BGC Results from CESM 1.5 Experiments

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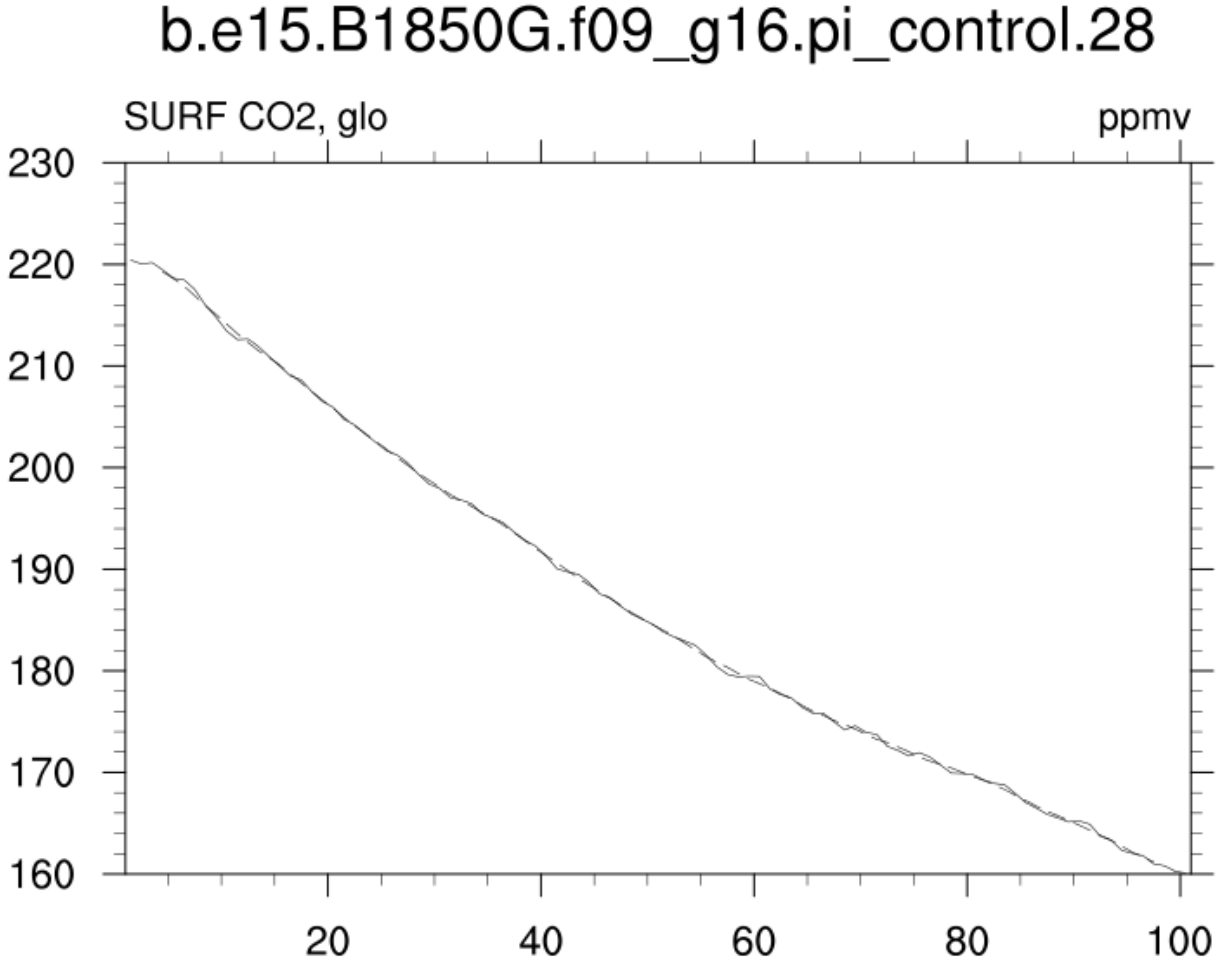
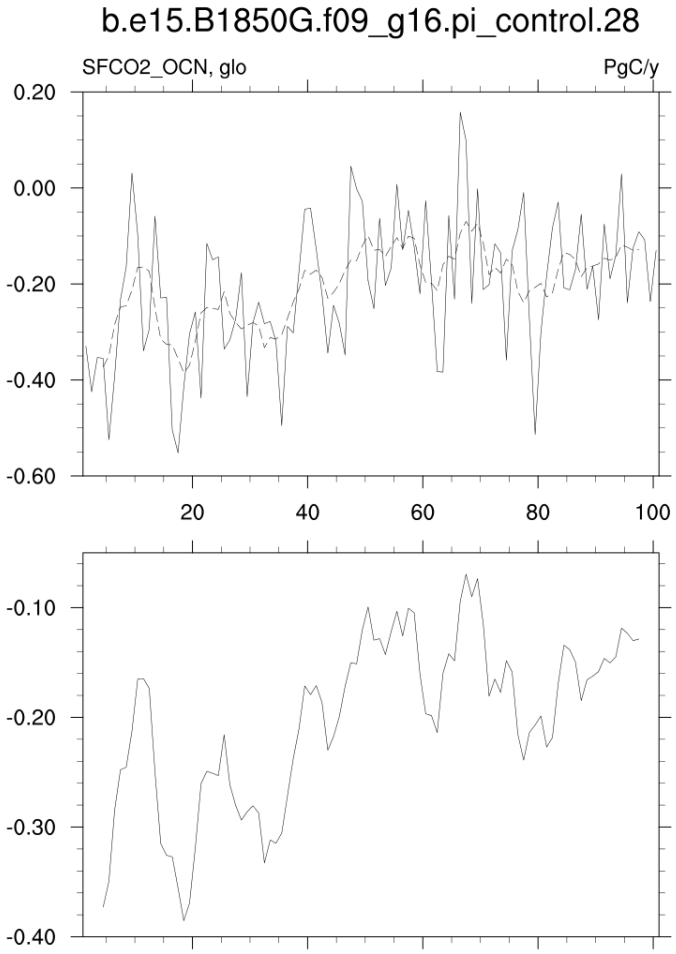
Background

