# Update on BGCWG Activities, Jan 2013

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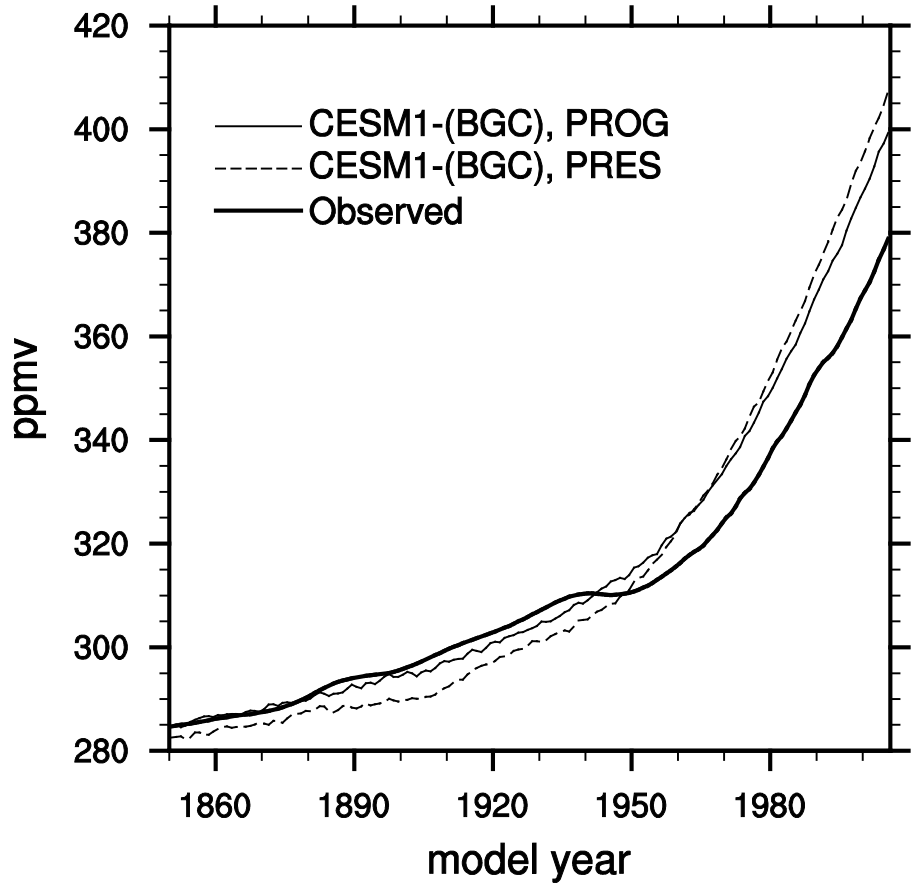
Community Liaison: Keith Lindsay (klindsay@ucar.edu)

- Notable BGC biases from CMIP5 Runs
- Developments for CESM1.2 release and beyond
- Other Projects in Progress

NCAR is sponsored by the National Science Foundation


# $CO_2$ in 20th Century Experiments




Modeled increase of $CO_2$ over 1850-2005 too large:

