Simulation of the World Ocean climate with the INM – IO RAS numerical model

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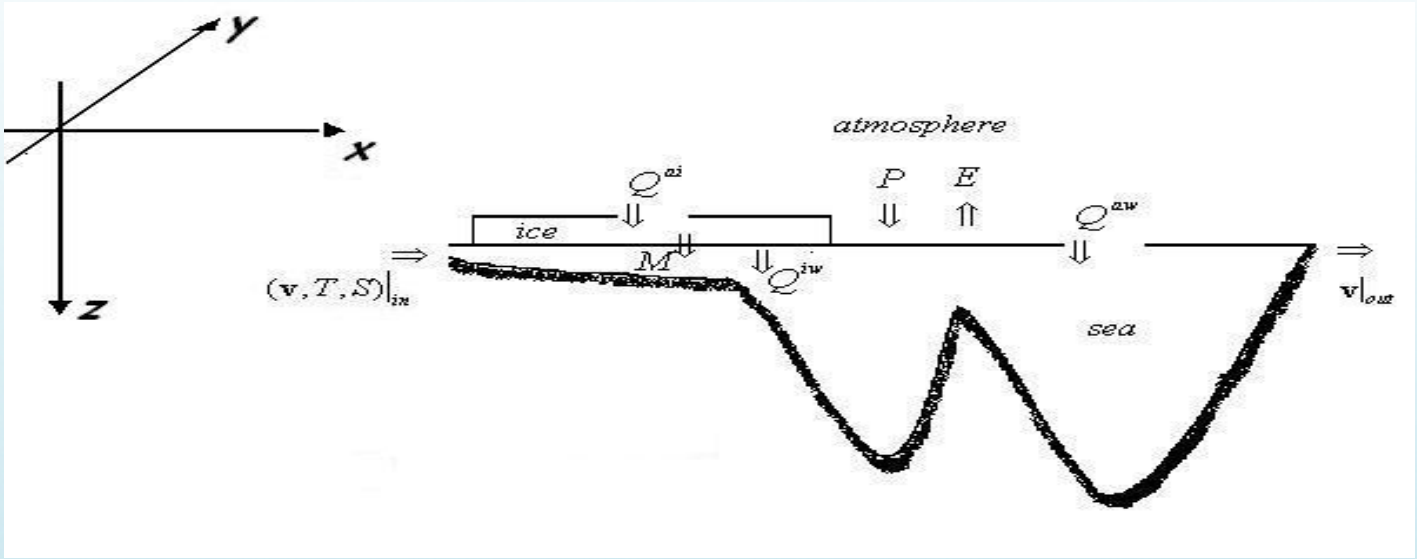
CITES - 2013

Model equations



$$u_t + (\vec{v}\cdot\vec{\nabla})u - fv = -\rho_o^{-1} p_x + (K_m u_z)_z + D_u$$

$$v_t + (\vec{v}\cdot\vec{\nabla})v + fu = -\rho_o^{-1} p_y + (K_m v_z)_z + D_u$$

$$p_z = \rho g$$

$$\vec{\nabla}\cdot\vec{v} = 0$$

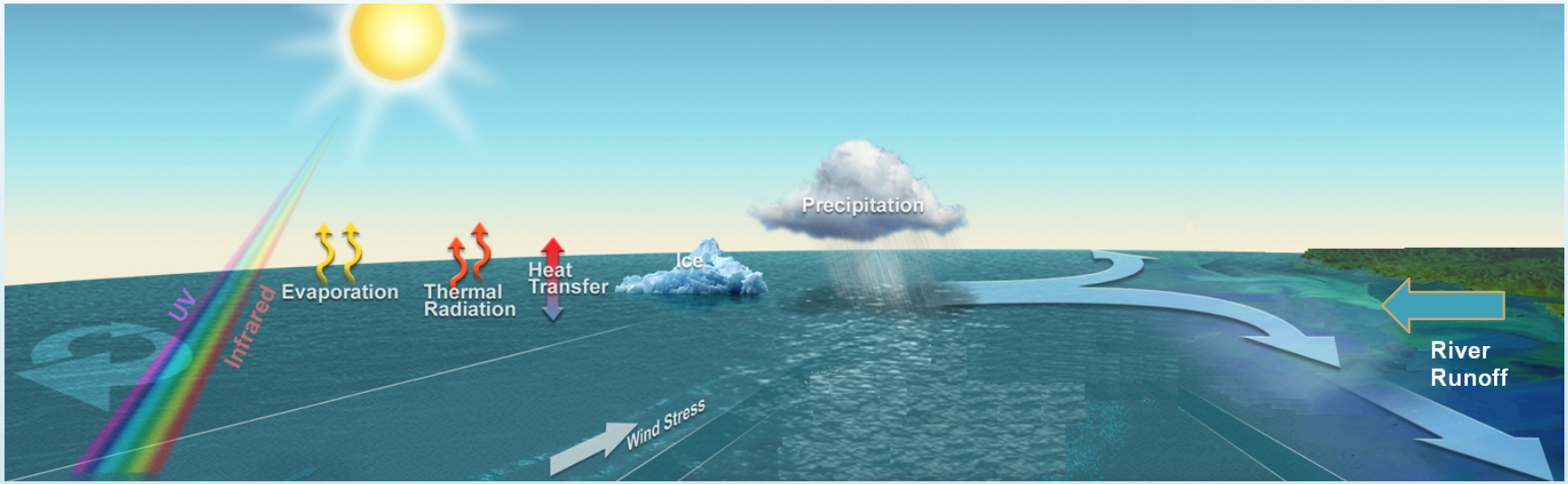
$$\zeta_t + \vec{v}\cdot\vec{\nabla}(z+\zeta) = \rho_f^{-1}(P + M - E)$$

