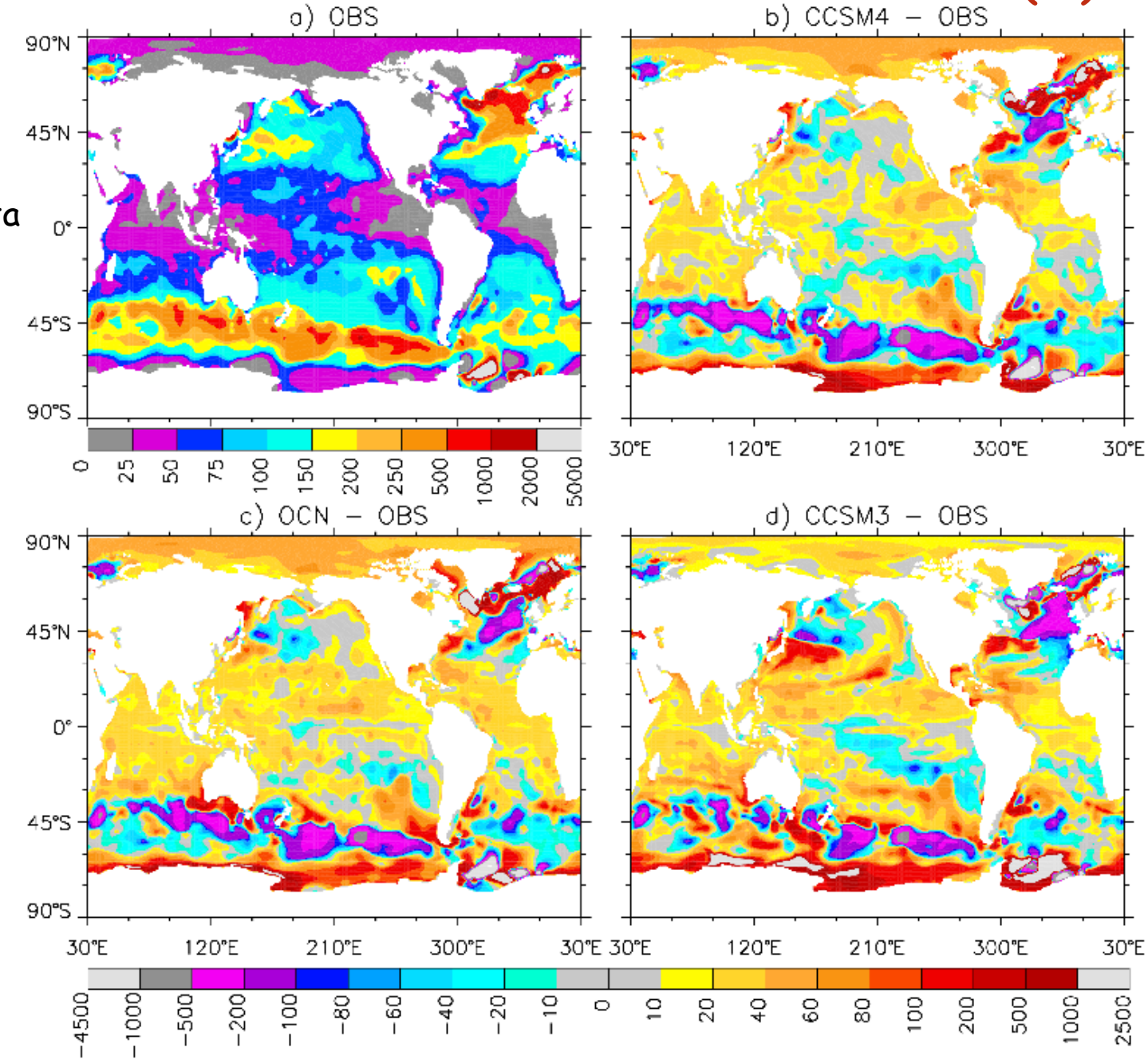
OCEAN MODEL DEVELOPMENTS RELEVANT TO BGC (EXPLORATORY SENSITIVITY EXPERIMENTS)

Gokhan Danabasoglu, Matt Long, Markus Jochum,
Keith Lindsay, Keith Moore, Peter Gent

- Preliminary investigation of parameter sensitivities of ventilation and mixing biases.
- Initial focus is the Southern Ocean, considering mixed layer depth and CFC-11 distributions as metrics.

