NIWs in CCSM

A climate process team together with
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&

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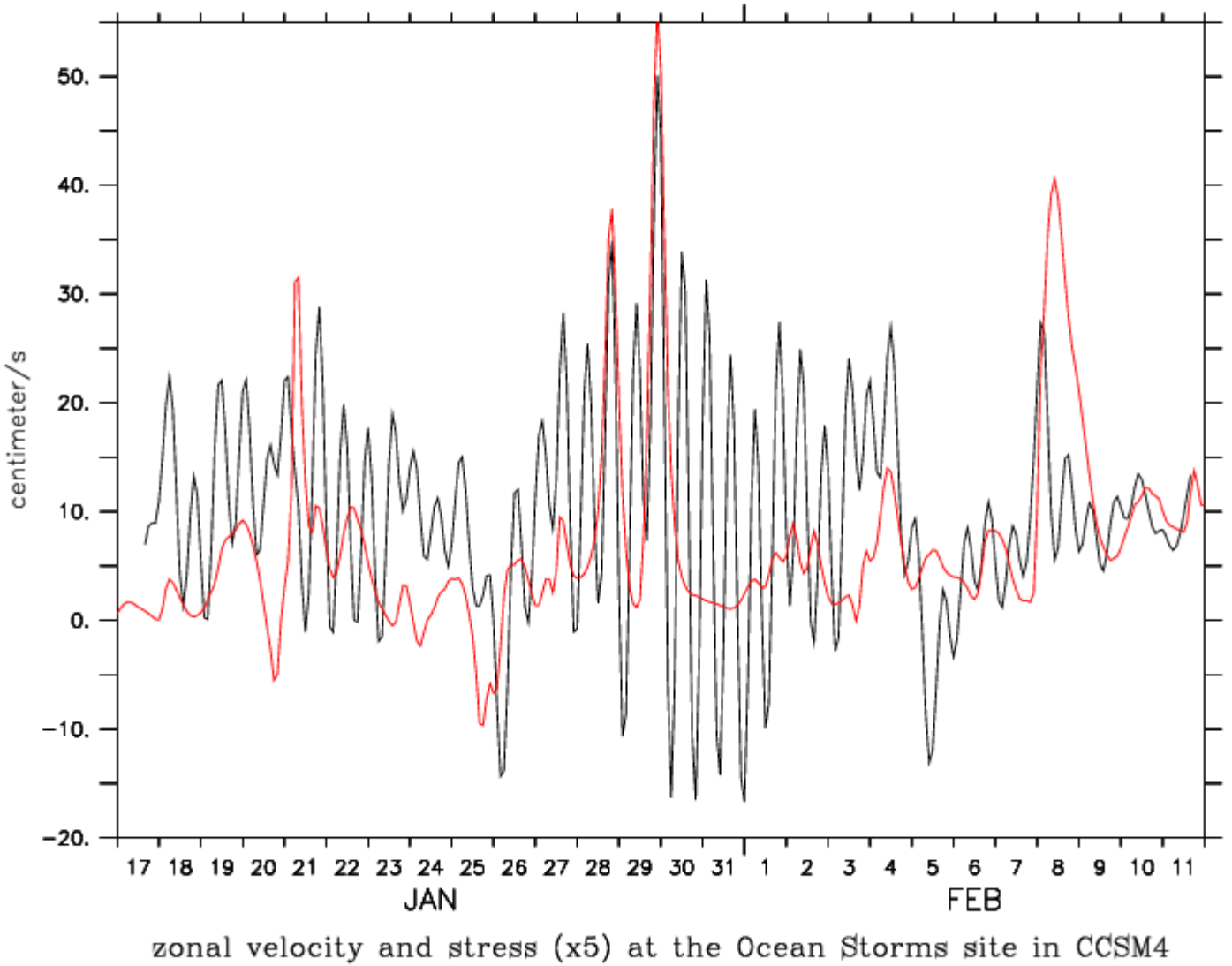
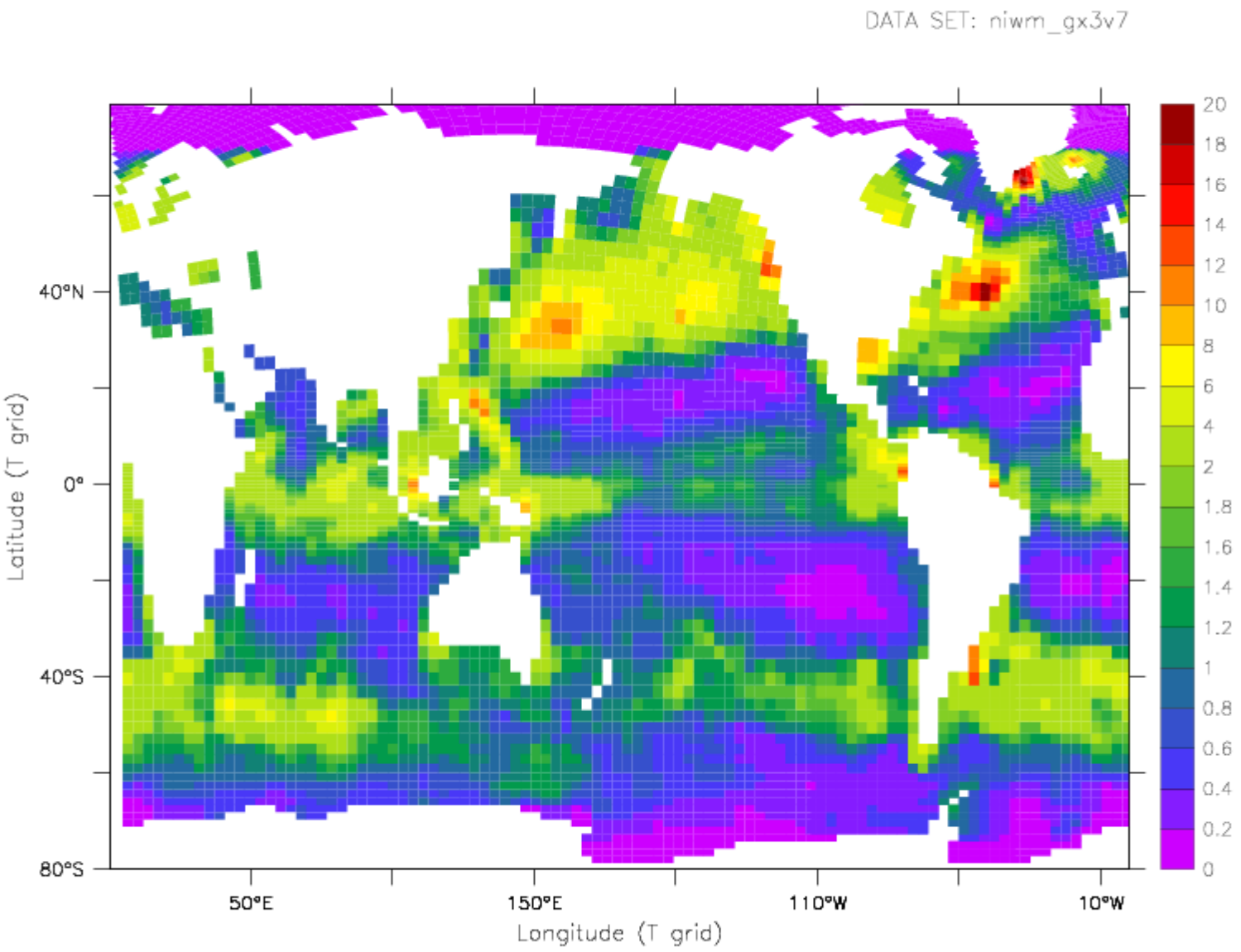
NIW motions in CCSM4

