Outline

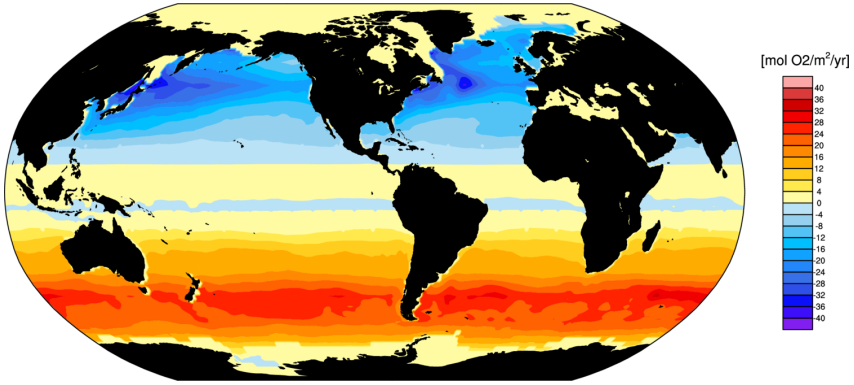
1. Modeling assets
2. Fluxes: expected spatial and temporal patterns
3. Atmospheric signals
   - Evolution at regional scales
   - Property-property relations
   - Background air
4. Forecast system ideas
5. SOCCOM floats

Model configurations

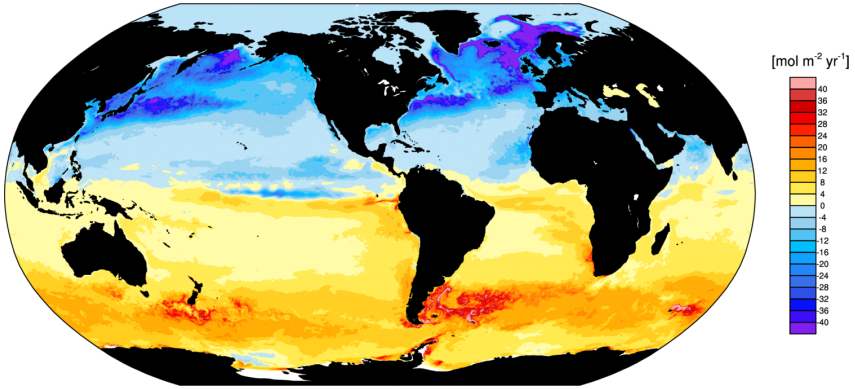
Compset	Description	Resolutions	Notes
B	Fully coupled	1°	▸ prognostic fluxes (CO_2, O_2) wind forcing consistent with transport ▸ long control runs ($\mathcal{O}(10^3)$ yr) ▸ generates internal variability, not in phase with nature ▸ experimental application: nudge atm. state to forecast product (GEOS5); simulate prognostic fluxes
F	Atmosphere-land	2° 1° 0.25°	▸ forced by observed SST ▸ specified dynamics: nudge state to re-analysis or forecast products (MERRA, GEOS5)
G	Ocean-ice	1° 0.1°	▸ prognostic fluxes (CO_2, O_2) ▸ forced by re-analysis products ▸ climatological or inter-annually varying forcing