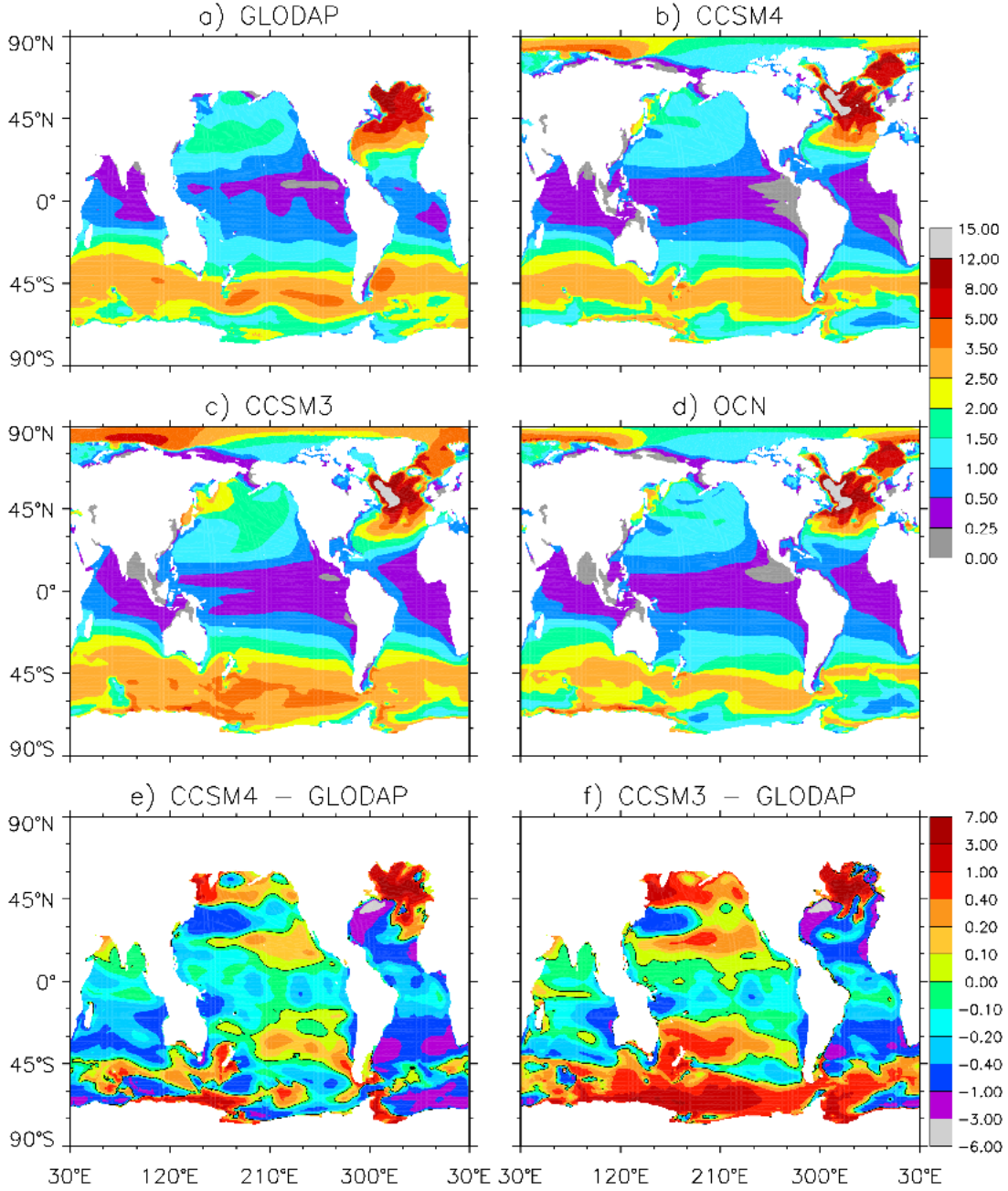
WINTER-TIME MIXED LAYER DEPTH (m)

Based on PHC2 data



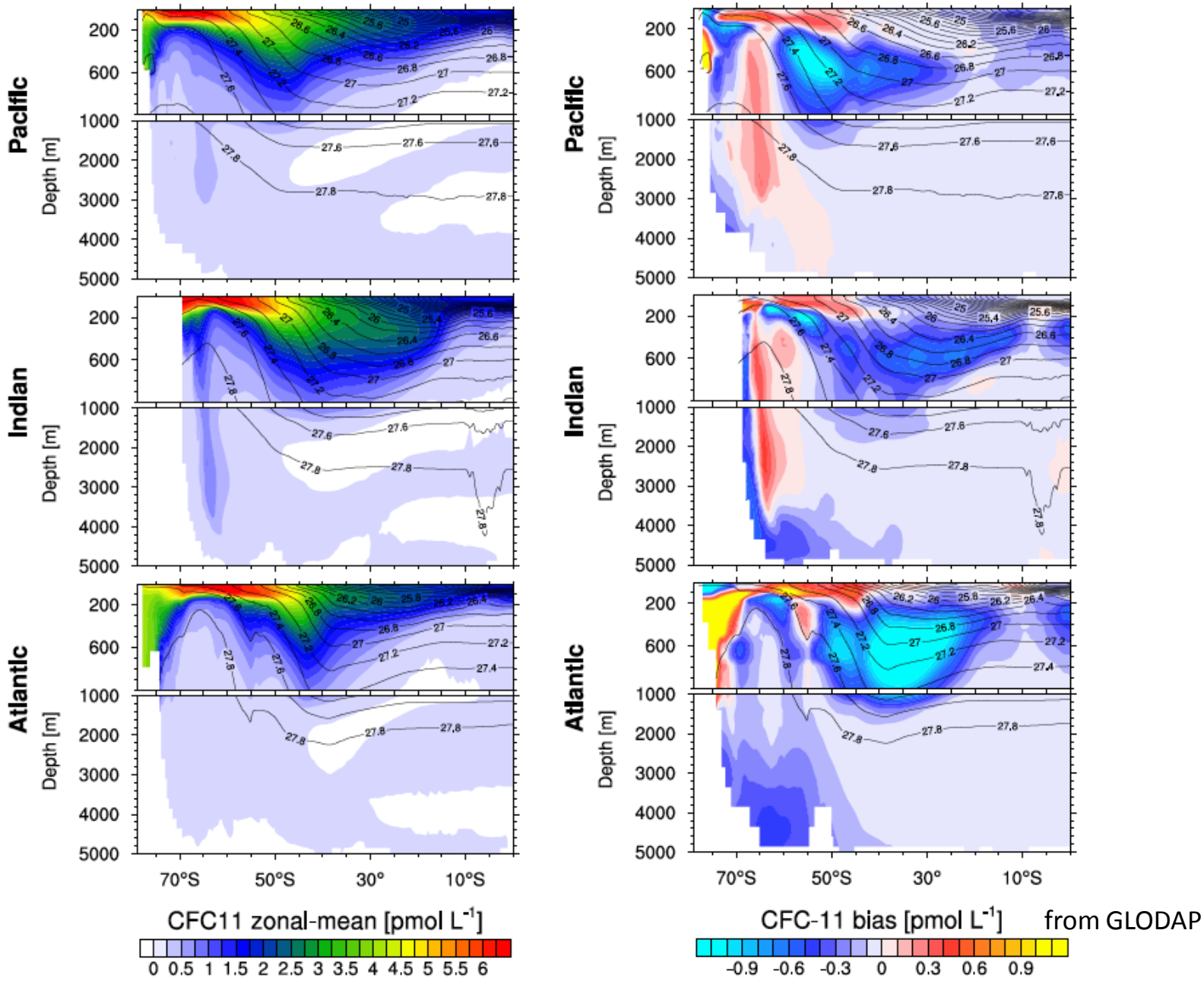
Density change of 0.125 kg m^{-3} from surface