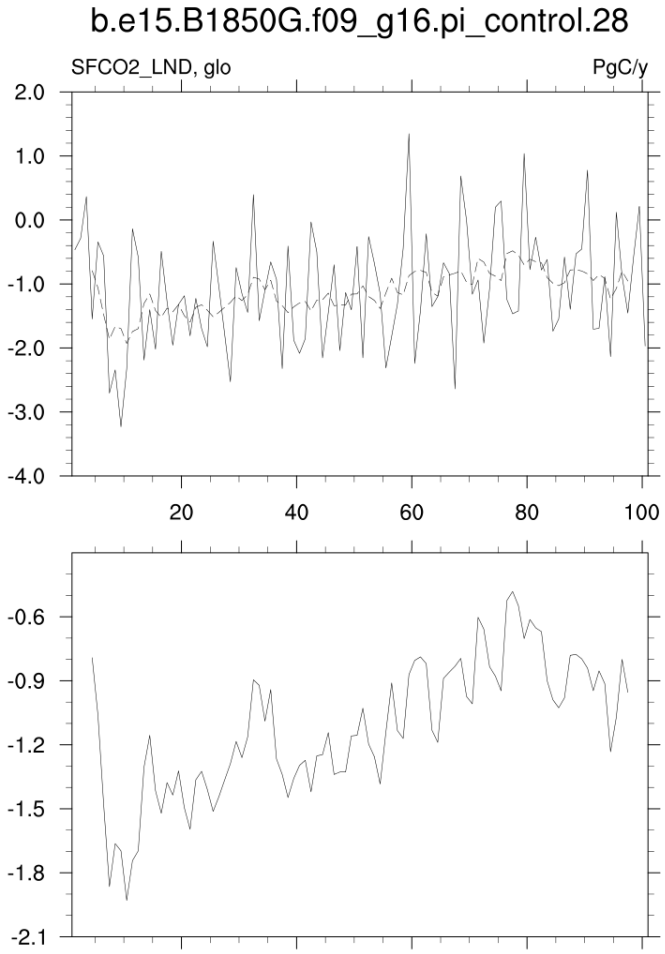
- Carbon Cycle included in development runs of coupled model
  - we've been asking for this
- Carbon Cycle is not spun-up
- Model predicted atmospheric CO_2 is NOT coupled to LW/SW or BGC computations
  - atm CO_2 is purely diagnostic in these runs

