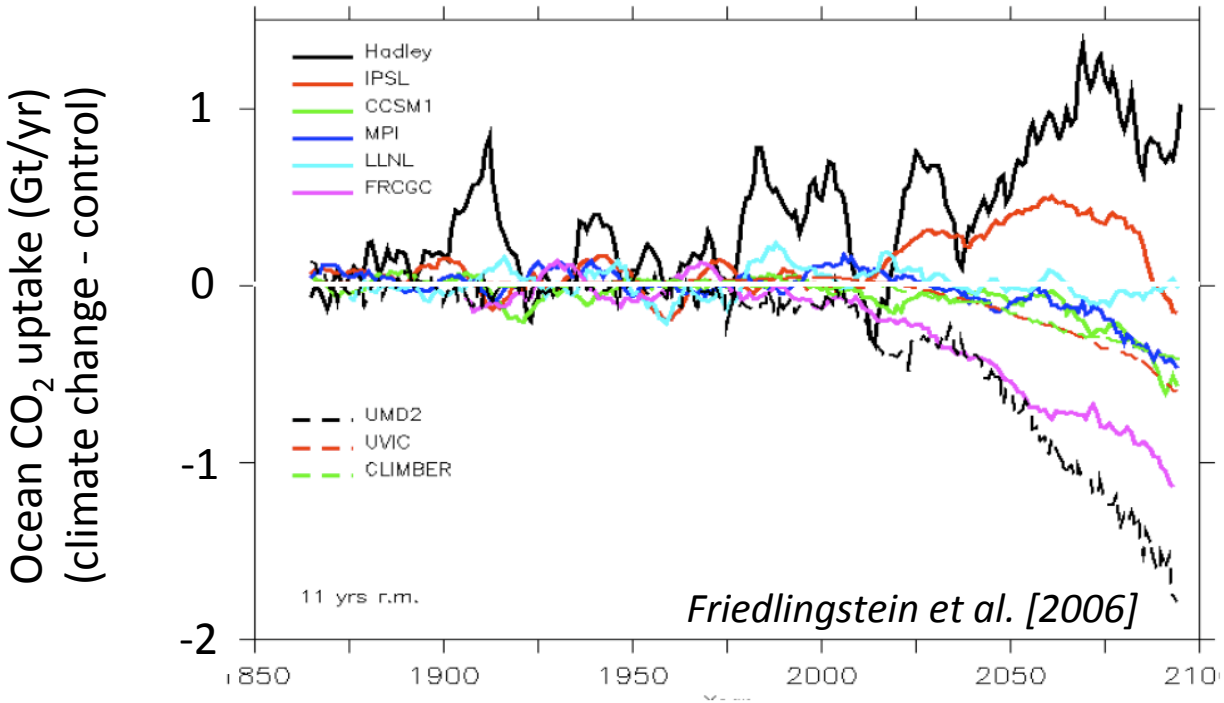
CLIVAR/OCB Working Group:
Oceanic Carbon Uptake in CMIP5 Models

Co-chairs: Annalisa Bracco, Curtis Deutsch, Taka Ito

What happens to ocean carbon cycle in a warming climate?