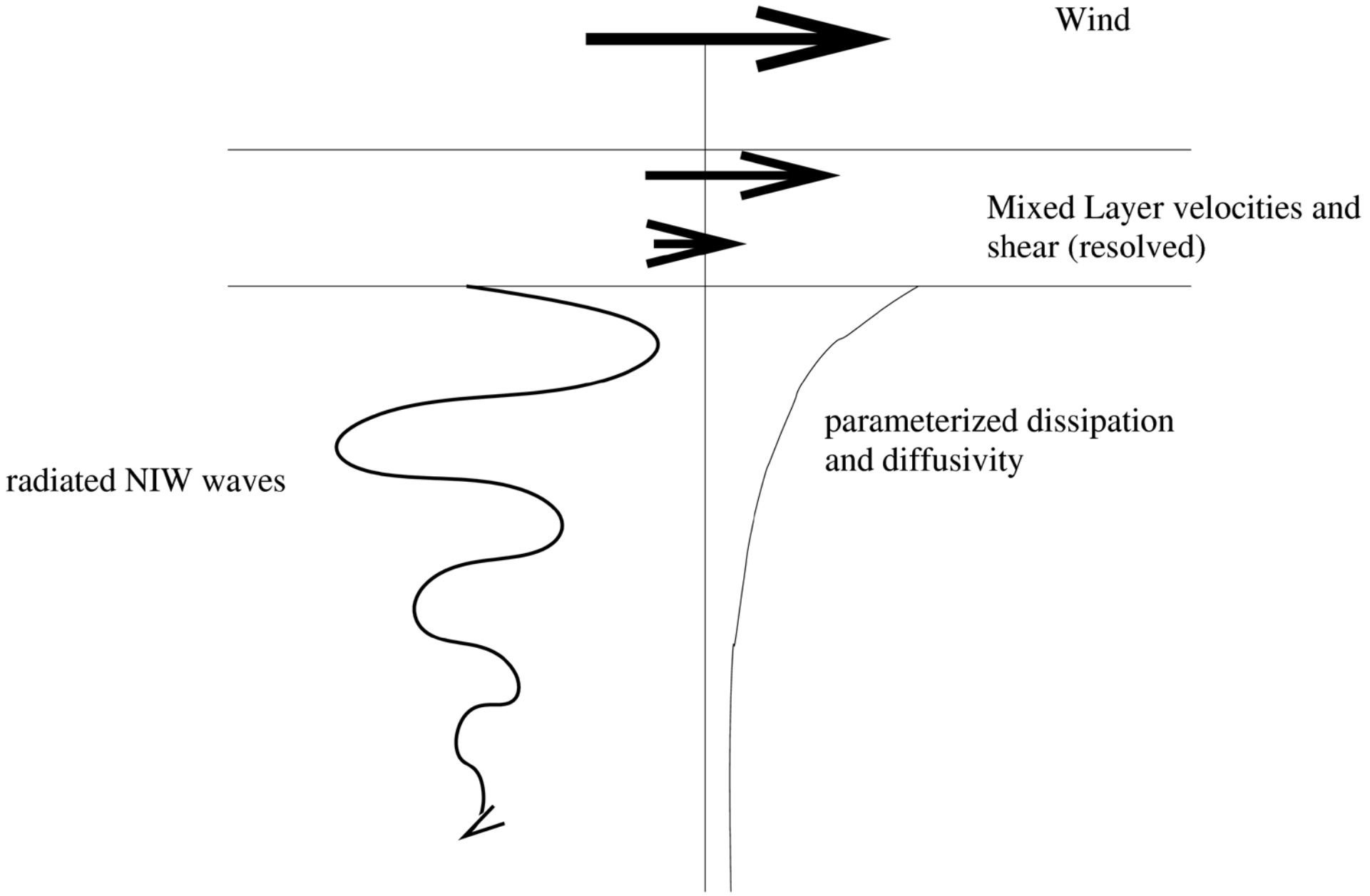


zonal velocity and stress (x5) at the Ocean Storms site in CCSM4

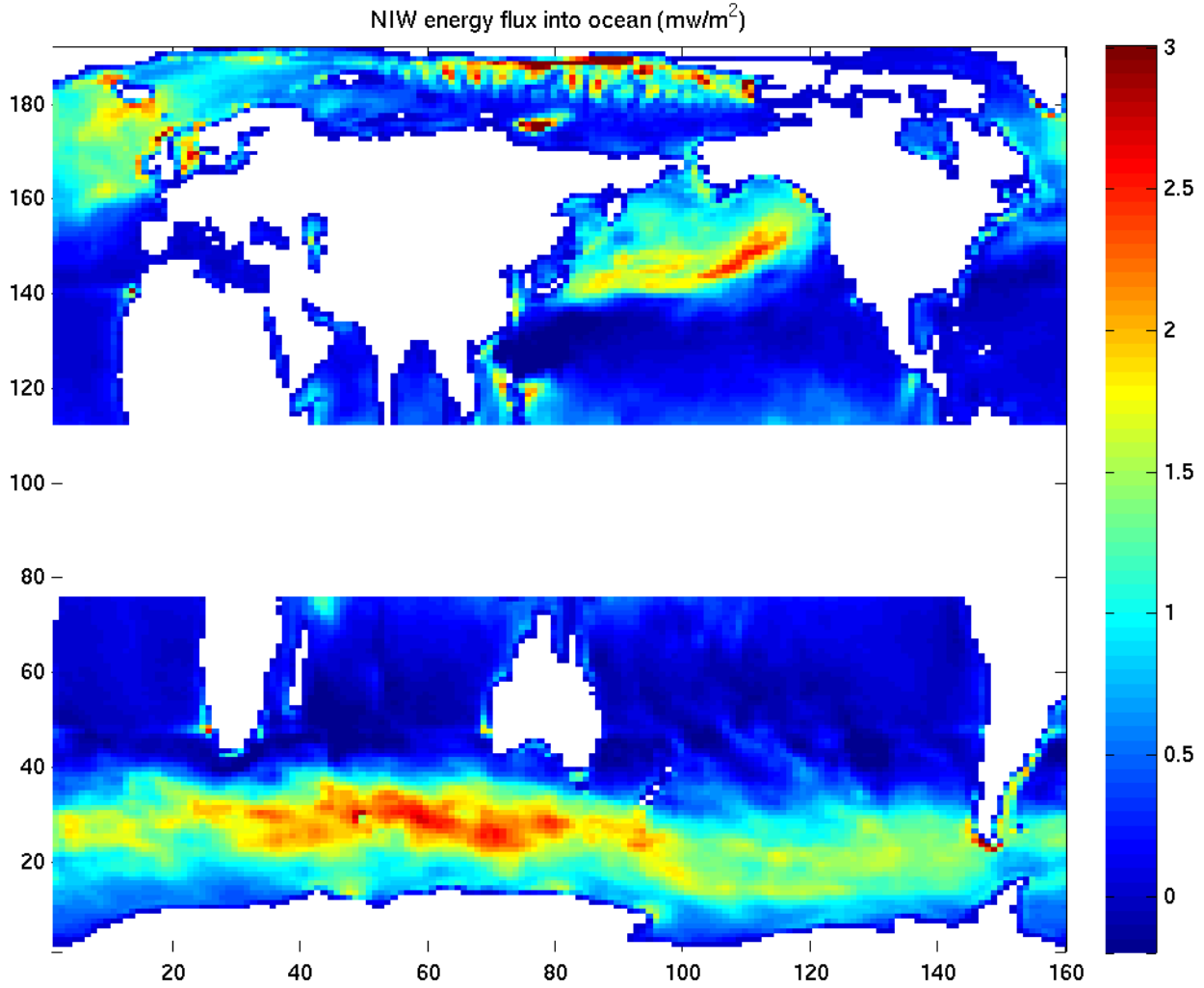
'Observed' NIW flux into the ocean (NCEP + slab ocean)



NIW energy flux into the ocean (mW/m2, Alford, 2003)