Carbon Cycle is not spun-up drift is large in 1850 control



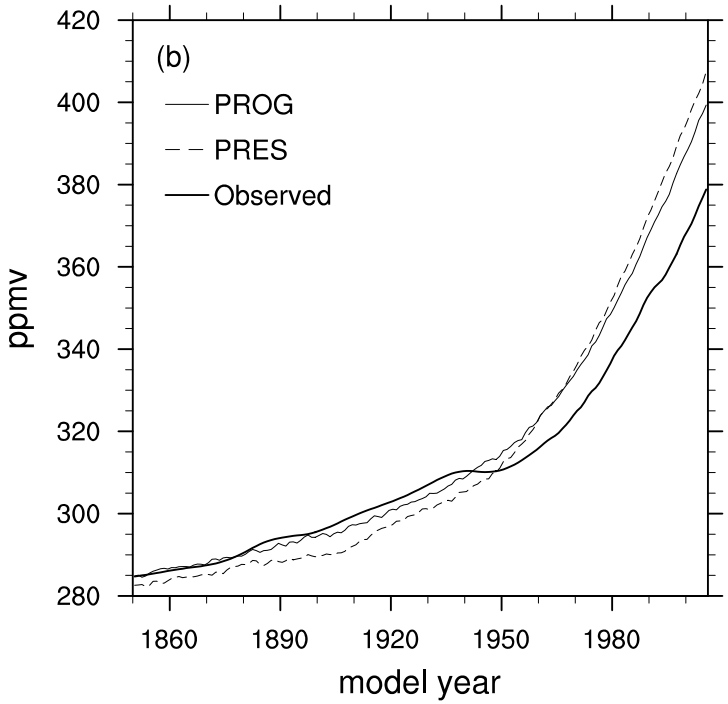
Ocean & Land are both taking up CO_2 at substantial rates



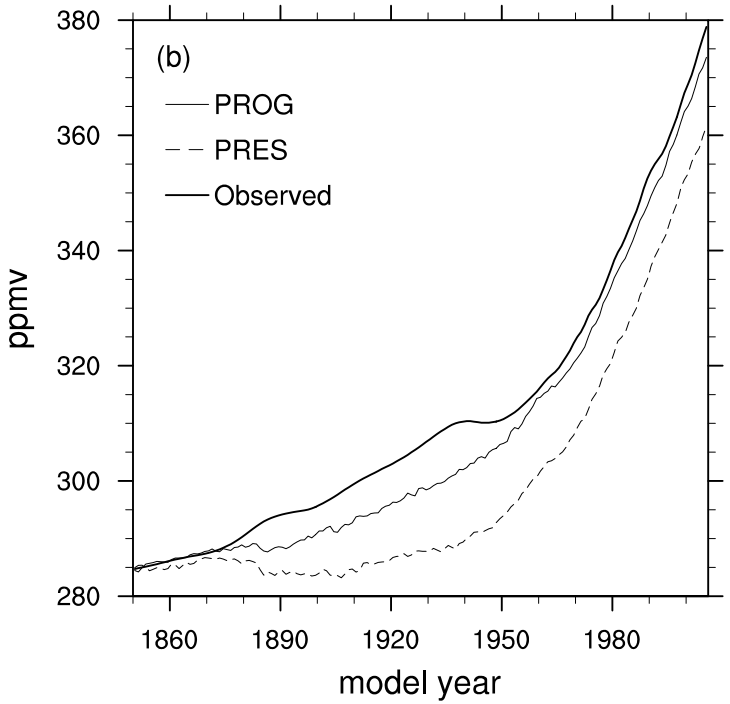


Global 20th Century Surface CO_2 (from previous model versions)