$$T_t + (\vec{v}\cdot\vec{\nabla})T = (K_h T_z)_z + D_T + (\rho_o c_p)^{-1} I_z \cdot (1 - A)$$

$$S_t + (\vec{v}\cdot\vec{\nabla})S = (K_h S_z)_z + D_S$$

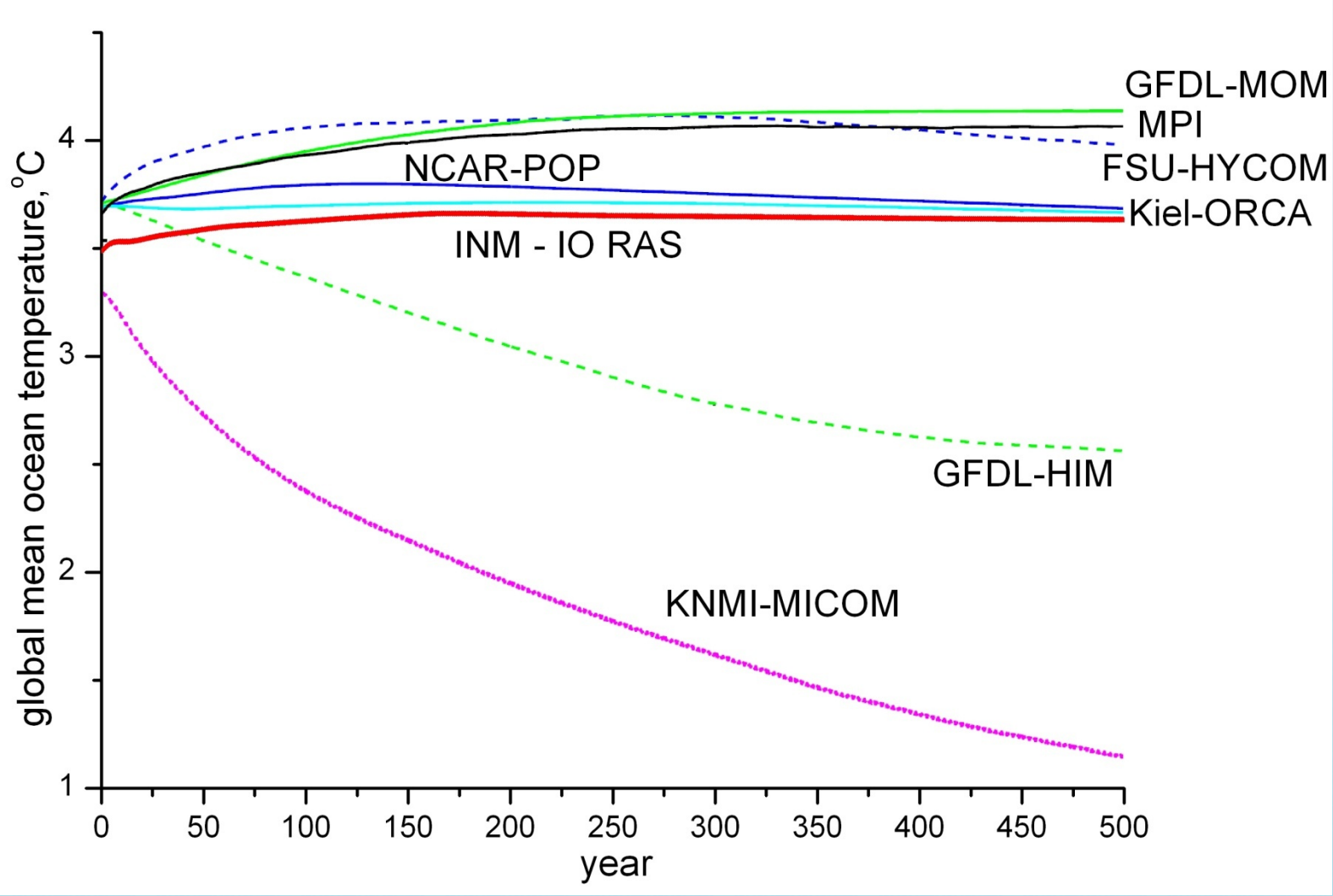
$$\rho = \rho(T, S)$$

CORE-I experiment protocol