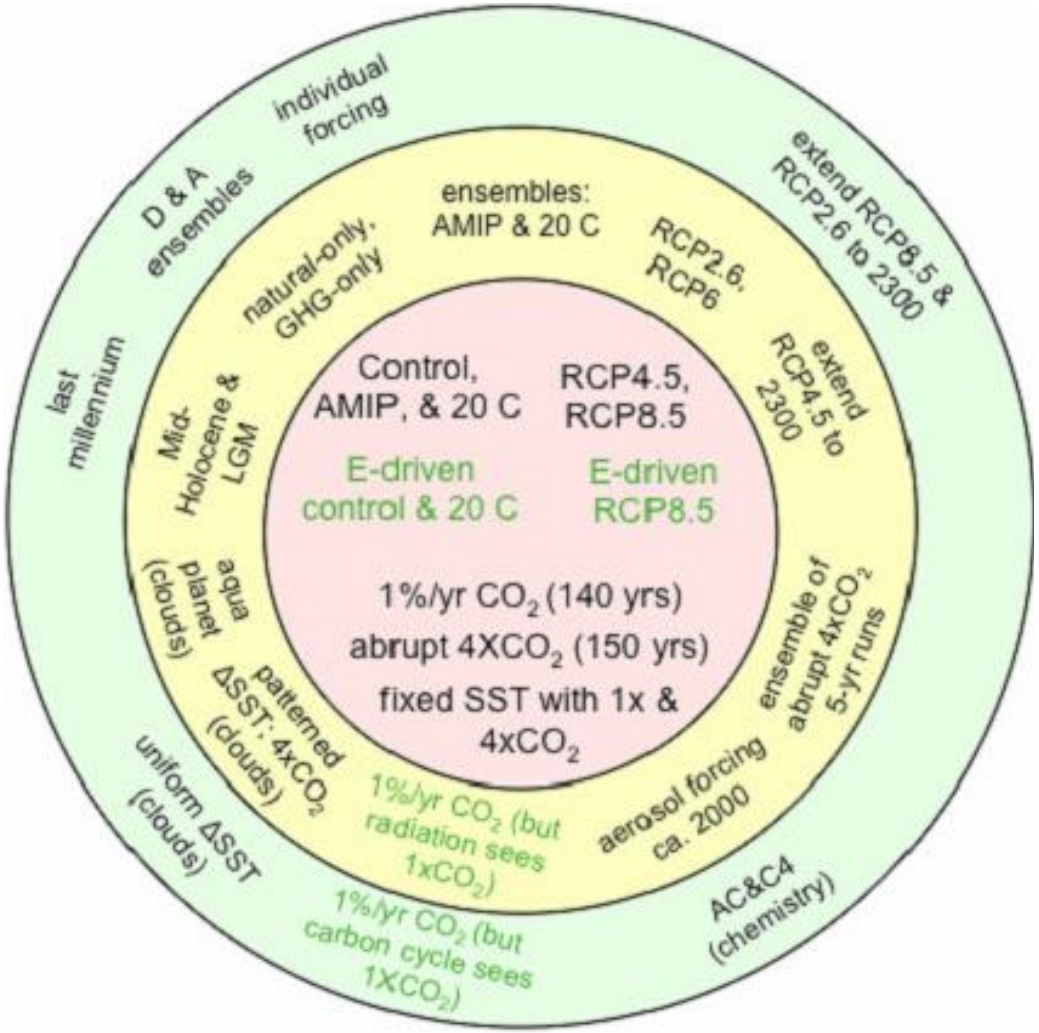
Purpose and Progress

To promote collaboration between members of the US-CLIVAR and OCB communities and between modelers within each community, to advance our understanding of the processes responsible for the oceanic carbon uptake and their representation in climate models.

Harness existing efforts Pis (or coerce new ones) toward this common goal

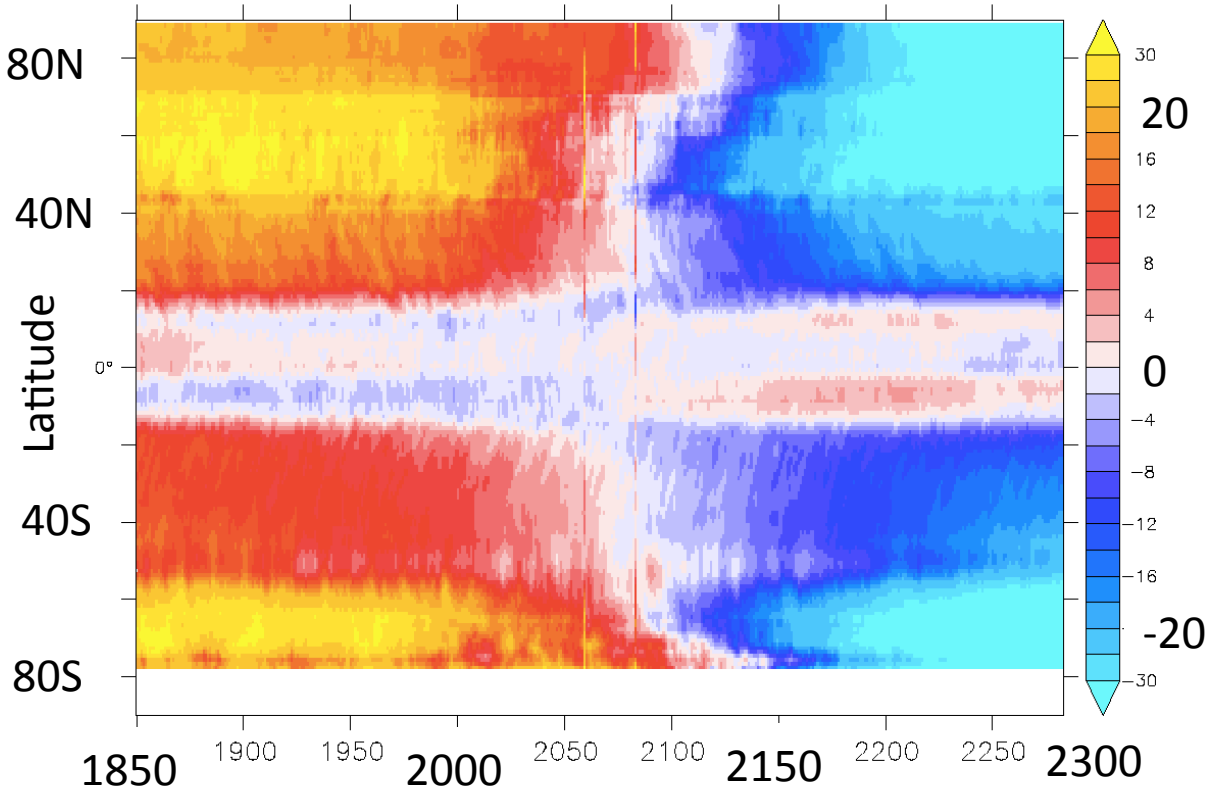
- Working group formed, April 2012
  - First telecon in May
- Membership
  - 12 US members, 2 Canadian
  - 3 representing US modeling centers (2 NCAR, 1 GFDL)
- First in-person meeting being planned
  - AGU (Dec) or ASLO (Feb) meeting

CMIP5 Earth System Models



- GFDL (2 versions)
- NCAR
- IPSL (2 versions)
- MPI (2 resolutions)
- CCCM
- MIROC
- Hadley Center
- CSIRO

Changing CO_2 storage



Zonally and vertically averaged (100-500m) O_2 anomaly (~ $-\Delta CO_2^{bio}$).