CFC-11 COLUMN INVENTORY (moles km^{-2})



for 1994

ZONAL-MEAN CFC-11 from CONTROL



from GLODAP

EXPERIMENTAL SETUP

Ocean – sea-ice coupled simulations (G cases) forced with the CORE inter-annually varying data sets for the 1948-2007 period.

CONTROL: 300-yr simulation,
SENSITIVITY EXPERIMENTS: 60-yr integrations starting from year 240 of the control case.

Experiments:

Ricrx2: Set Ri_{cr} = 0.6 (up from 0.3)

Pistonx2: Double the CFC piston velocity

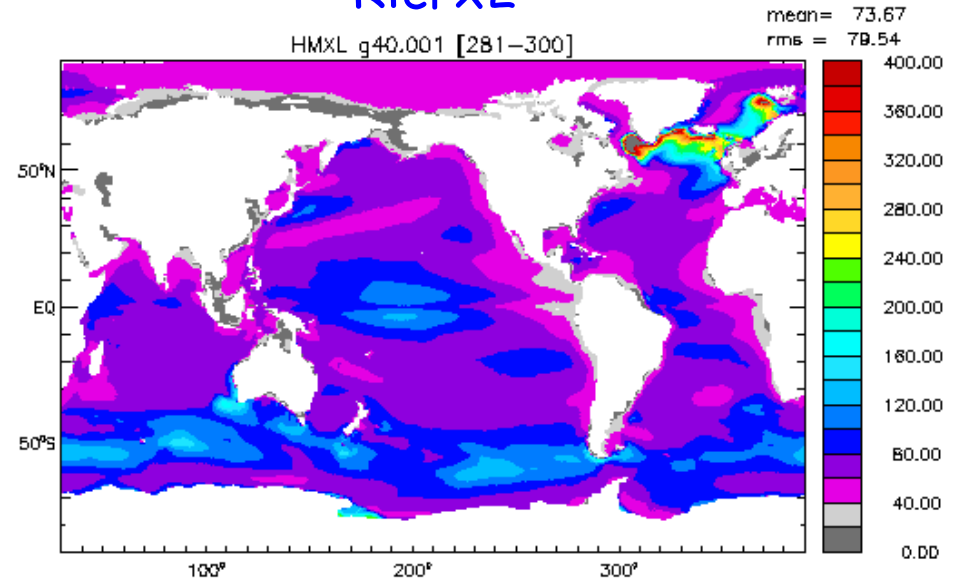
K(600): increase minimum Redi diffusivity coefficient to 600 $m^2\ s^{-1}$ (from 300 $m^2\ s^{-1}$)