Observed: 94 ppmv

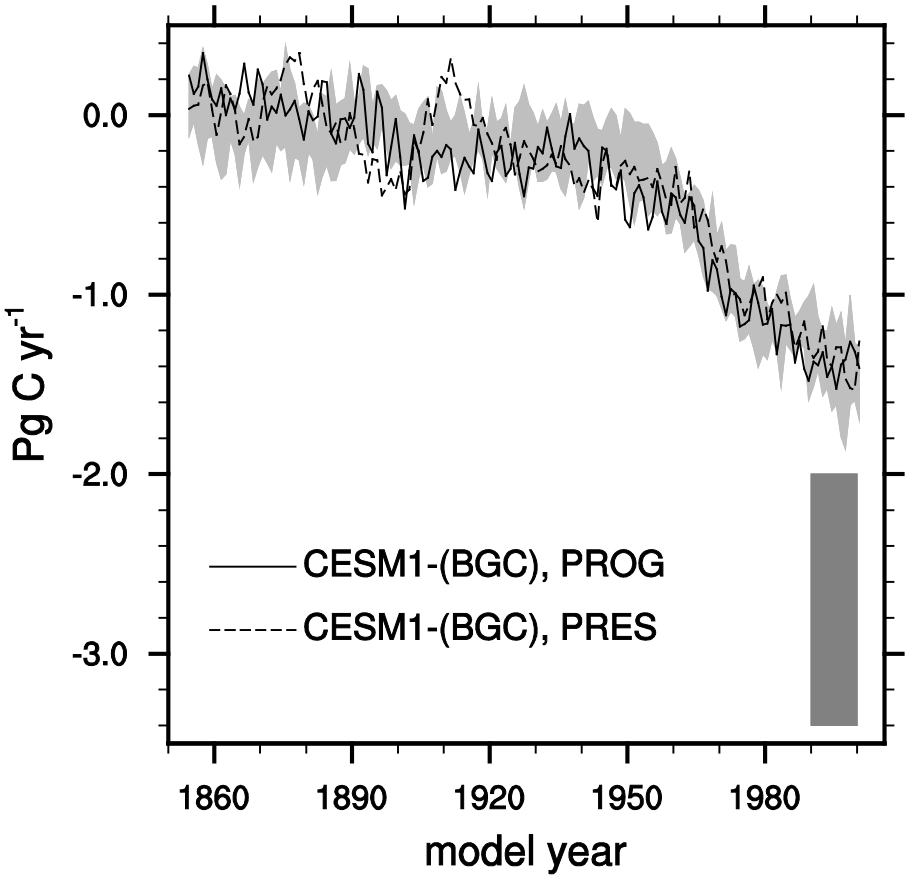
Diagnostic $CO_2$ tracer: 125 ppmv

Prognostic $CO_2$ tracer: 114 ppmv