January O_2 fluxes

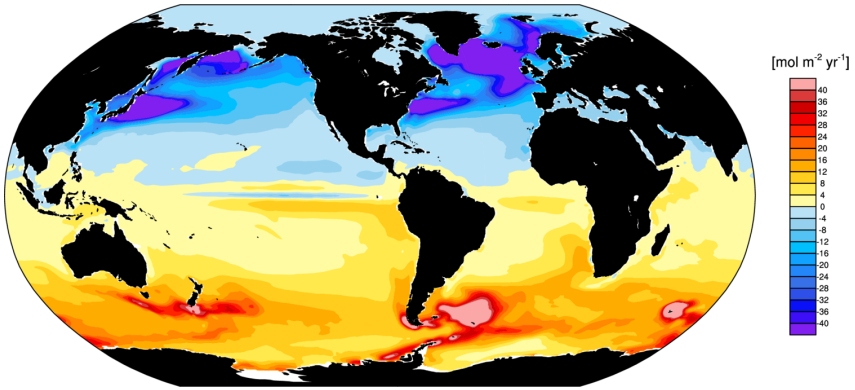
Garcia & Keeling 2001



CESM 0.1°

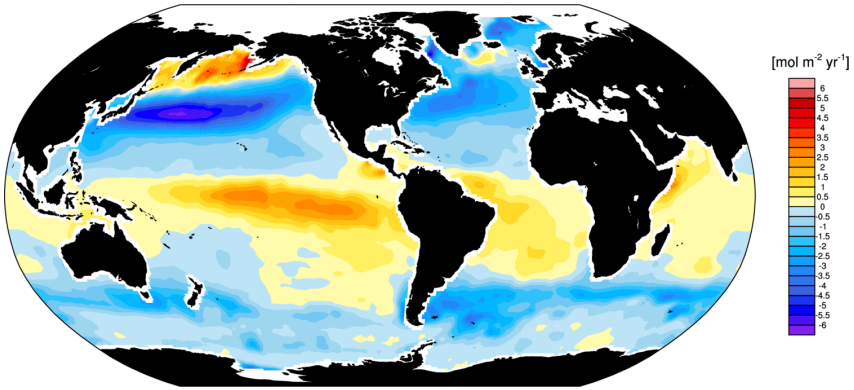


CESM 1°

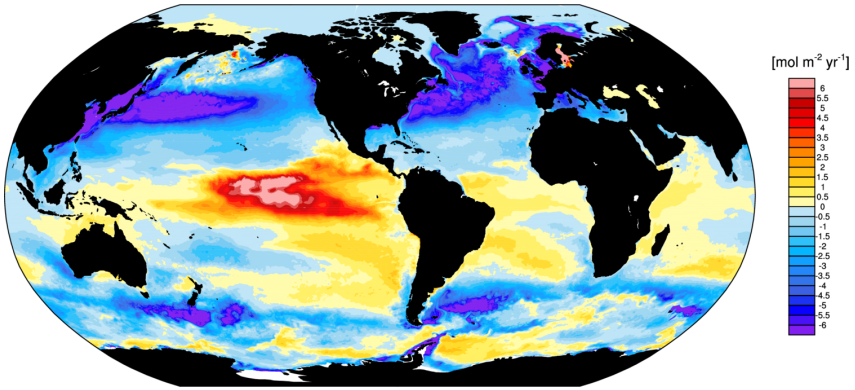


January CO_2 fluxes

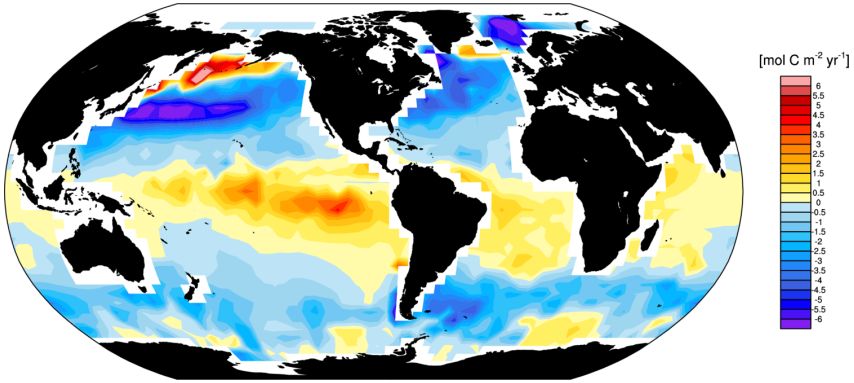
Landschützer 2014



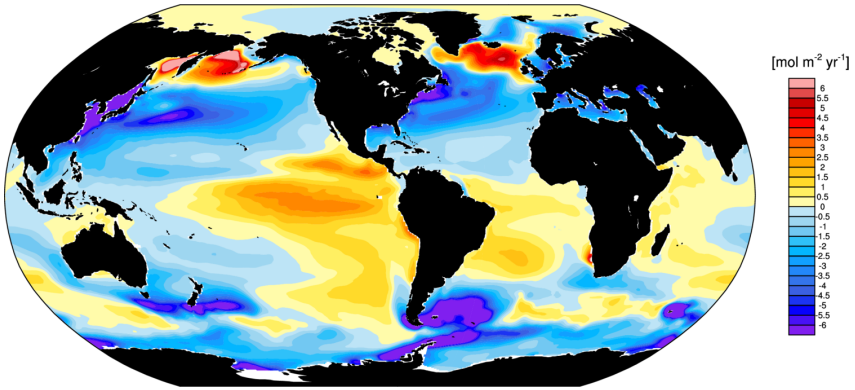