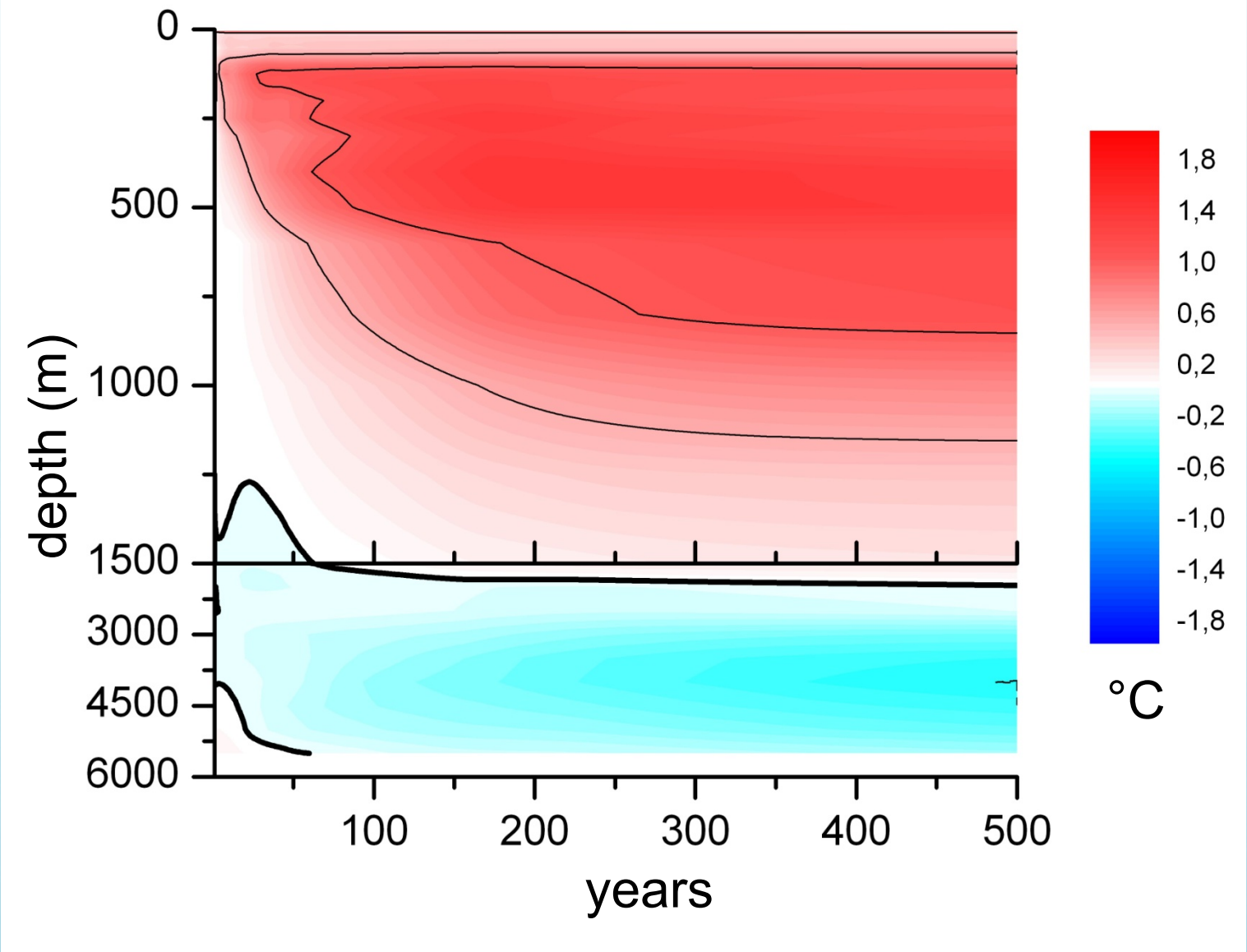


- Coupled ocean-ice model
- Climatological initial conditions
- Normal year forcing – 500 years
- CCSM atmospheric boundary layer
- Sea surface salinity relaxation
- Hydrology normalization