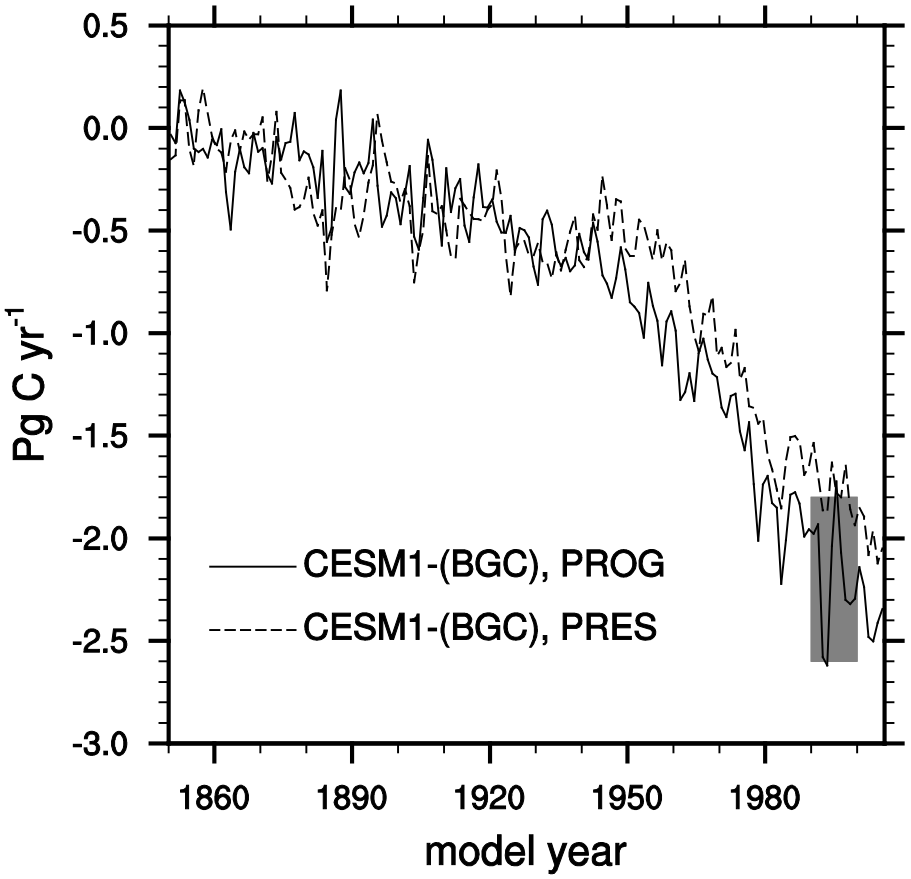
Lindsay et al., submitted

# 20th Century $CO_2$ Sinks from Atm

Land Residual Uptake



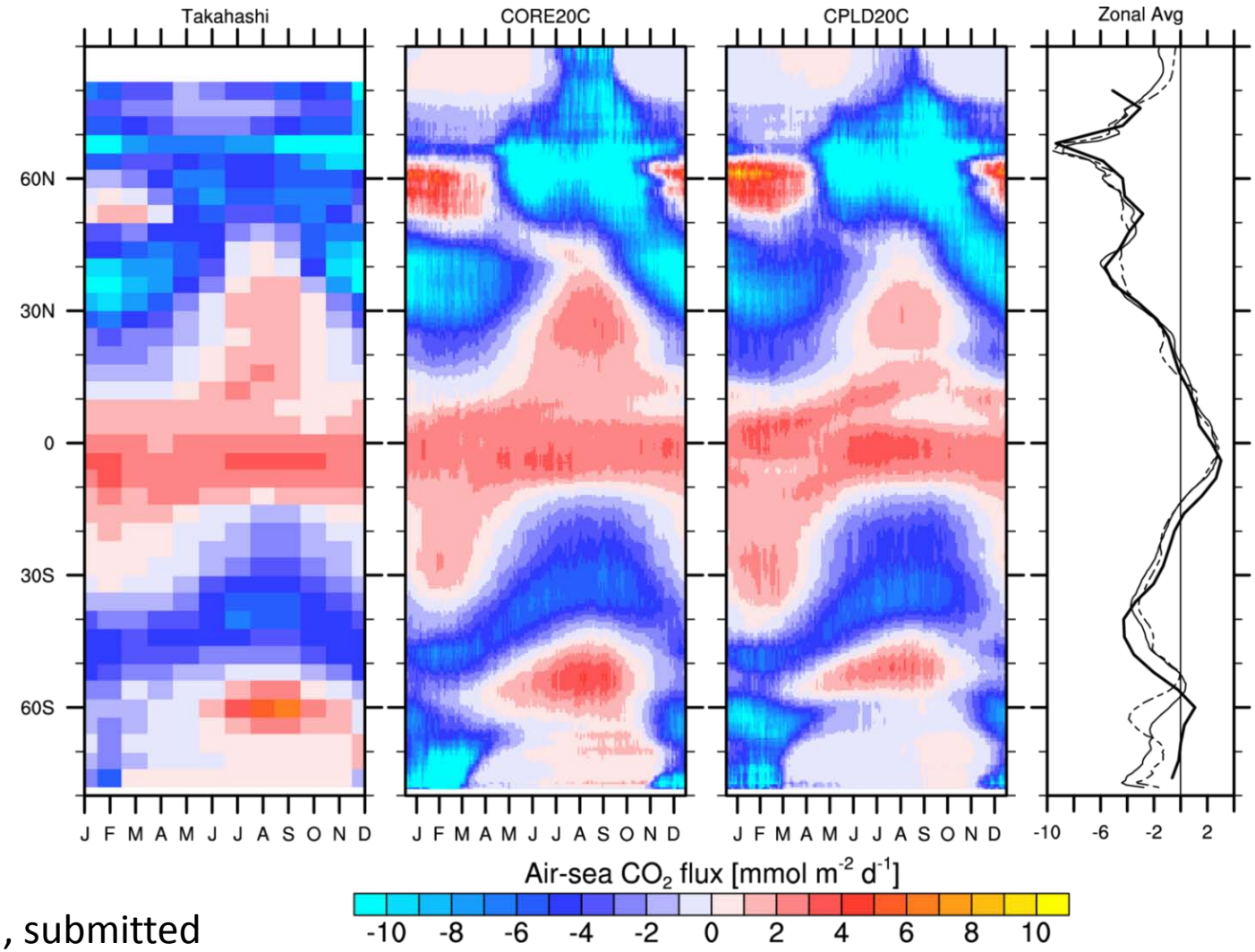