Mean of all IPCC ensemble runs, historical+RCP85.

Carbon storage by "biological pump" predicted to increase in thermocline (O_2 decreases), but opposing trend in tropics.

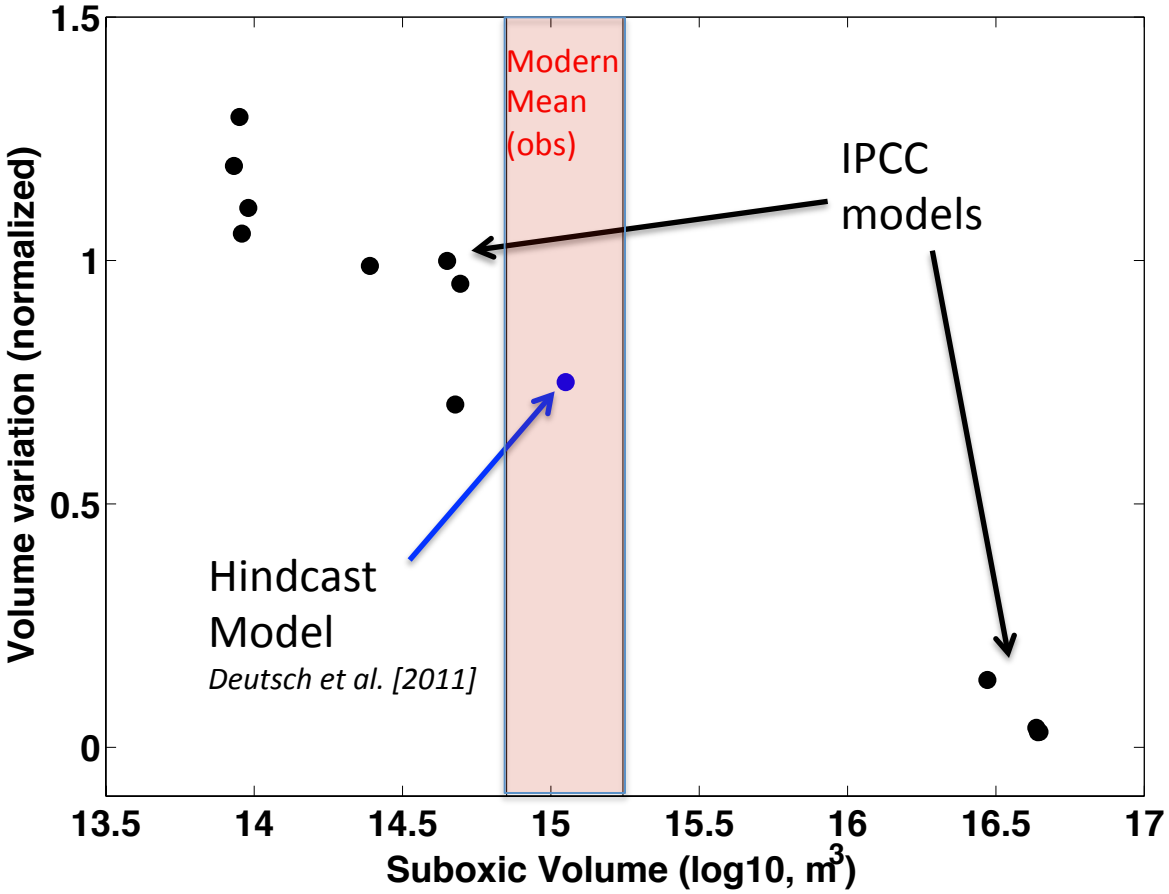
Anticipated Outcomes

1. Identify simple, common metrics of physical ocean/climate forcing of carbon cycle (wind strength, mixed-layer depth, stratification).
   - Comparison of those metrics across models and vs observations; connection to physical modeling community
2. Climatic drivers of variable CO_2 uptake at different time scales and regions of importance.

   -- Interannual/decadal variability vs long term trends

      -- Southern Ocean, North Atlantic, Tropical Pacific)
3. Analyses that tease apart physical circulation vs. biological processes governing C uptake/storage.
4. Diagnose strength of coupling between climate warming and CO_2 uptake. Simulations with and without coupling. (c.f. C4MIP)

Many wrongs make right?



Across all IPCC Earth System Models, amplitude of change in historical suboxic zone volume is highly correlated to its mean size.

→ Knowledge of the mean state can be used to constrain the amplitude of variability.