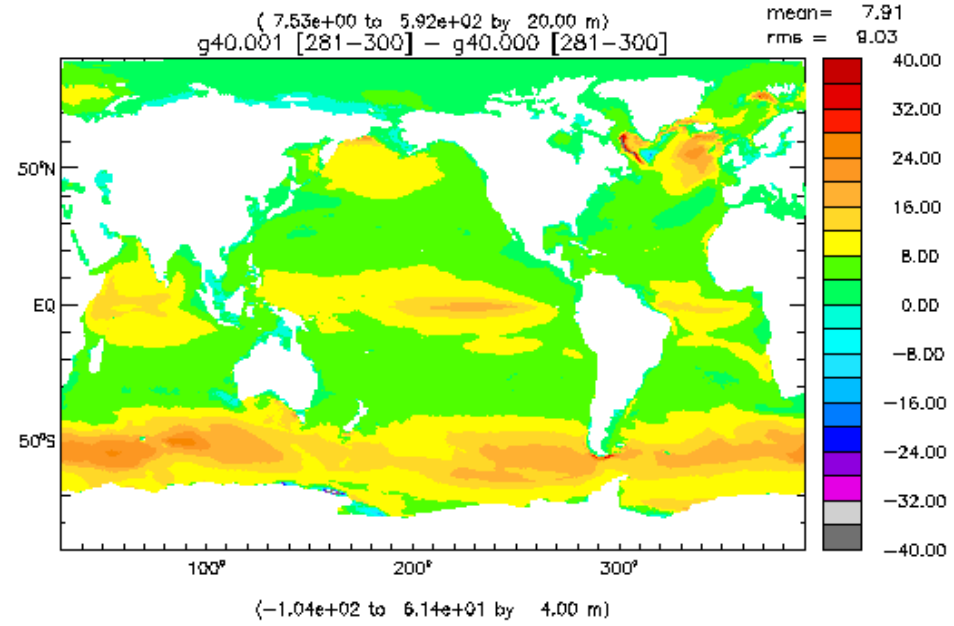
K(1000): increase minimum Redi diffusivity to 1000 $m^2\ s^{-1}$

k_v: increase the background vertical diffusivity to 0.3×10^{-4} $m^2\ s^{-1}$ (from 0.17×10^{-4} $m^2\ s^{-1}$)