Ocean Uptake




Lindsay et al., submitted

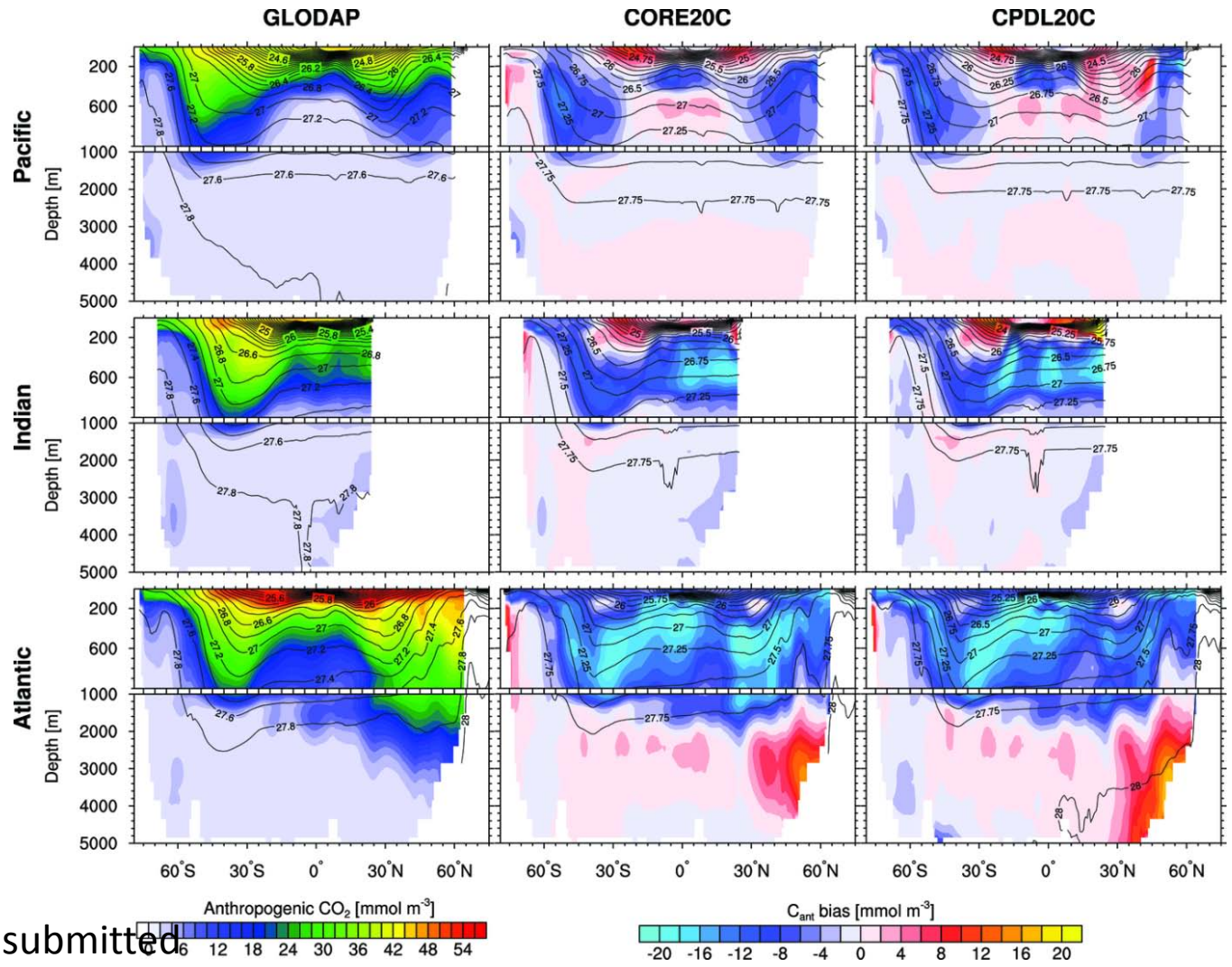
Gray bars are 1990s estimates from Canadell et al., PNAS, 2007.