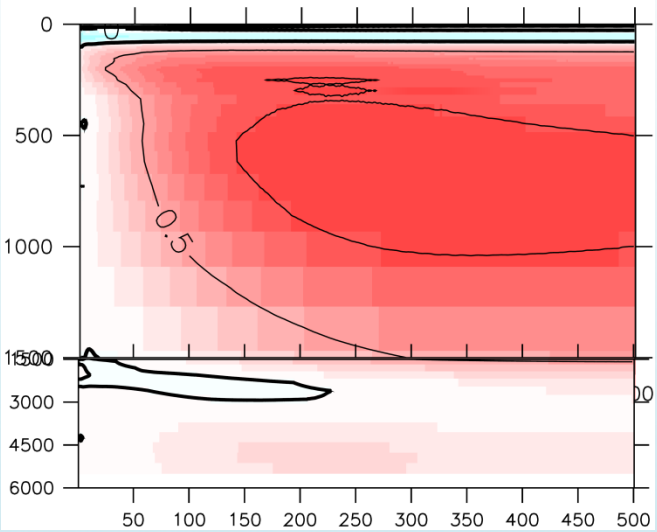
Global mean ocean temperature



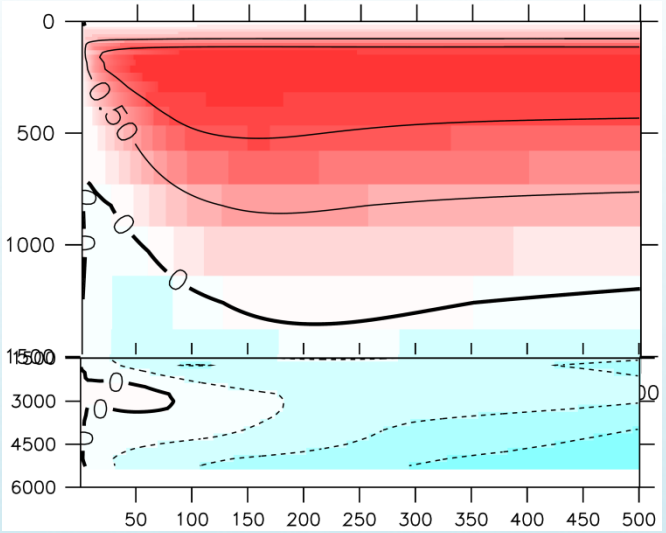
Globally averaged temperature drift