CESM1(BGC)

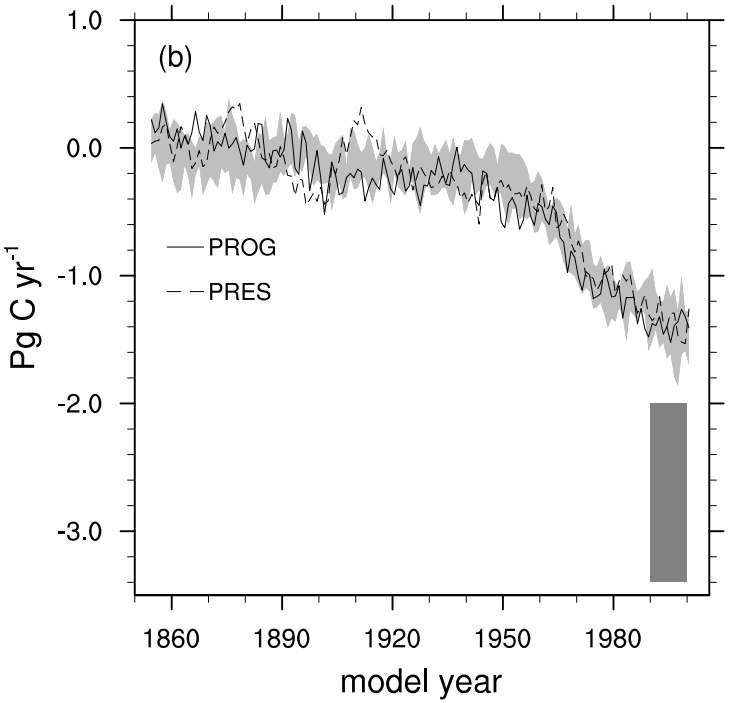


CESM1.2+(BGC)

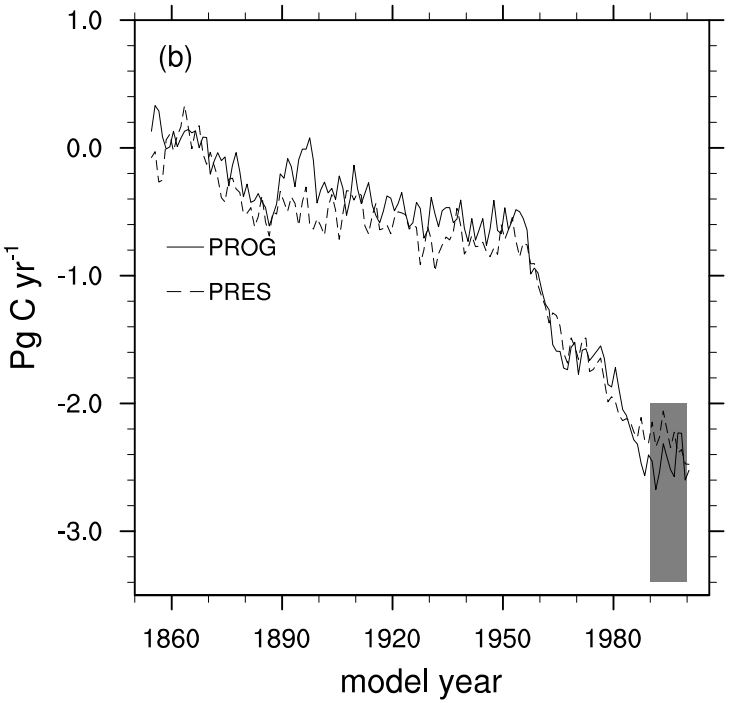


Global 20th Century Land (non-LULCC) Uptake of CO_2 (from previous model versions)

CESM1(BGC)