CESM 0.1°



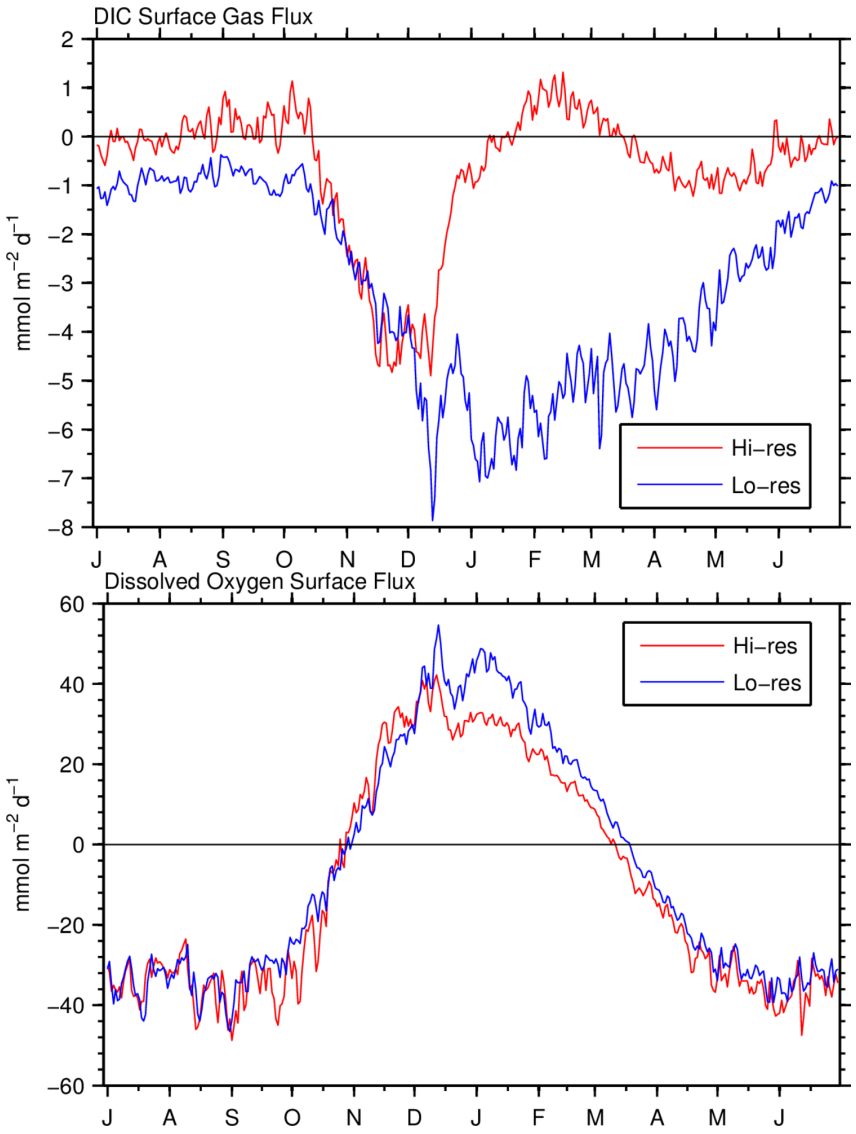
Takahashi 2009

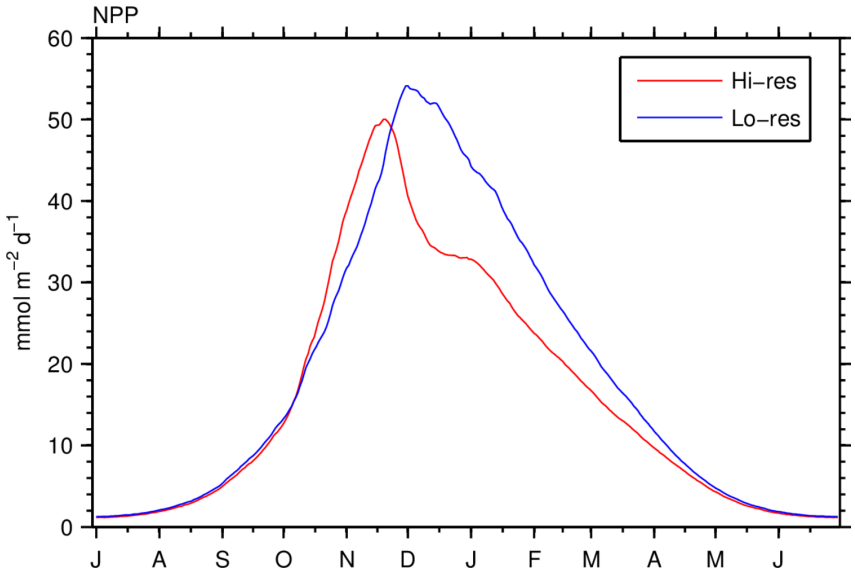


CESM 1°



Hi-res/Lo-res comparison: mean Southern Ocean fluxes





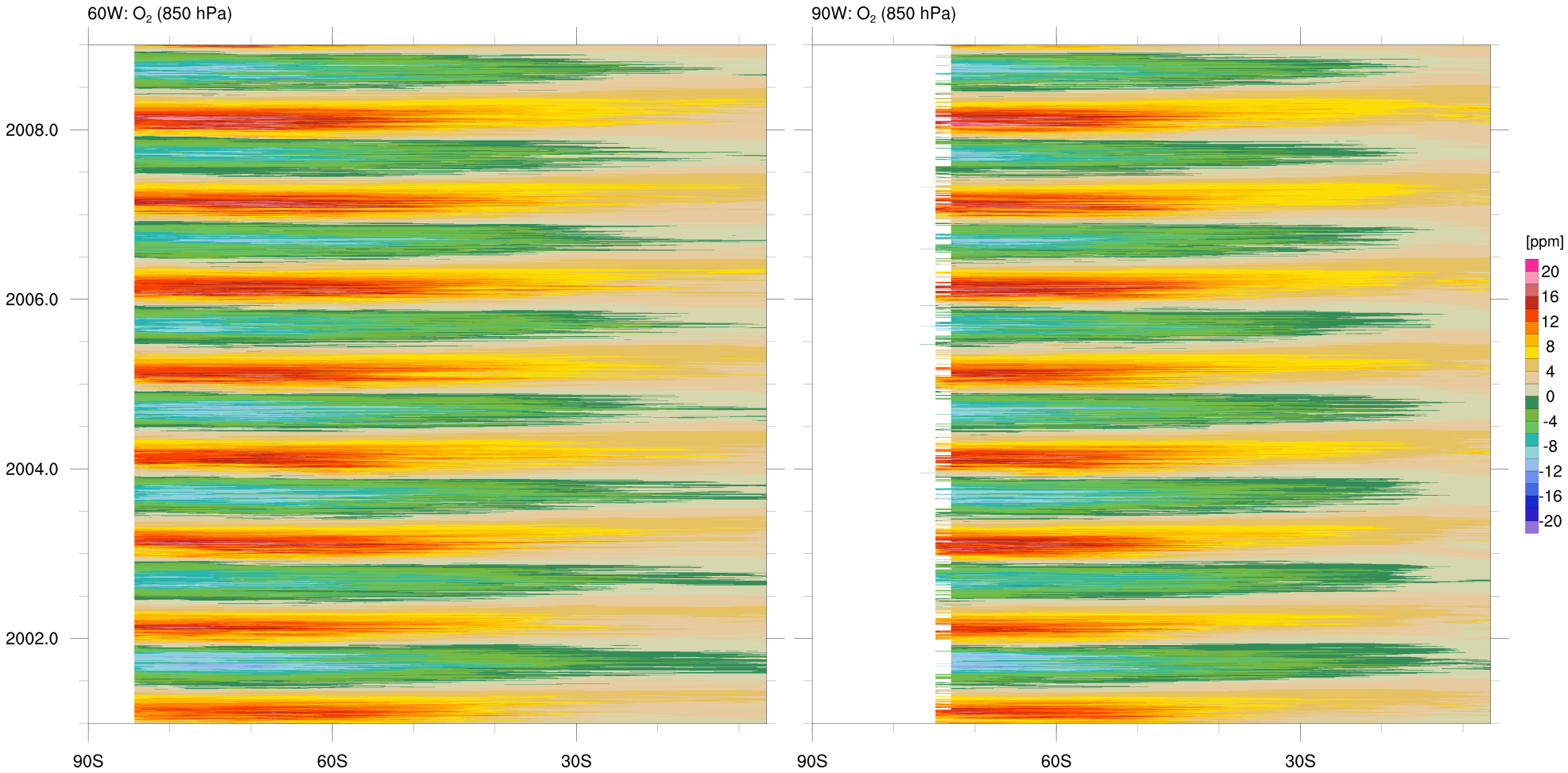
CAM transport fields: Specified dynamics (MERRA), CESM hindcast fluxes