Globally averaged temperature drift

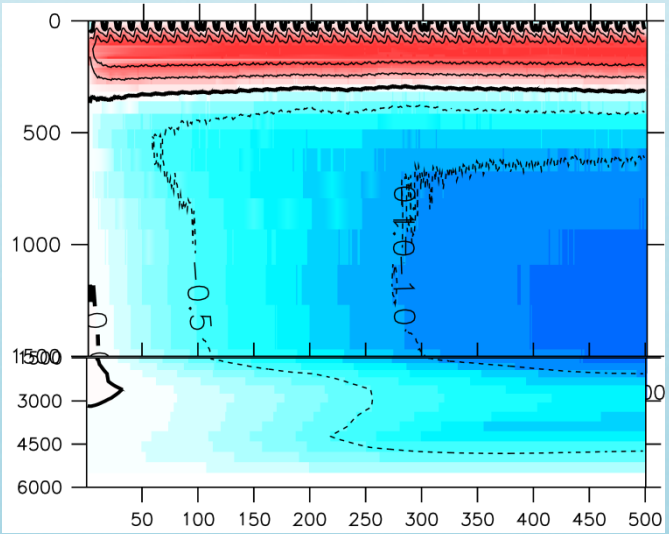


GFDL-MOM

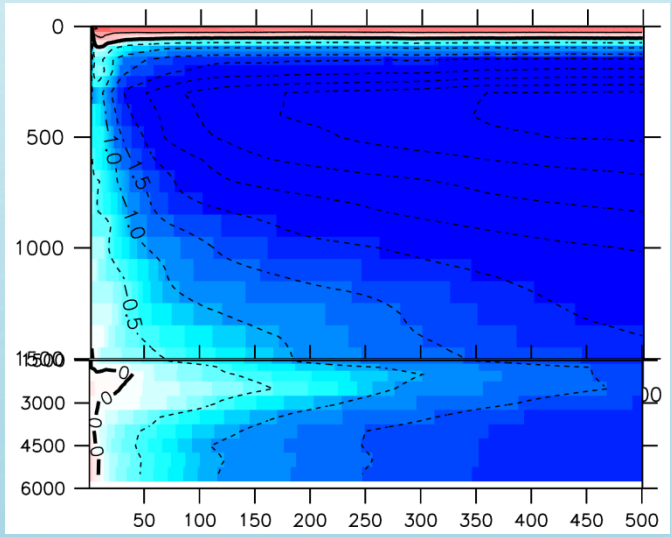