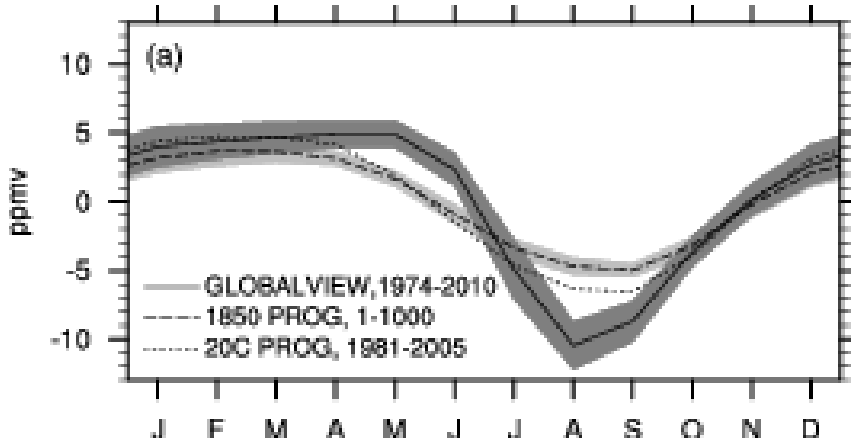
CESM1.2+(BGC)



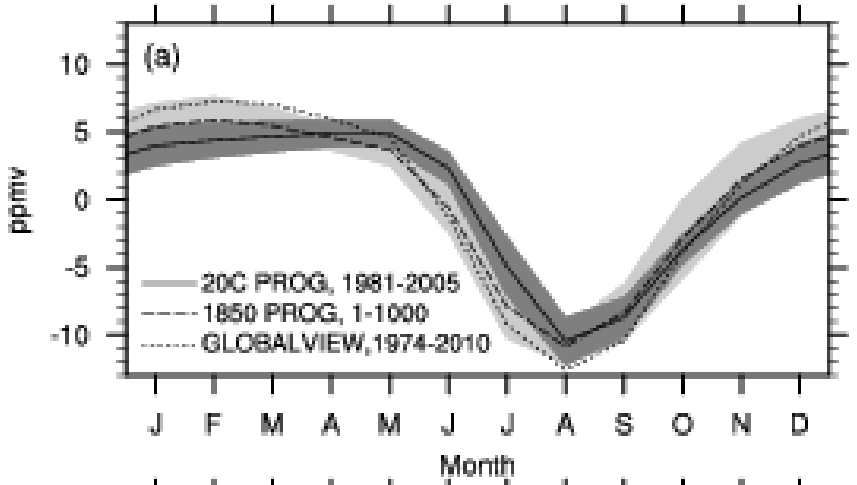
dark shading denotes estimates from Canadell et al. 2007

Seasonal Cycle of CO_2 at Point Barrow, Alaska

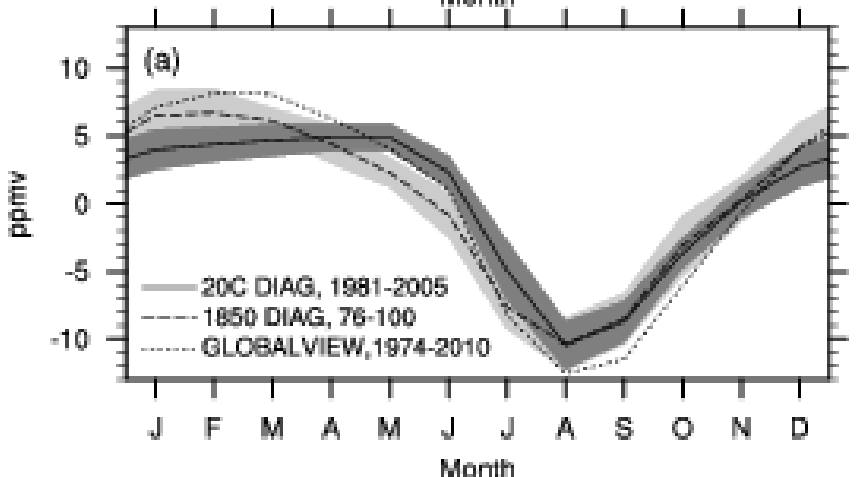
CESM1(BGC)