Surface O_2 anomaly

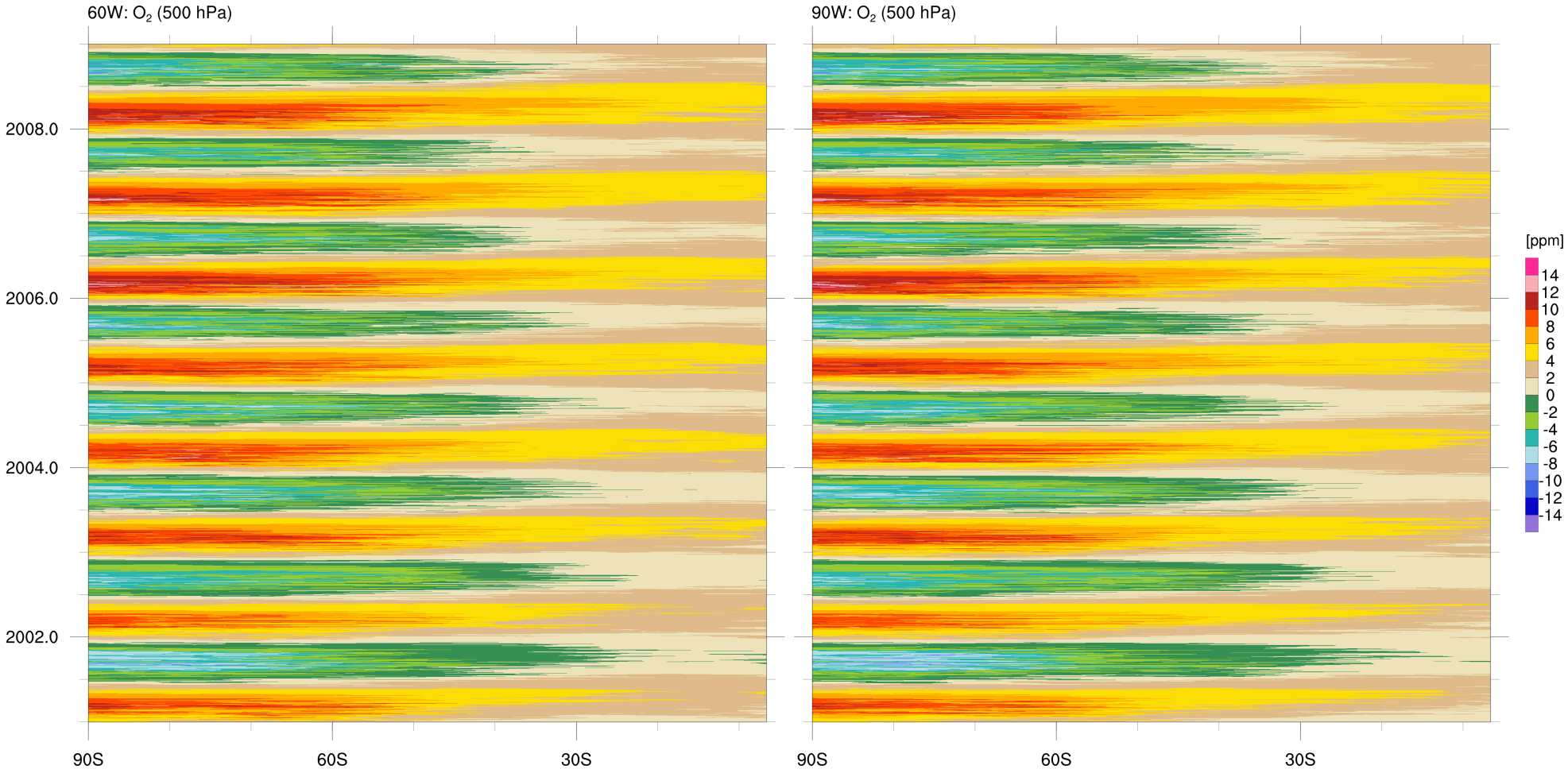
Large scale survey: 60W and 90W

O_2 anomaly

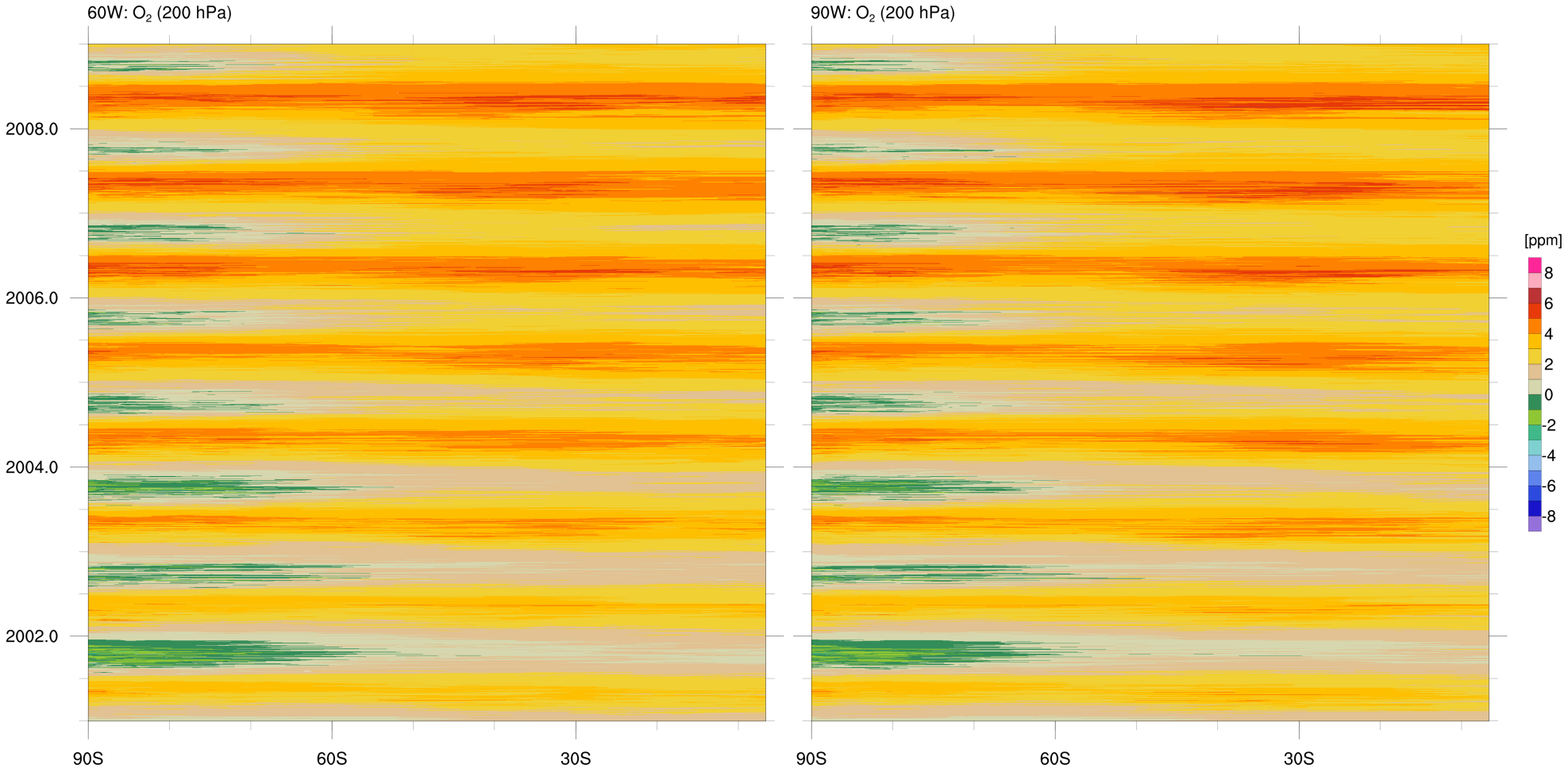
Large scale survey: 60W and 90W



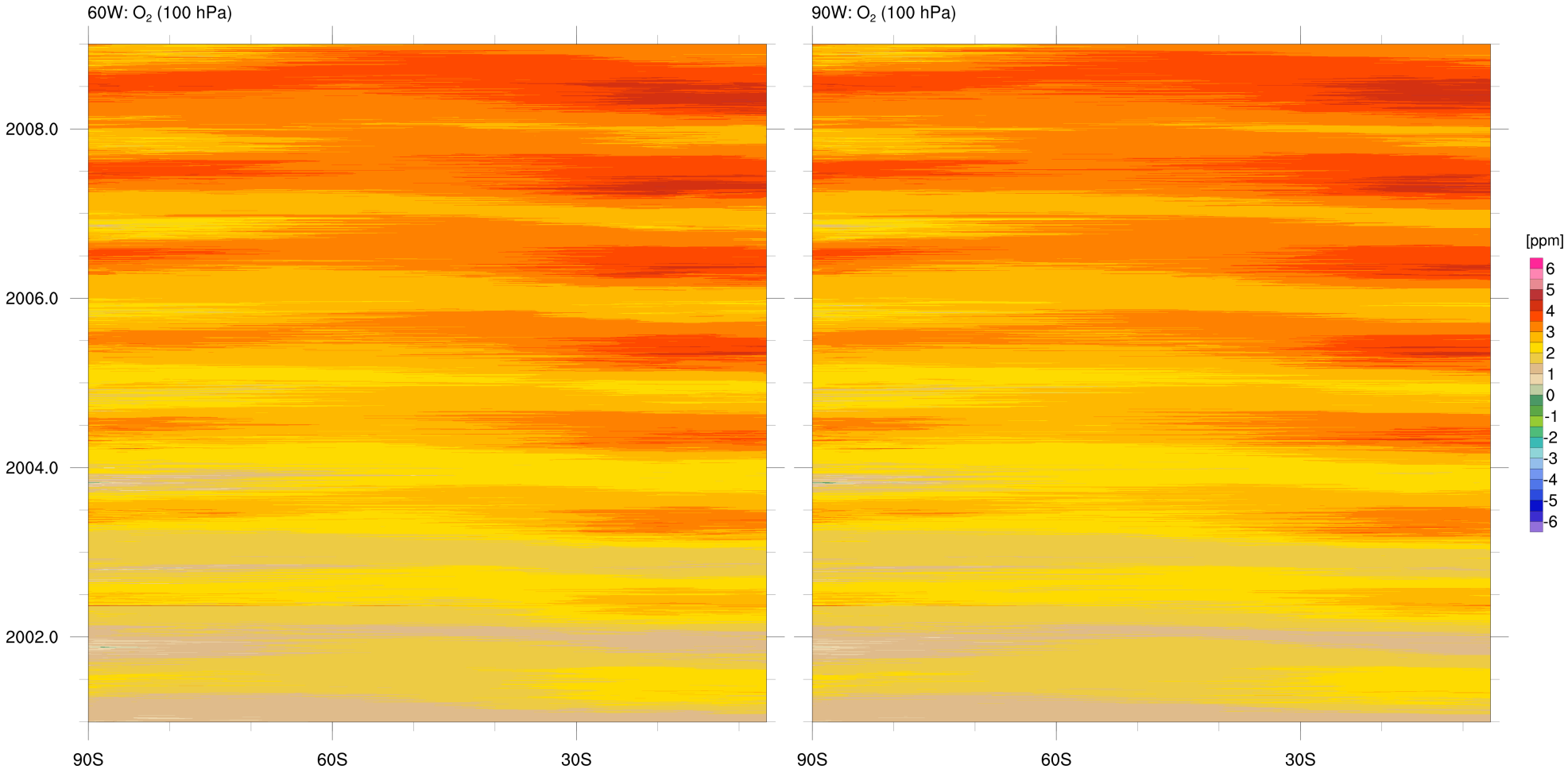
Large scale survey: 60W and 90W



Large scale survey: 60W and 90W