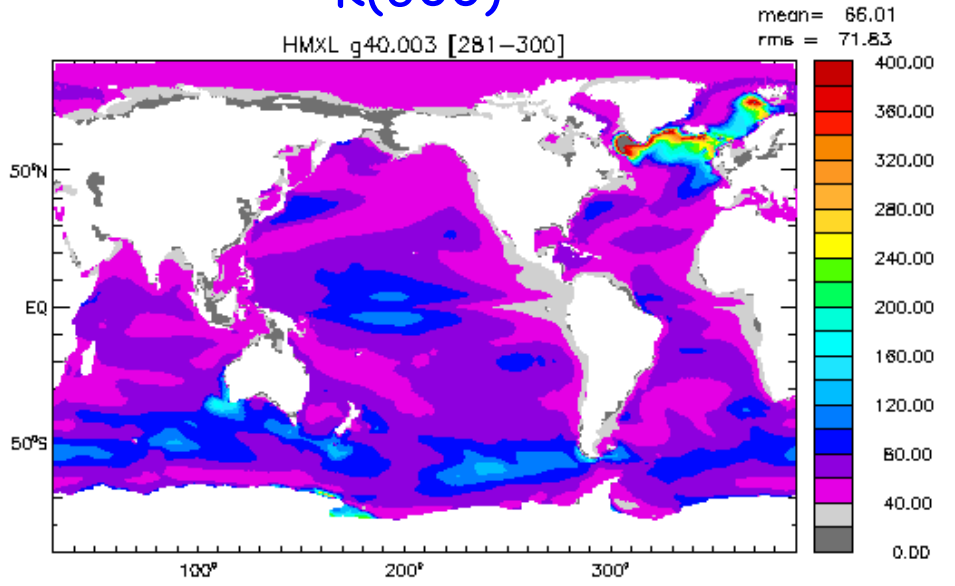
TIME-MEAN MIXED LAYER DEPTH

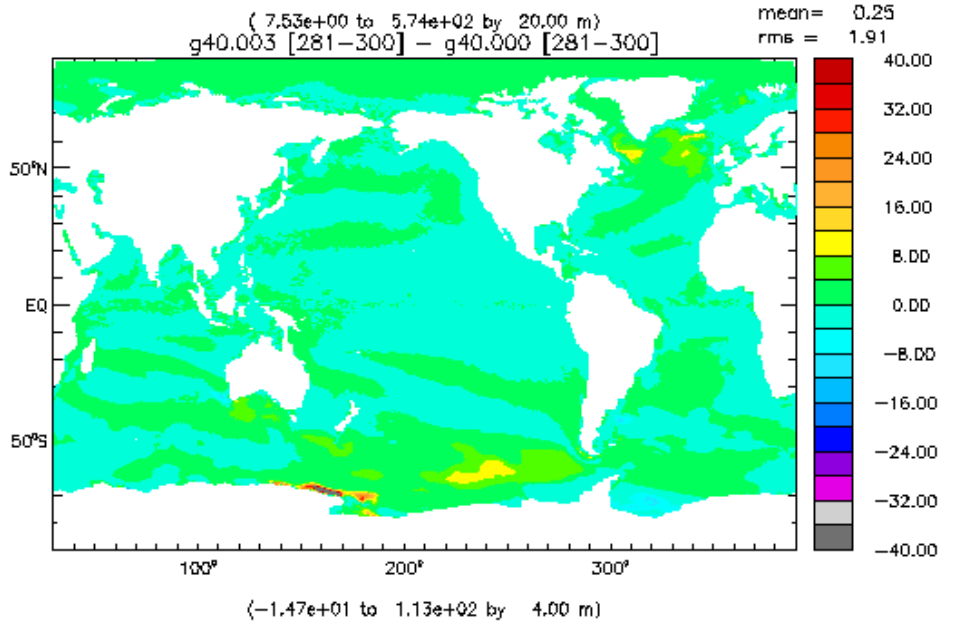
Ricrx2



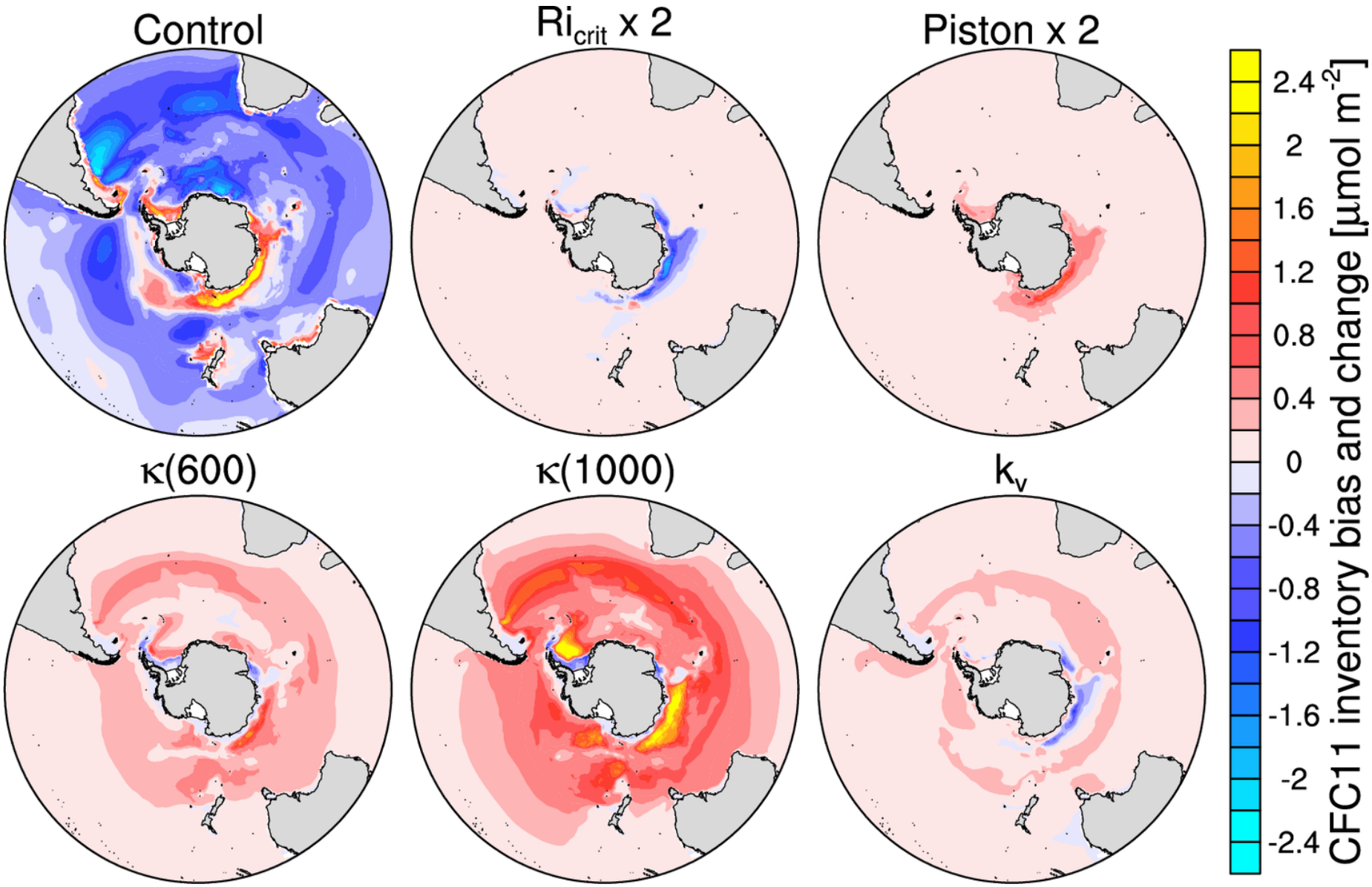


K(600)