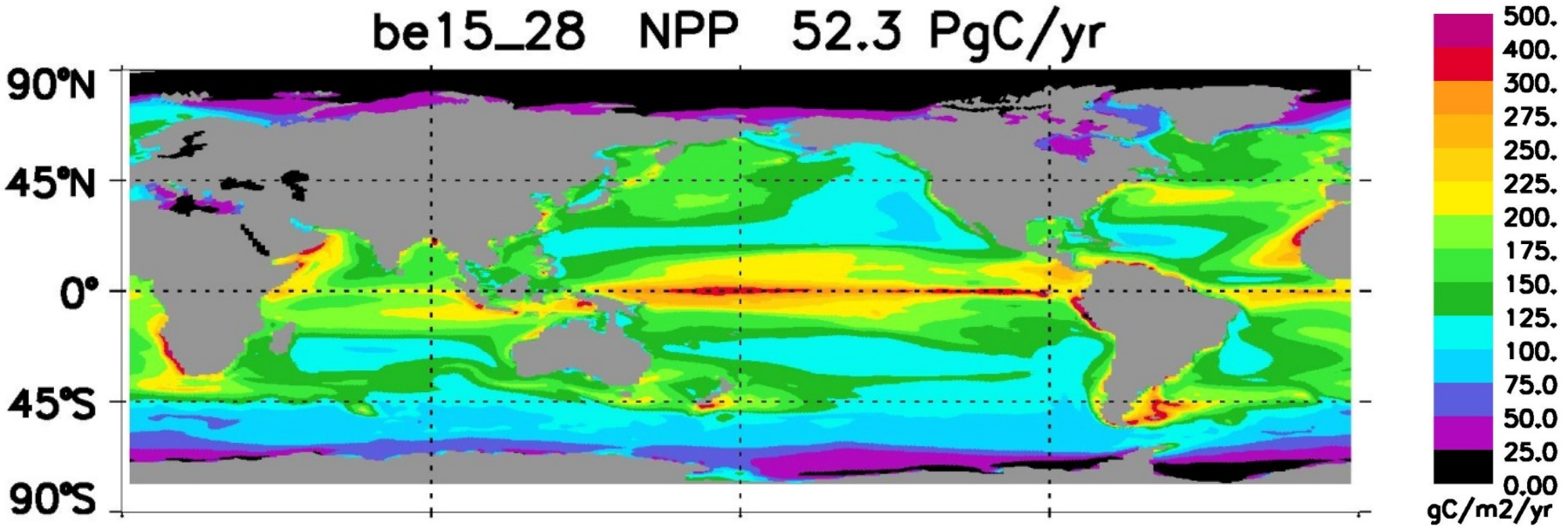


CESM1.2+(BGC)