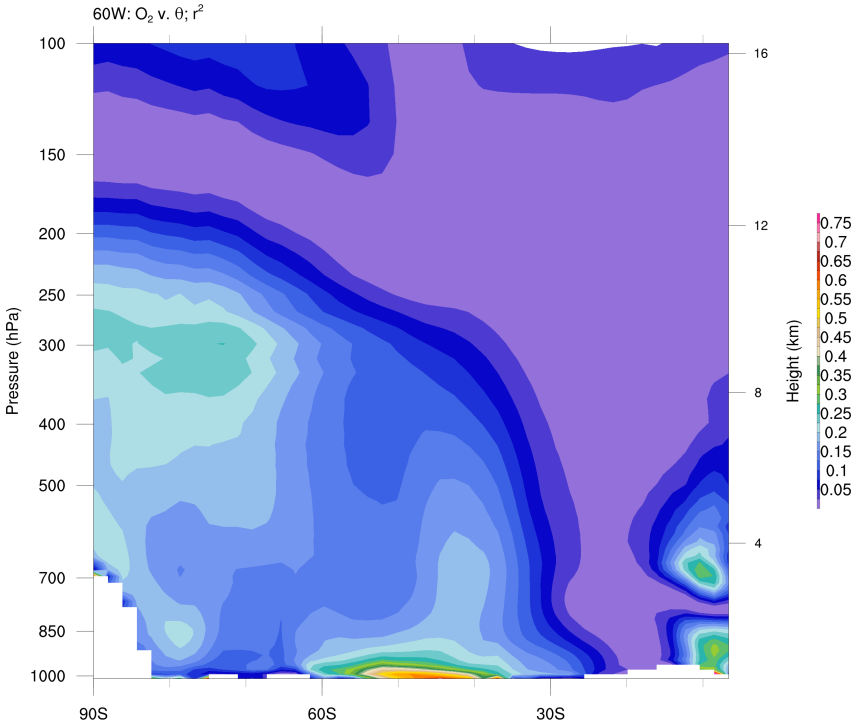
Large scale survey: 60W and 90W



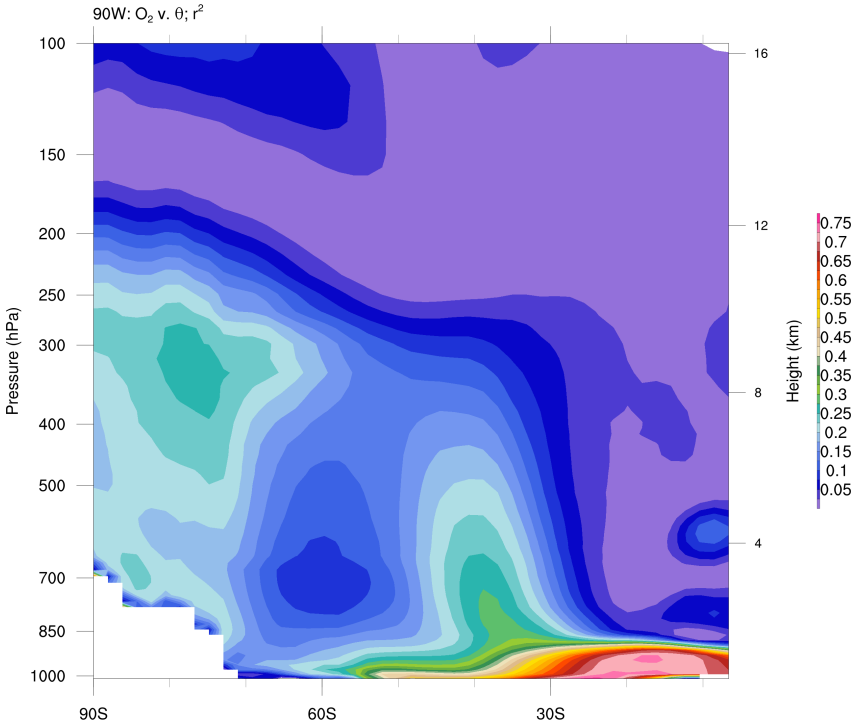
Large scale survey: 60W and 90W

Relationship of O_2 with potential temperature: variance explained

60°W

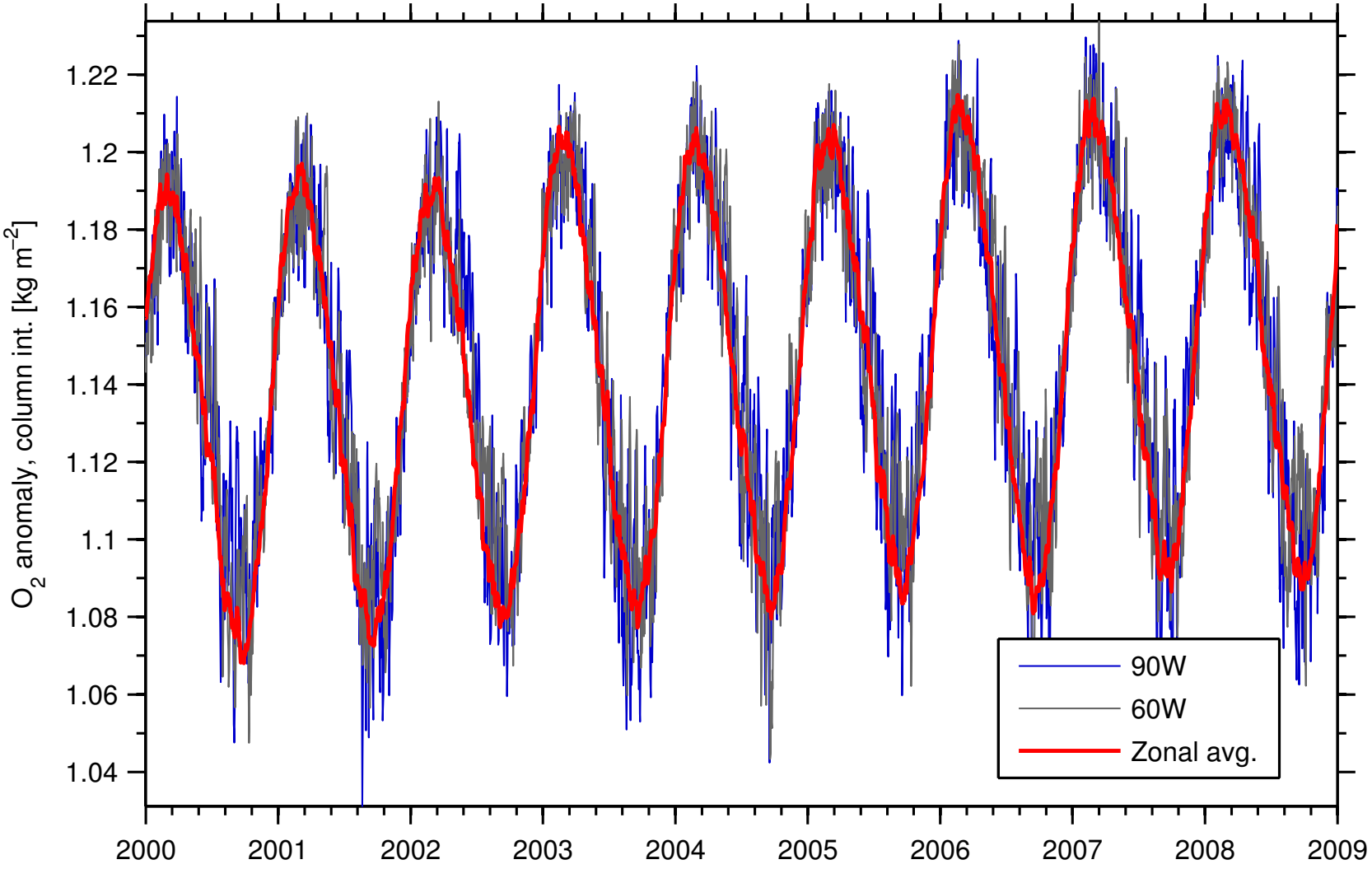


90°W



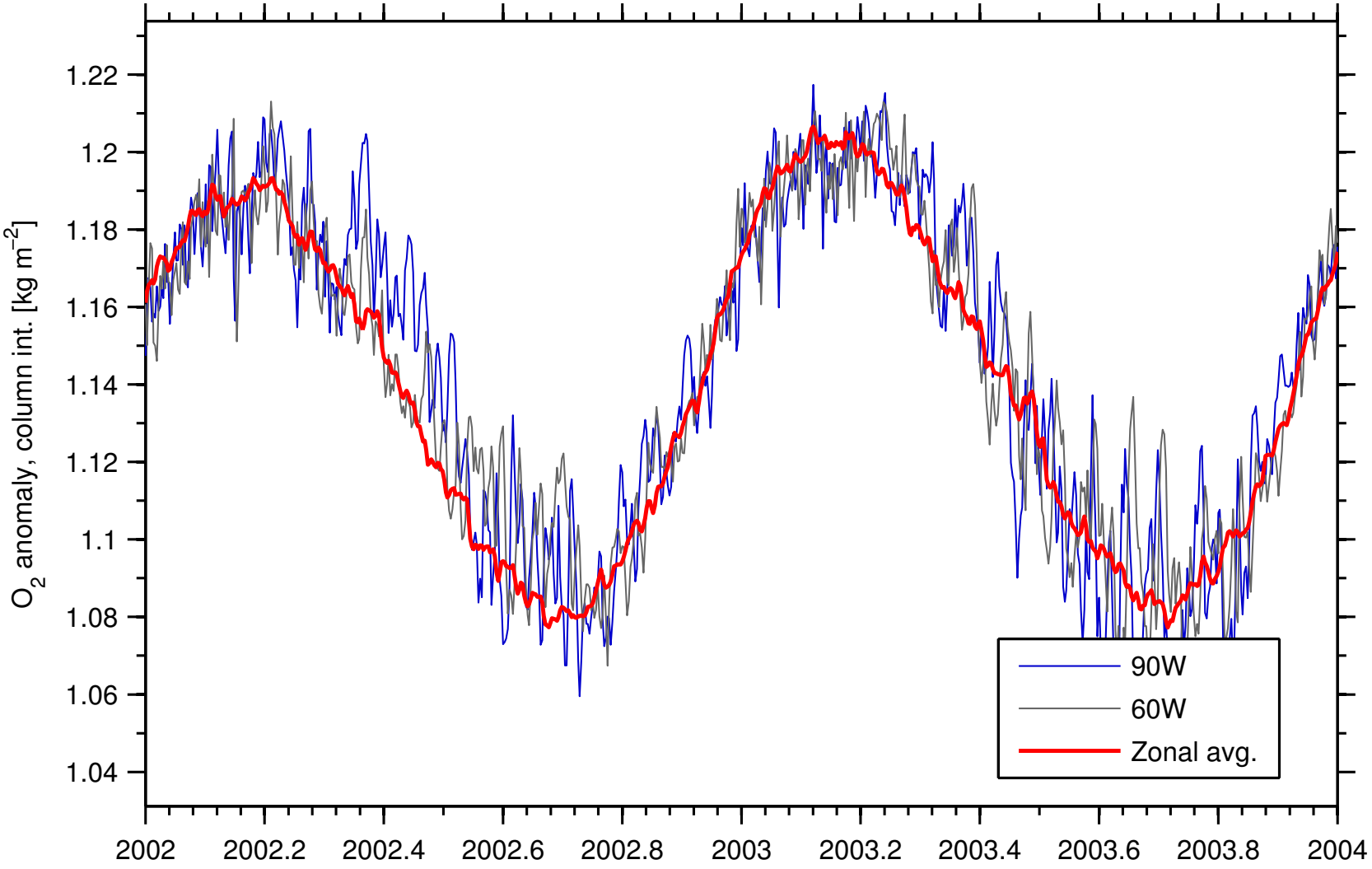