Conceptual framework for NIW parameterization

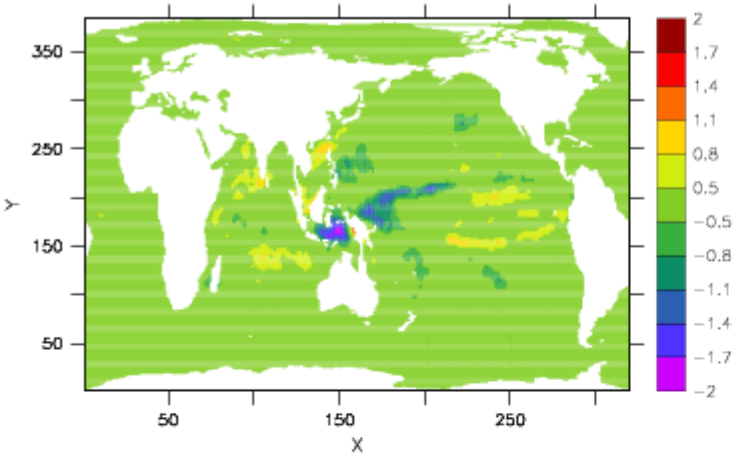


NIW energy based on CCSM4 with 2 hourly coupling

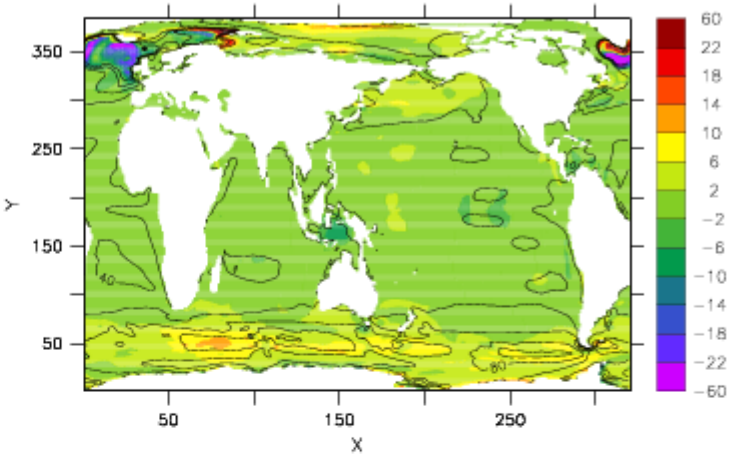
What did we do?

- incorporated latest diffusivity observations (in the Arctic from 1e-5 to 1e-6 cm2/s; in the Banda Sea from 1e-4 to 3e-4 cm2/s)
- switched from daily coupling to 2 hourly coupling
- added a parameterization for NIW mixing below the mixed layer: NIW energy available for mixing is proportional to the change in ML KE (Crawford and Large, '96), and distributed in the vertical analogous to Jayne (2009)
- rerun the full set with ocean ecosystem

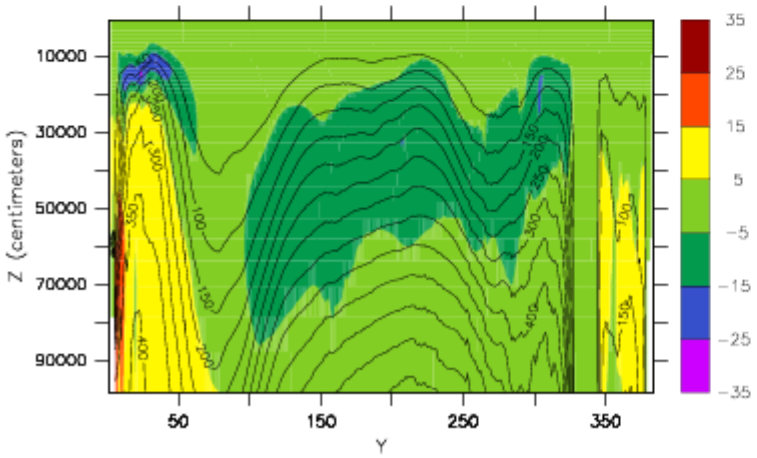
Results based on the last 20yrs of 100yr runs.



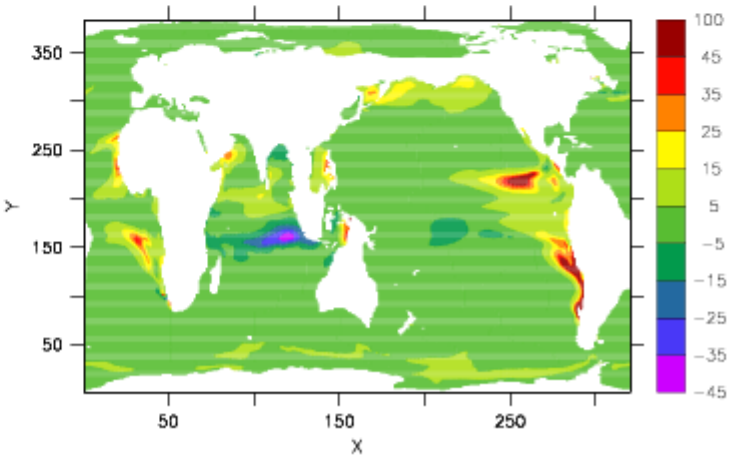
difference in precipitation [in mm/year]



difference in boundary layer depth [meters]



difference in zonally averaged ideal age [years]



increase in oxygen concentration at 150m (in %)

Summary

- the NIW-mixing parameterization has been successfully implemented
- the impacts on the physical climate are modest, but the mixed layer depths, the ventilation and the oxygen distribution have been improved
- the next step will be to replace the background diffusivity with the energy available for diapycnal mixing, and compute diffusivity as a function of this energy and the stratification