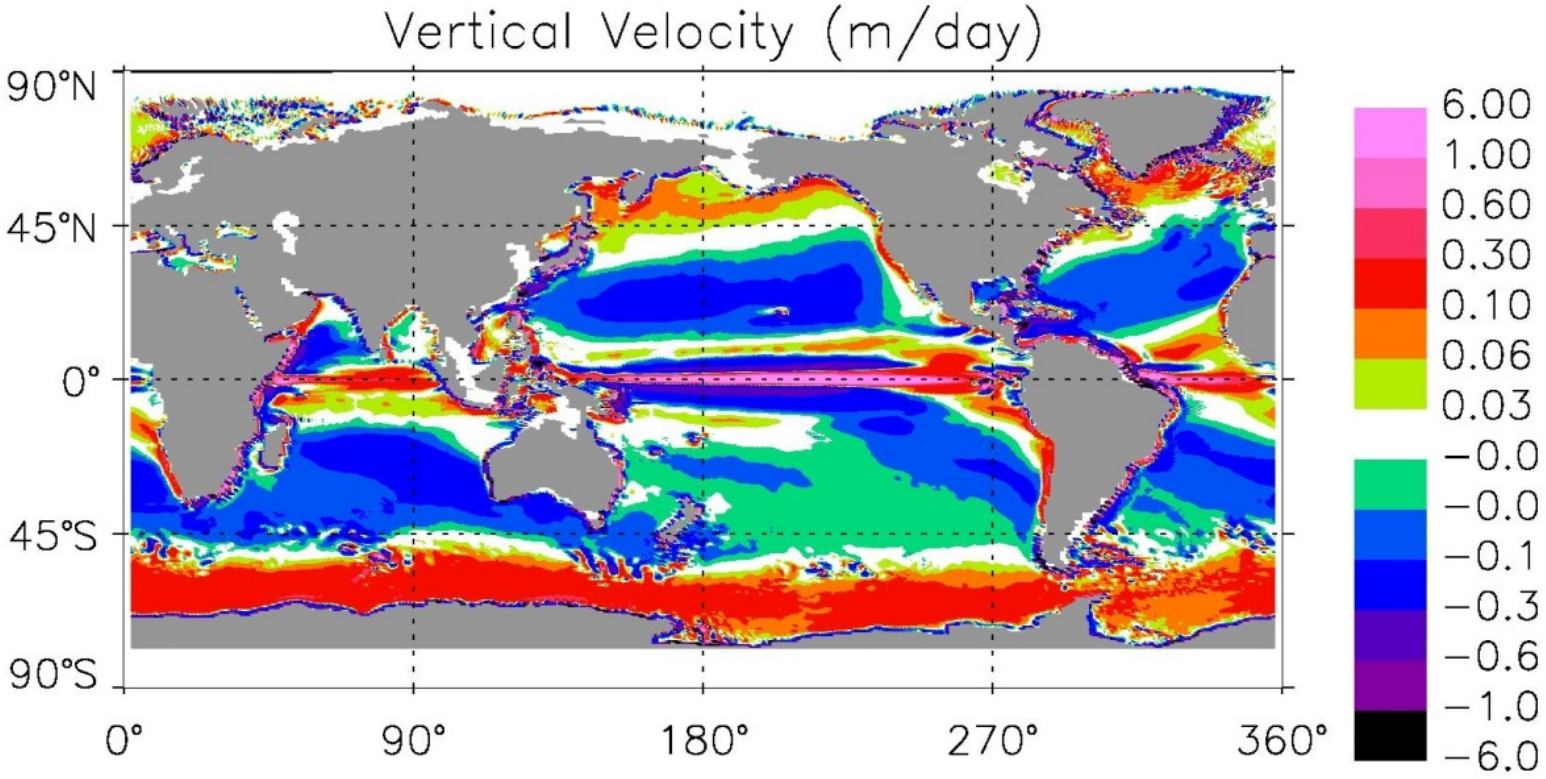
CESM1.5





Total Net Primary Production (NPP) and the spatial patterns look reasonable in general. One exception is the high NPP associated with equatorial upwelling extend too far west in the Pacific.