Large scale survey: 60W and 90W

Column integral: mean 67°S-45°S



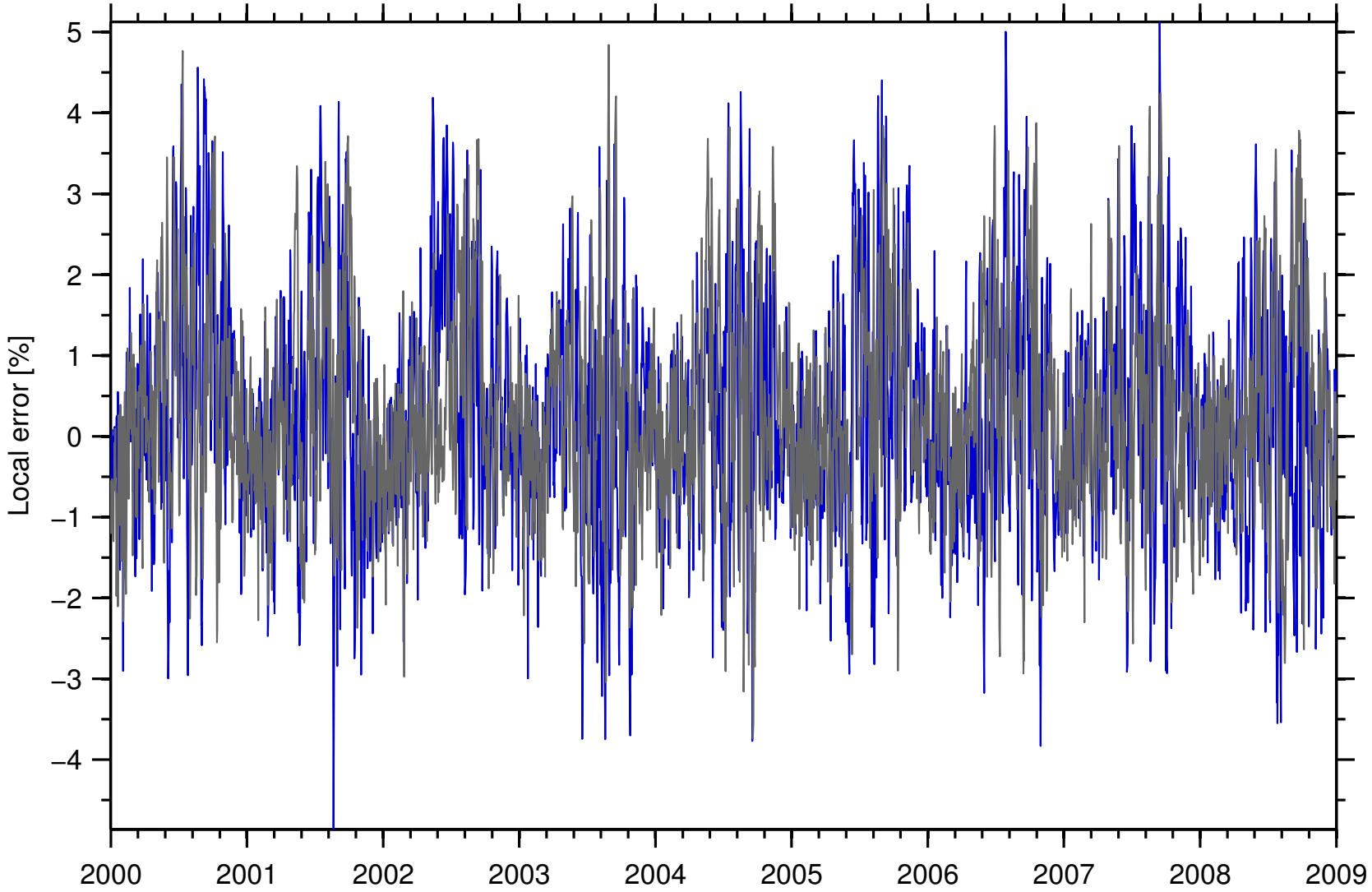
Large scale survey: 60W and 90W

Column integral: mean 67°S-45°S

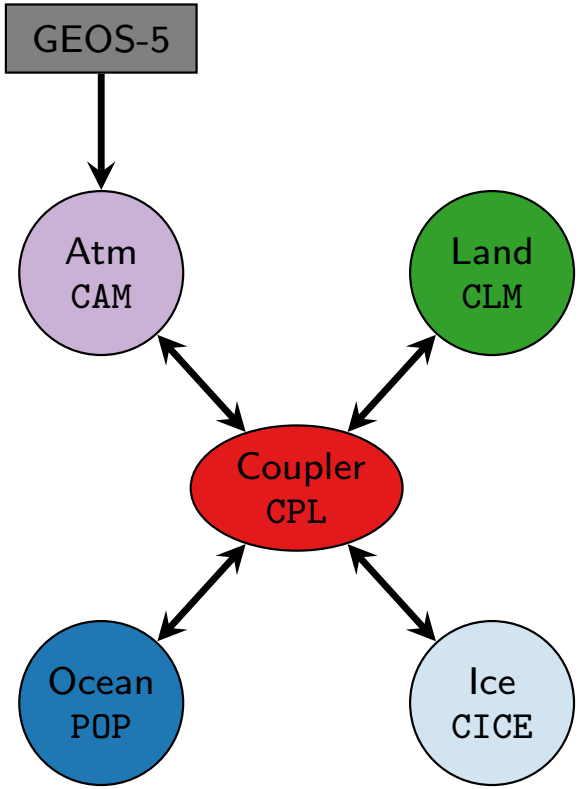


Large scale survey: 60W and 90W

Column integral: mean 67°S-45°S



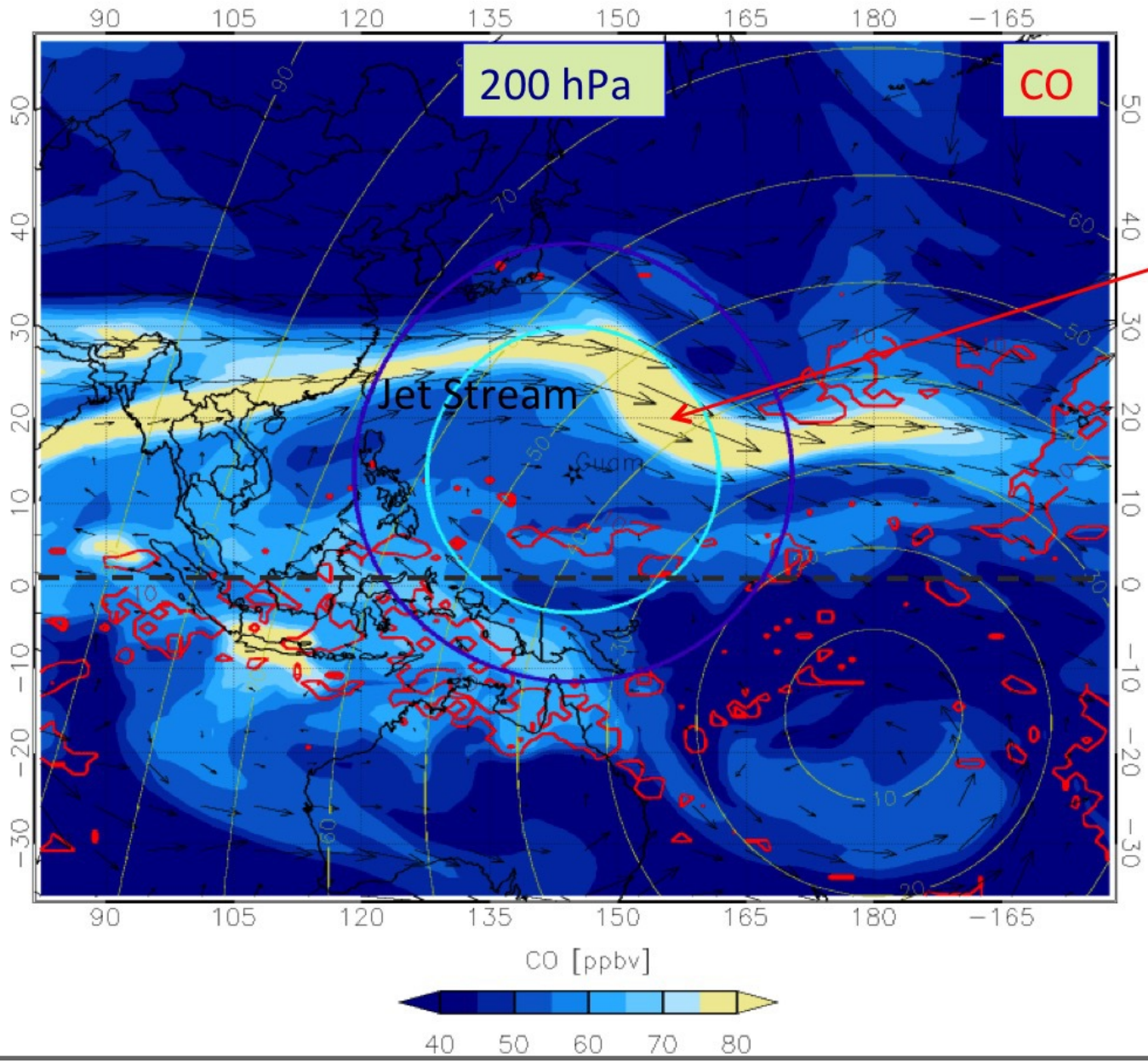