# Sea-to-Air $CO_2$ Flux




Long et al., submitted

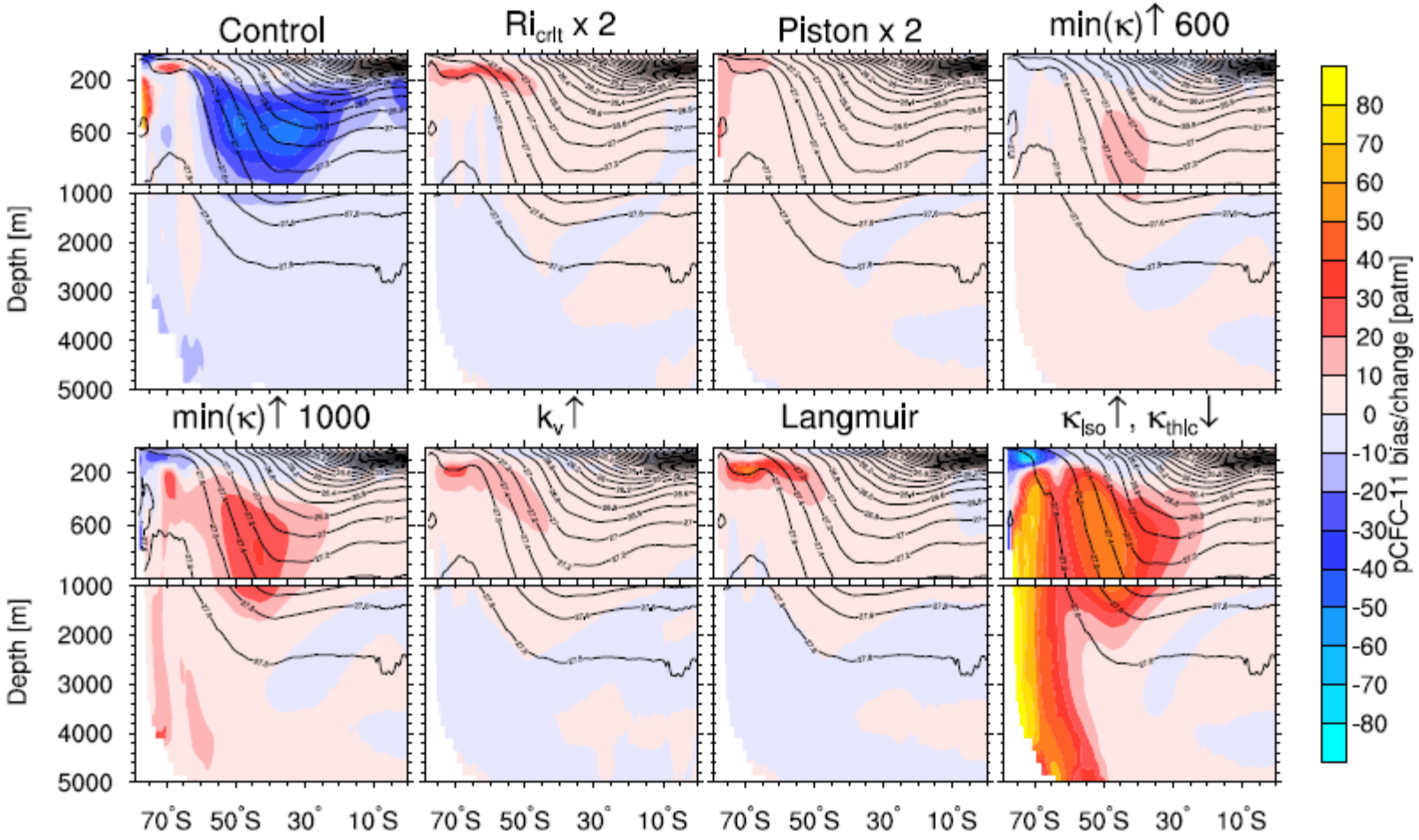
# Anthropogenic $CO_2$ vs GLODAP



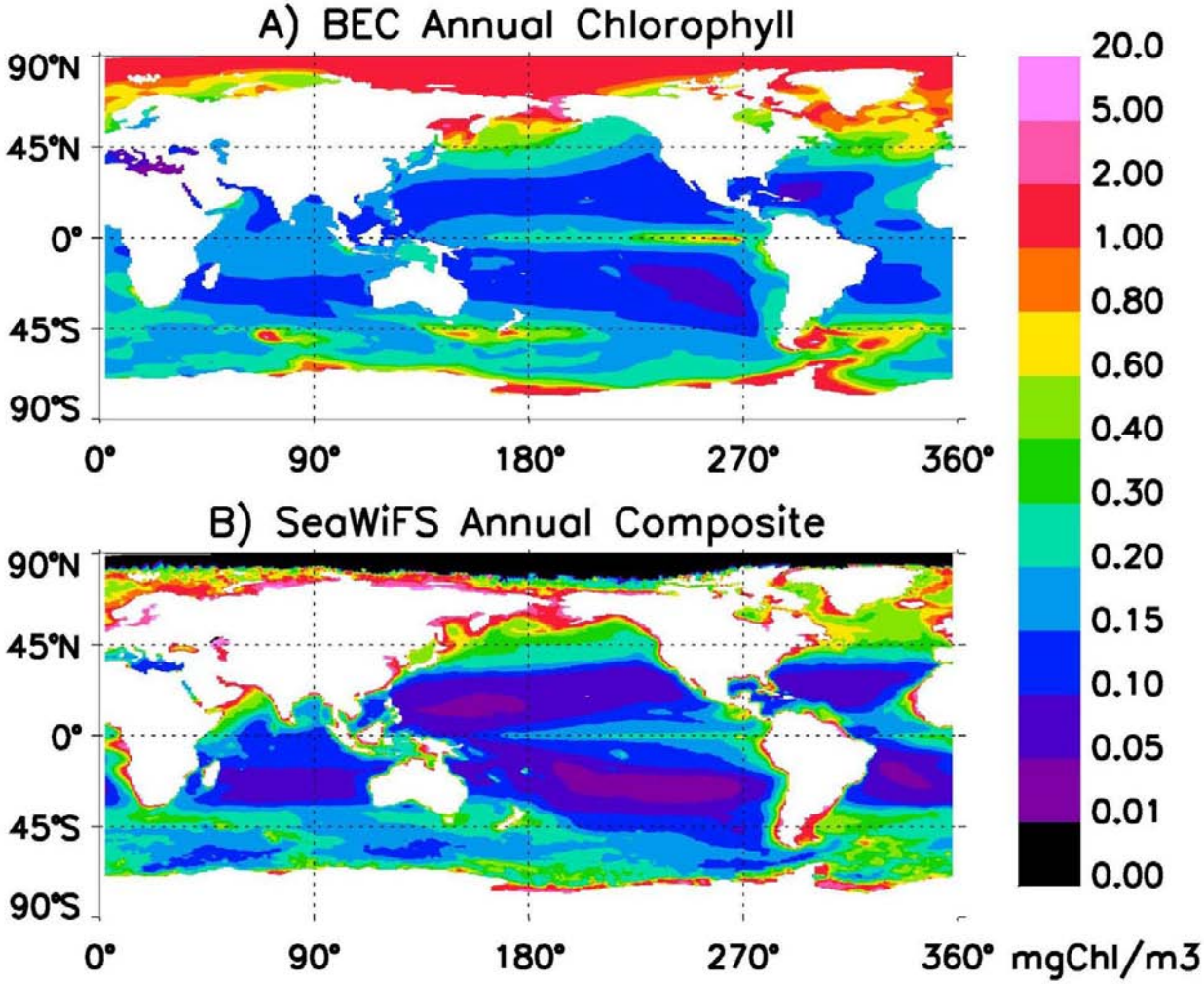

Long et al., submitted

# Transient tracer uptake

## Sensitivity experiments: bias (control) and change

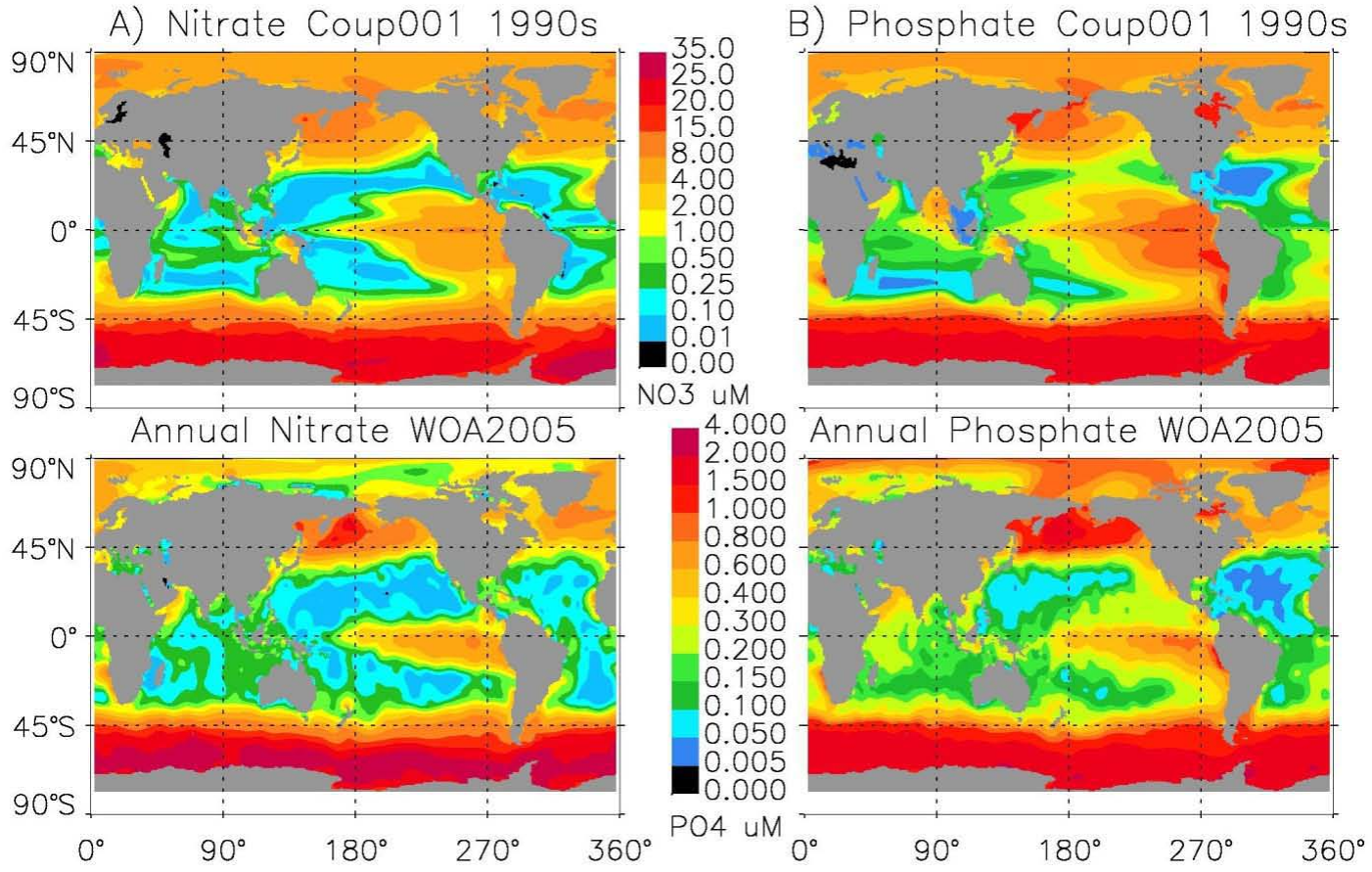


# Model Chl vs Satelitte Product



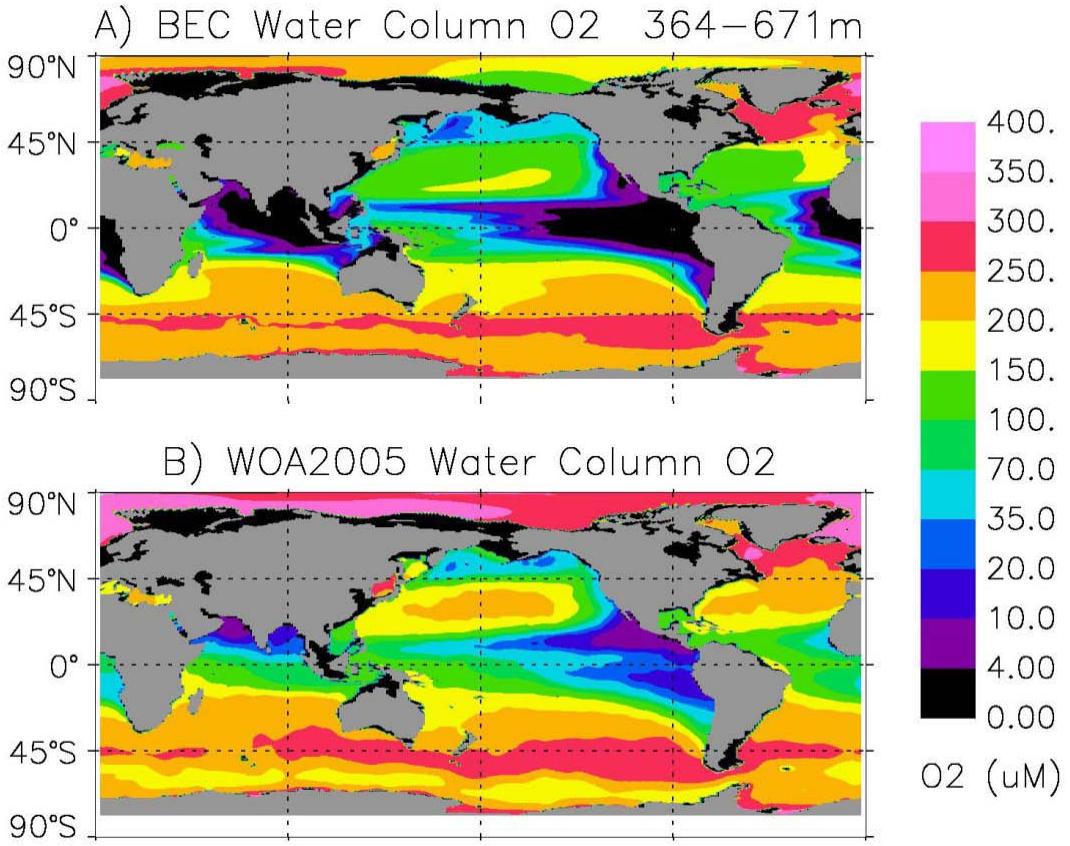