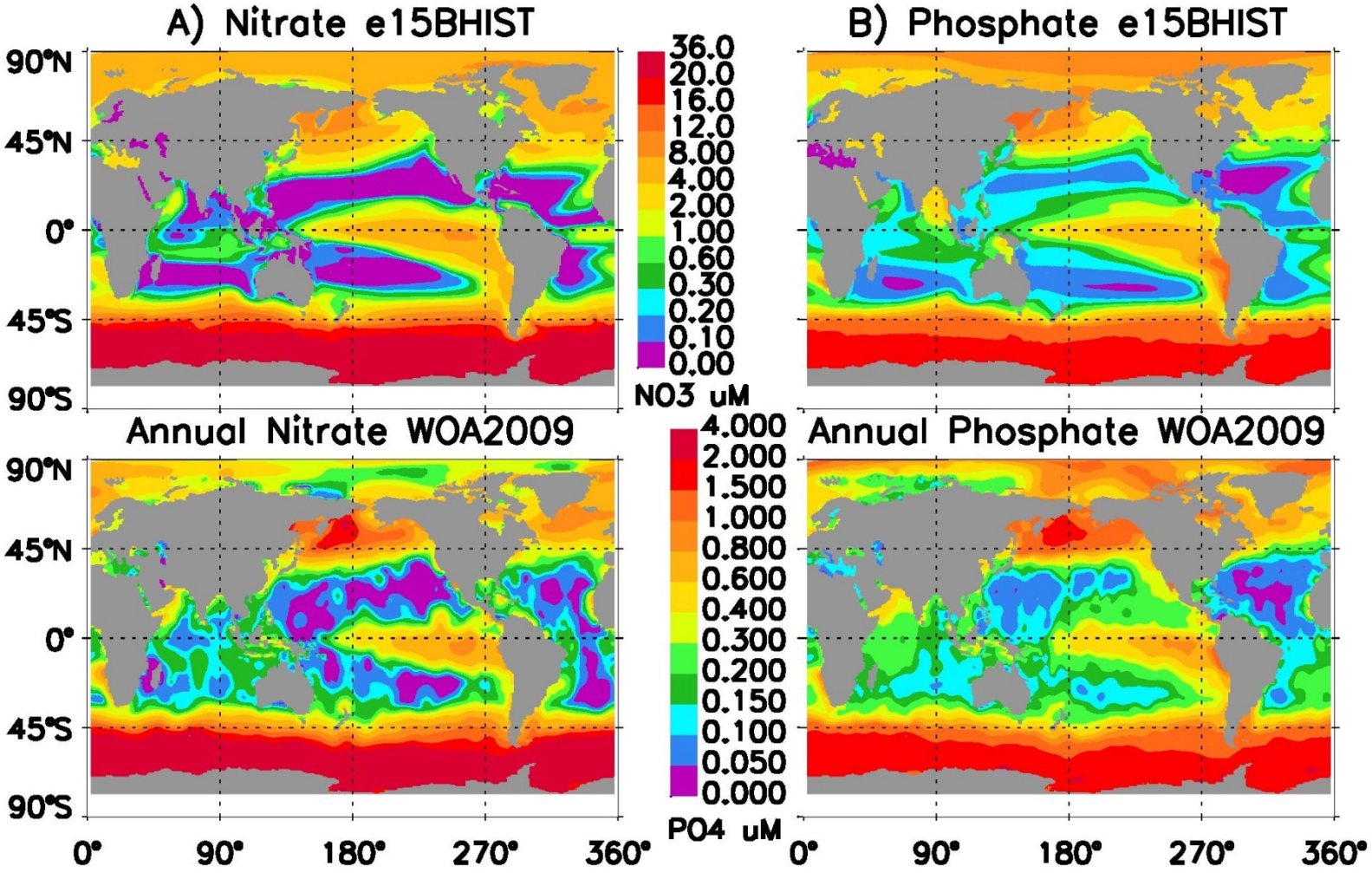
Vertical Velocity at 100m Depth



Equatorial upwelling extends too far to the west in the Pacific.

Eastern Boundary Current and Arabian Sea coastal upwelling zones look better than in CESM1.

Surface Nitrate and Phosphate Concentrations



Surface nutrients look as good or better than CESM1. But note eastward extension of the high-nutrient equatorial tongue in Pacific.

Summary

- Drift in carbon cycle precludes some analysis
  - Should spin-up be done in the development cycle?
- My fingers are crossed that improvements in CESM1.2 will carry over to CESM1.5 & 2.0.
- Seasonal cycle of atmospheric CO_2 looking OK.
- Ocean BGC has improvements
  - Western Equatorial Pacific productivity is worrisome, more investigation is needed to understand it.
- Other aspects of the carbon cycle (e.g. interannual variability) remain unexplored.