Community Earth System Model (CESM): hybrid configuration



Run fully coupled to get prognostic ocean-atmosphere fluxes;
nudge CAM to GEOS-5 forecast model.

- forecast O_2 (and CO_2) distributions;
- Idealized tracers for source regions: impulse response functions with decay;
- Applications to biogenic reactive gases?

CAM-Chem forecasts during CONTRAST



Feb 8: Sat, 10am

CO pollution source contained in Jet Stream.

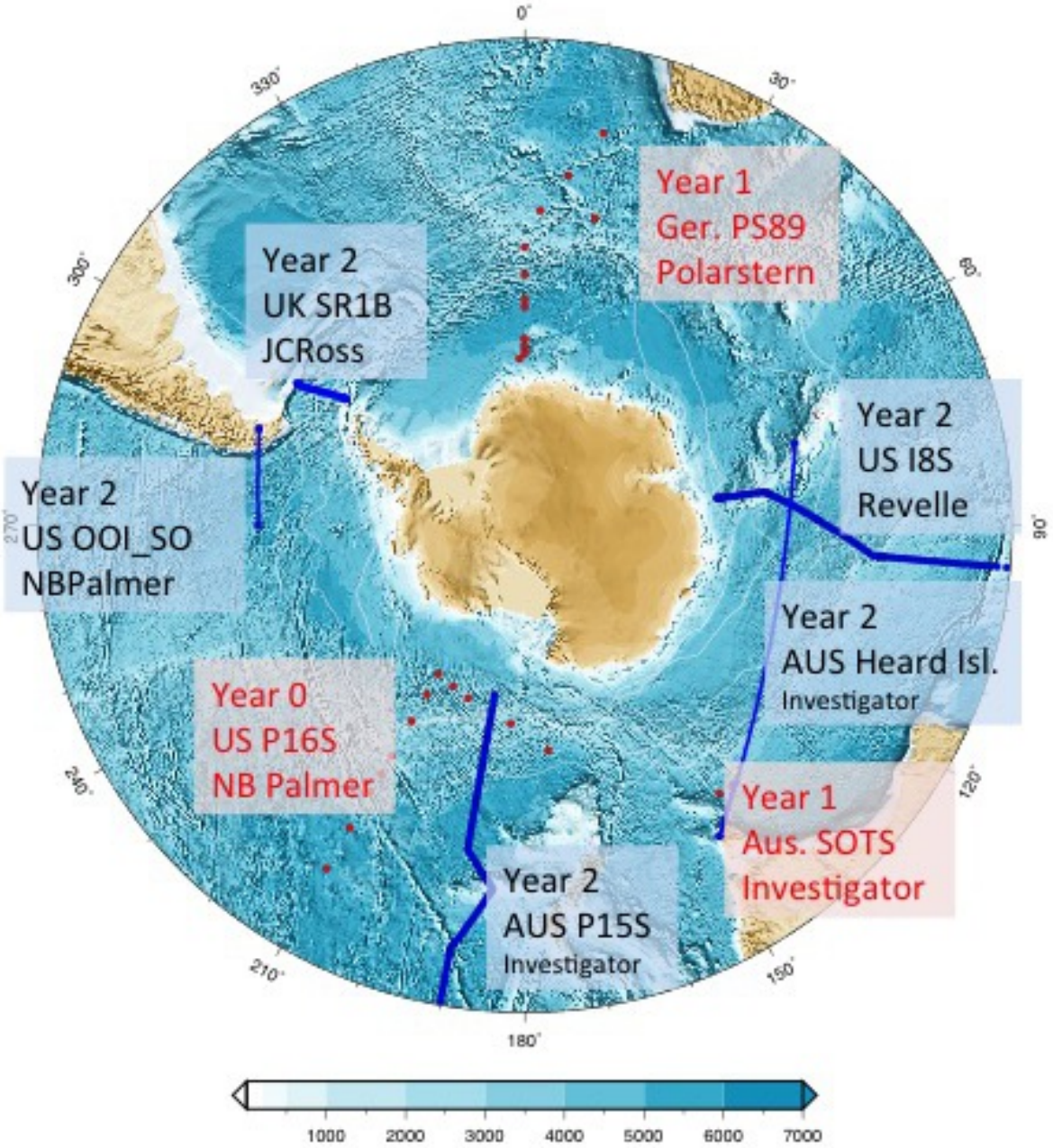
"River of CO"

CAM-Chem Model forecast

courtesy J.-F. Lamarque

SOCCOM Deployments

- JC Ross: 17.Dec.15–09.Jan.16
- NB Palmer OOI: Dec.15?



courtesy L. Talley