Moore et al., submitted

# Model Surface Nutrient vs WOA




Moore et al., submitted

# Subsurface $O_2$ vs WOA




Moore et al., submitted

# Developments for CESM1.2 release

- Generalization of functional group implementation
- Diagnostic PI DIC tracer

- KPAR computation
- Growth, Temperature, and Q10 Value
- Phytoplankton Iron/Carbon Ratios (Fe quotas)
- Remineralization Curves (for un-ballasted POM)
  - length scale increases with depth in upper ocean (100-600m)
  - increased length scale under low O2 concentrations
- Improved DOM cycling
- Optimized grazing and aggregation parameterizations
- Updated initial conditions (O2) and forcing (iron)

# Developments beyond CESM 1.2

- Explicit calcifier functional group
- Ocean Acidification feedbacks
- PAR under sea-ice
- Optional Phaeocystis functional group
- Fe in Sea-Ice
- Carbon Isotopes
- NH4 emissions, N2O tracer
- Spatially varying iron ligand
- Methane module
- Couple to Sea-Ice Algae

# Other Projects

- Enhanced interaction with OMWG
- Comprehensive Diagnostics Package
- Inclusion of BGC in Large Ensemble Experiment
- Newton-Krylov based fast spinup
- Offline tracer tools
- Ecosystem dynamics with resolved eddies