NCAR-POP

z-coordinate



GFDL-HIM

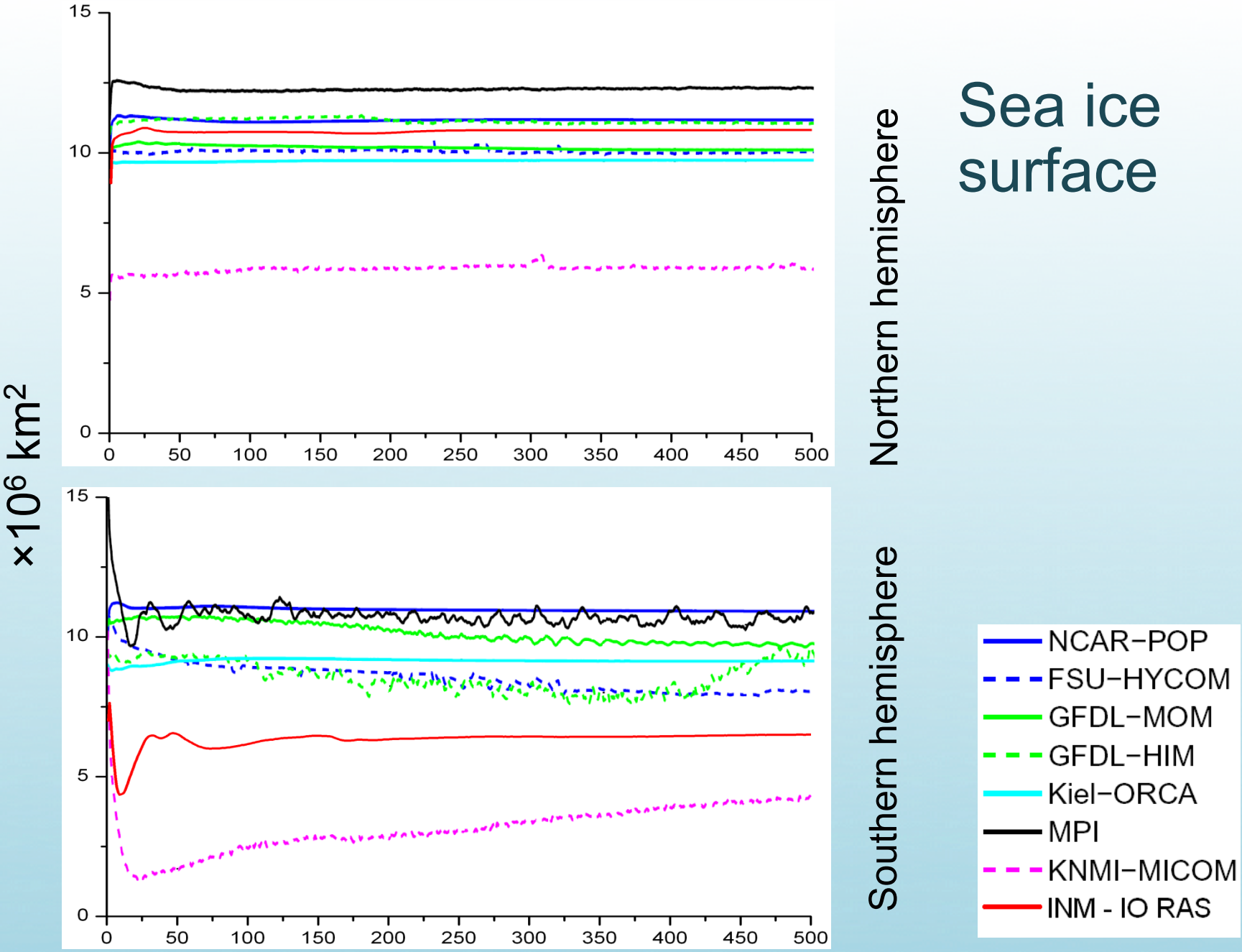


KNMI-MICOM

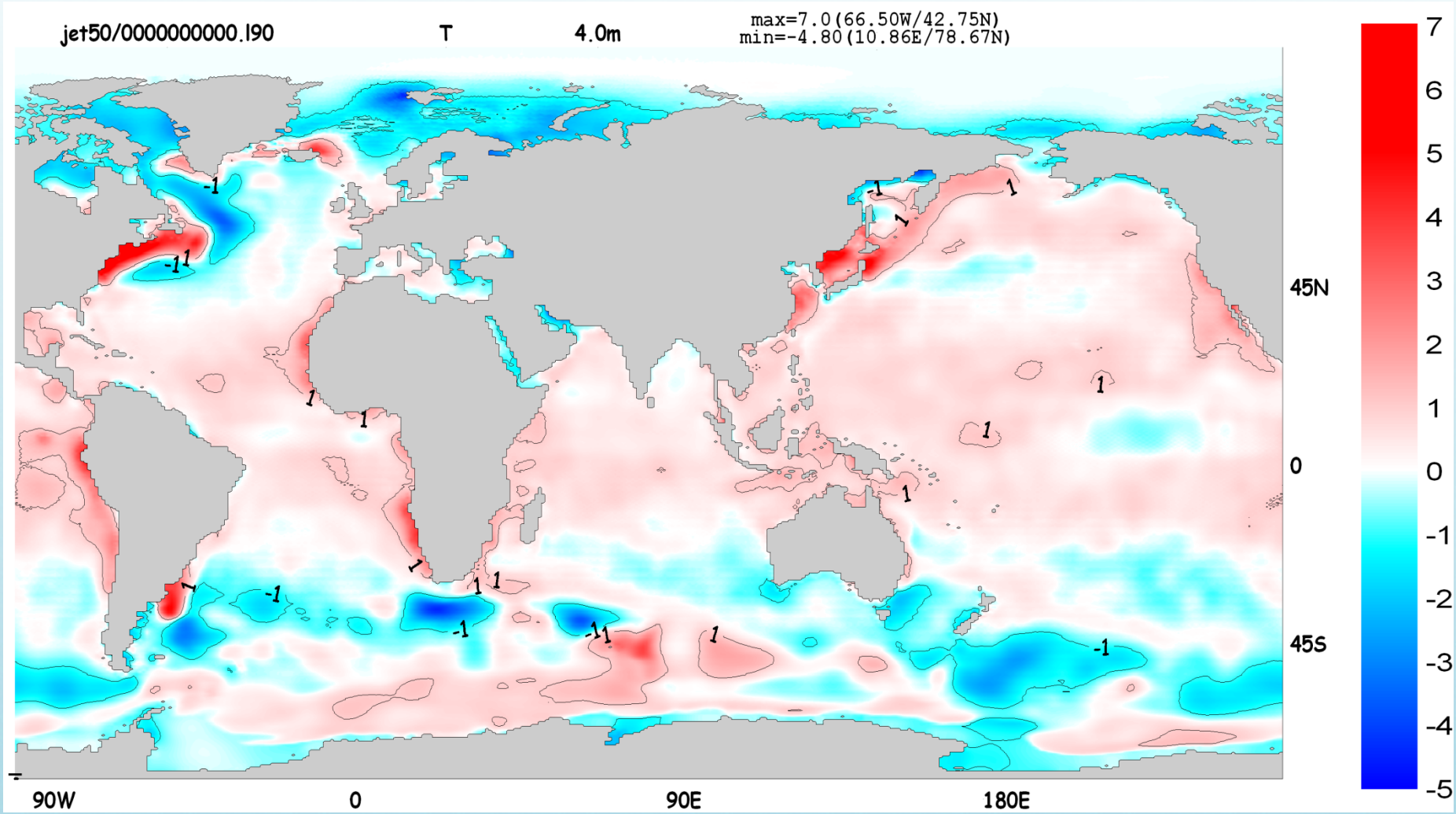
isopycnal