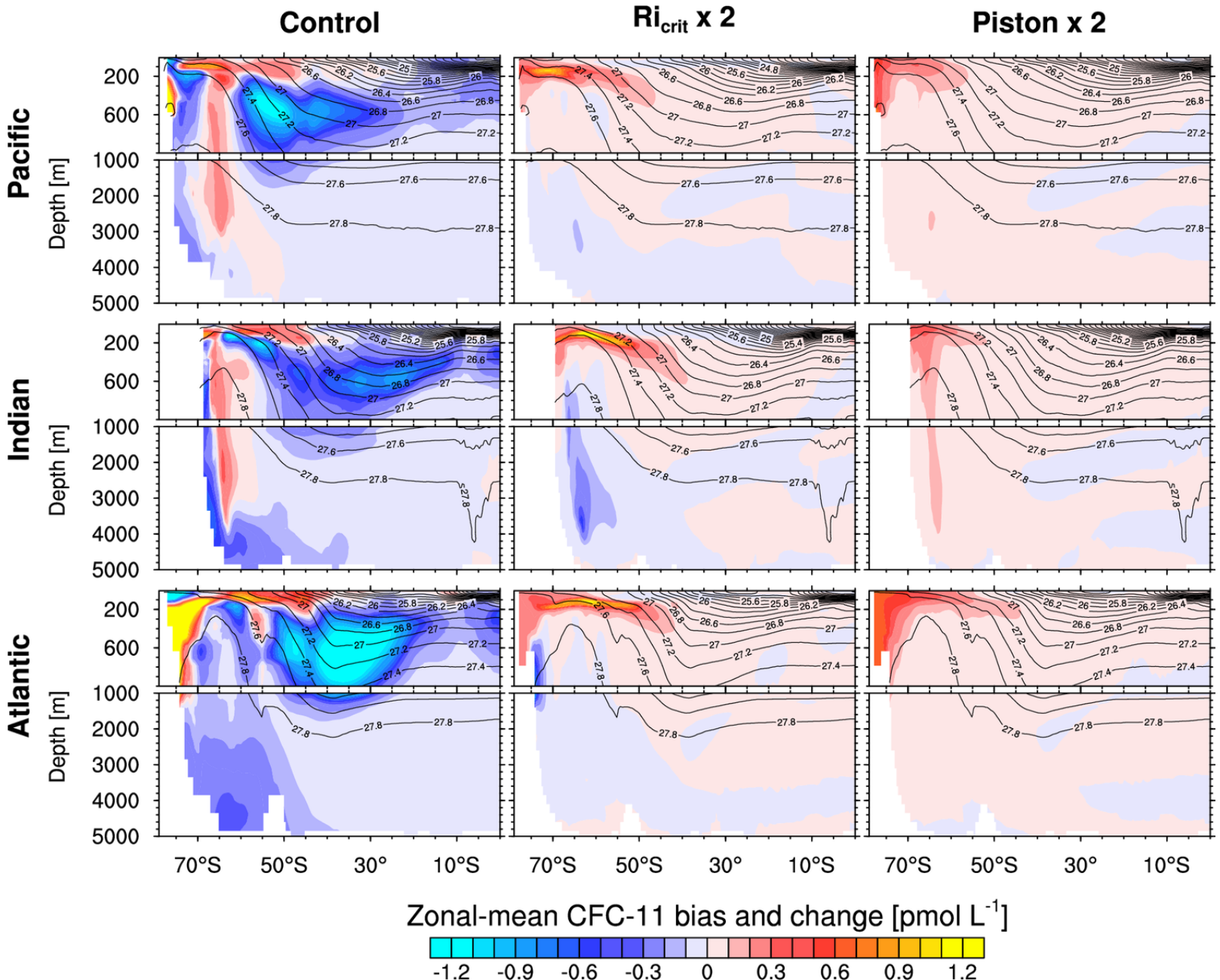




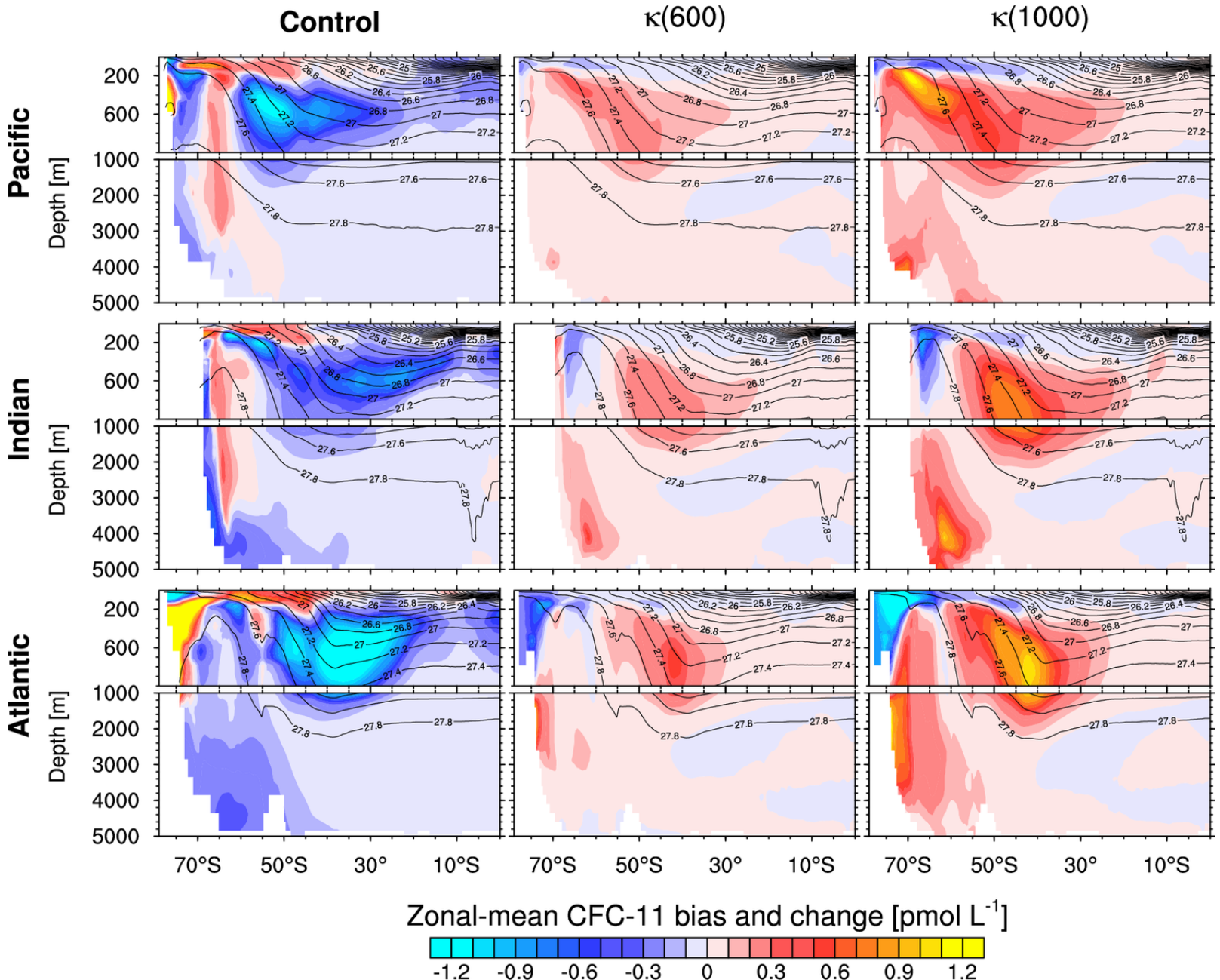
CFC-11 COLUMN INVENTORY



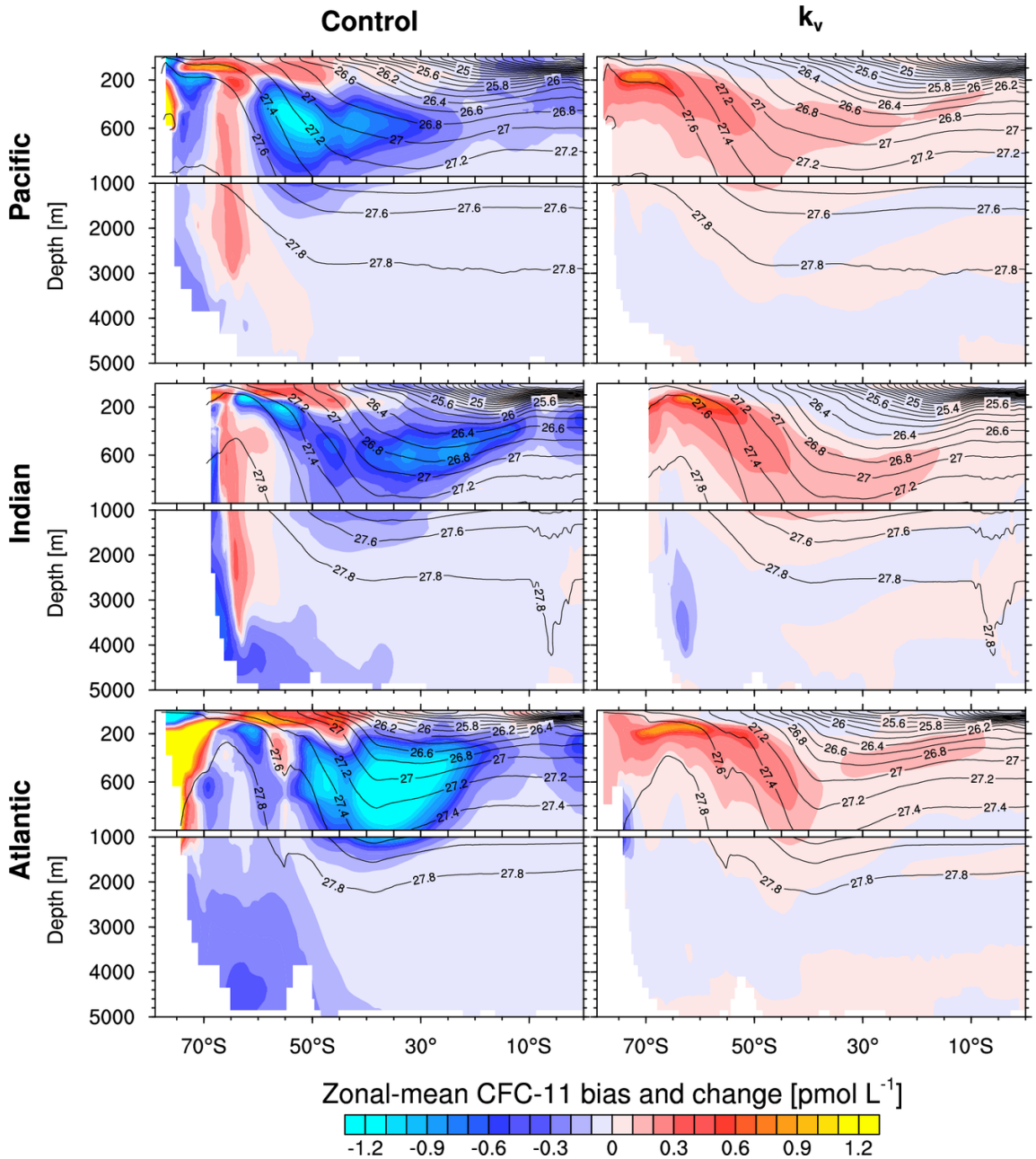
ZONAL-MEAN CFC-11 DIFFERENCES



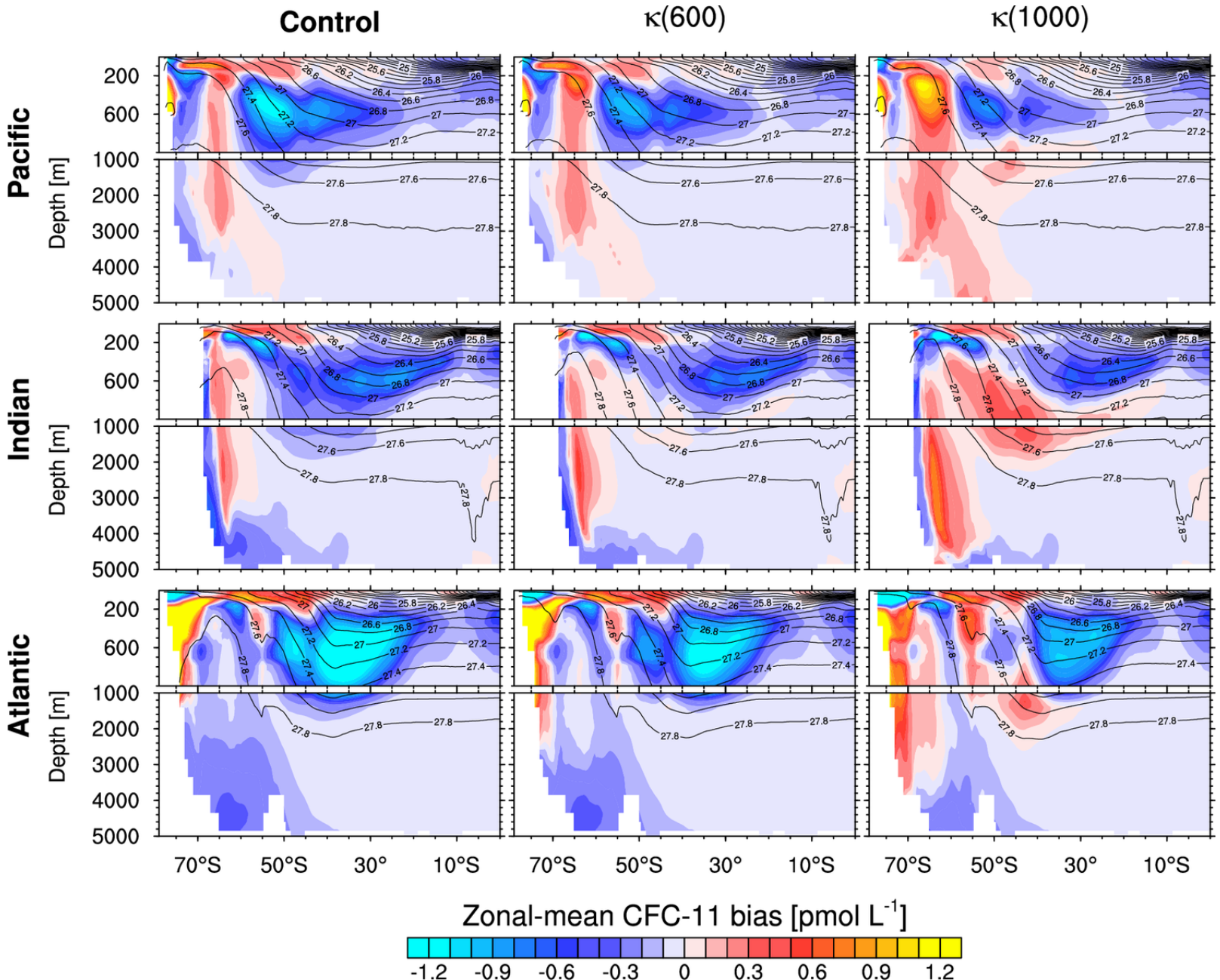
ZONAL-MEAN CFC-11 DIFFERENCES



ZONAL-MEAN CFC-11 DIFFERENCES



ZONAL-MEAN CFC-11 DIFFERENCES FROM OBSERVED



SUMMARY AND FUTURE WORK

- Work in progress,
- Clear improvements in CFC-11 distributions, particularly with increased Redi diffusivity.

- Anisotropic mesoscale mixing formulation,
- More detailed comparison of model and observations regarding MLD,
- Near-inertial wave mixing and frequent coupling impacts,
- Come up with a set of optimal parameterizations and parameter choices, also considering impacts on other metrics,
- Assess long term behavior.

Any other suggestions?