Griffies et al., 2009

Sea ice surface

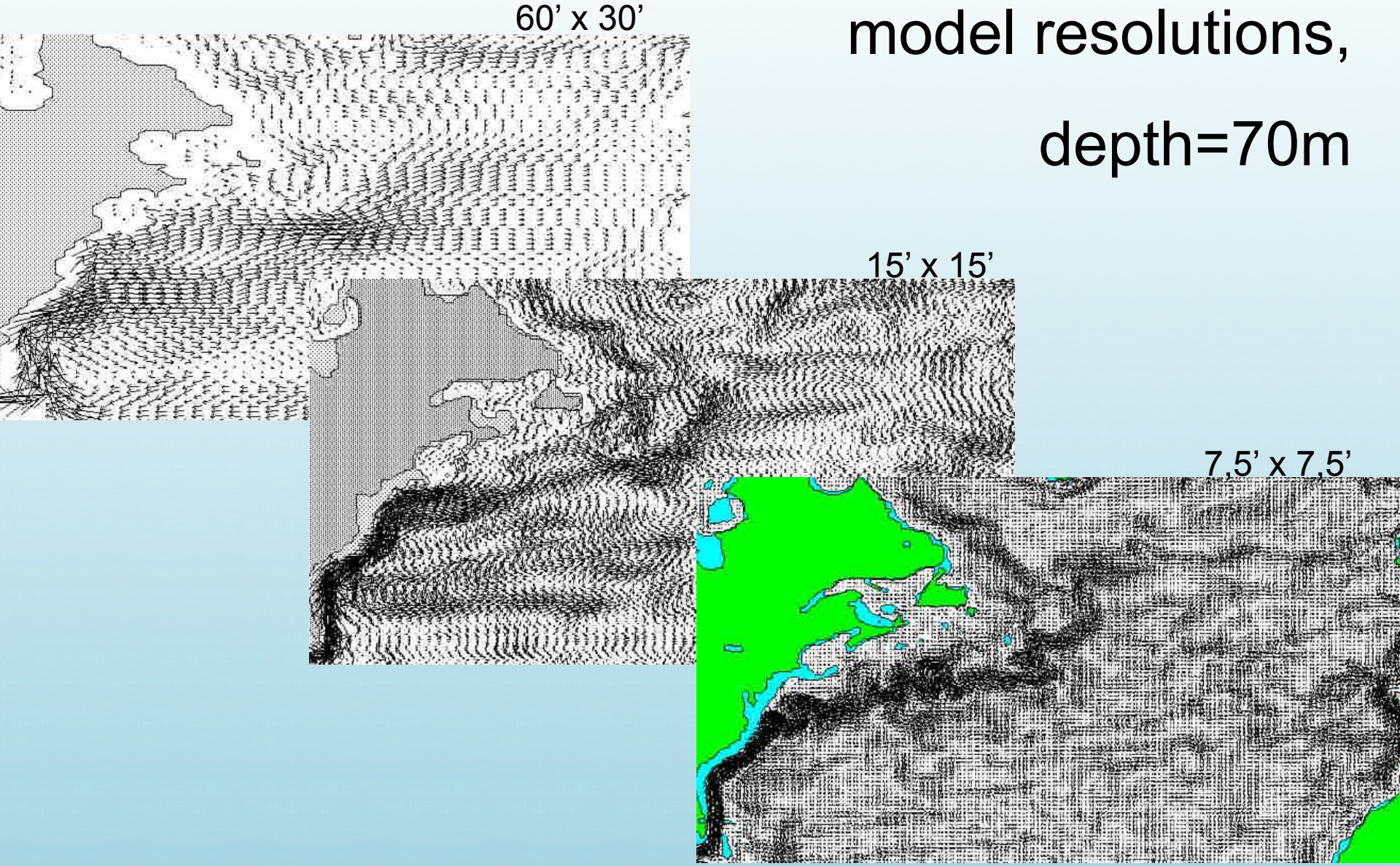


SST anomaly, averaged for years 491-500

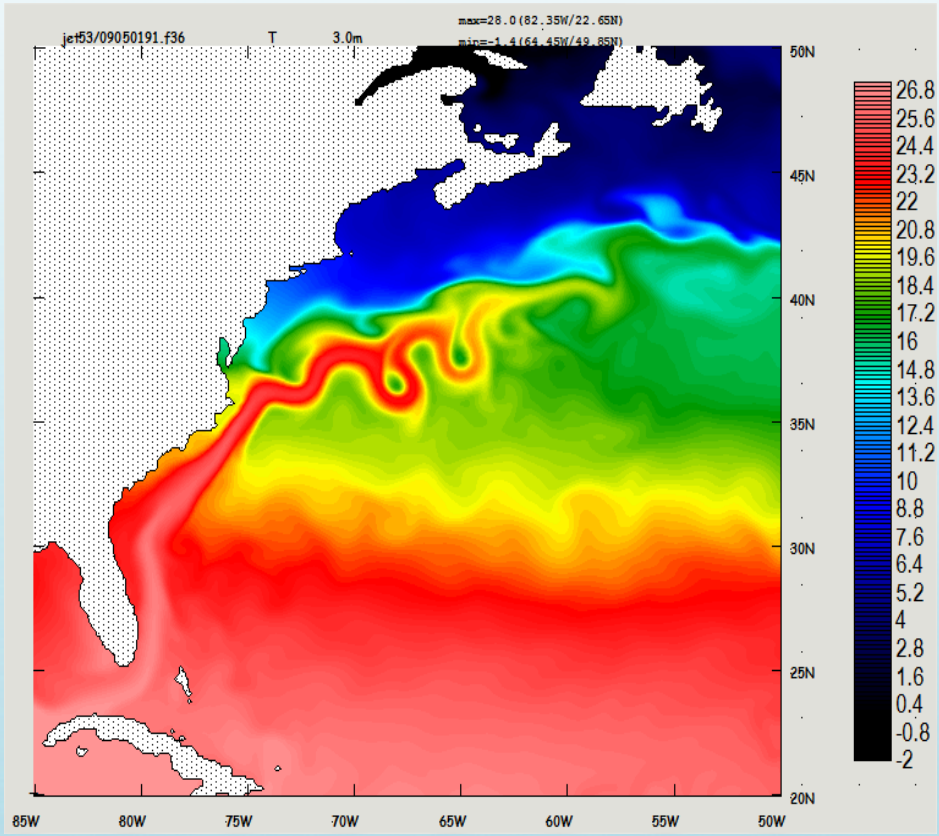


Gulf Stream at various model resolutions,

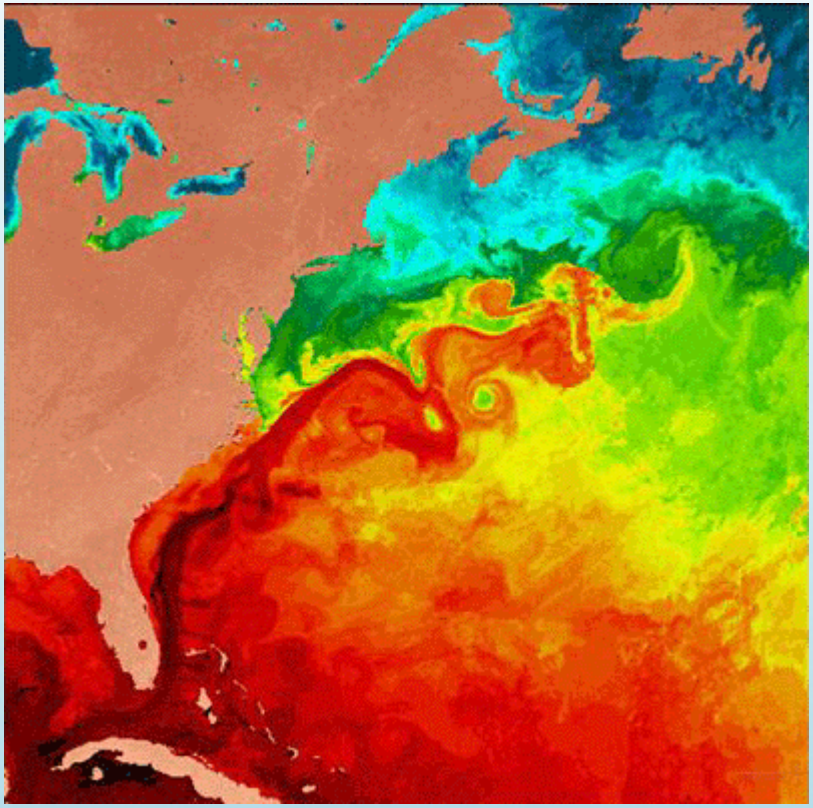
depth=70m



Gulf Stream region model tuning



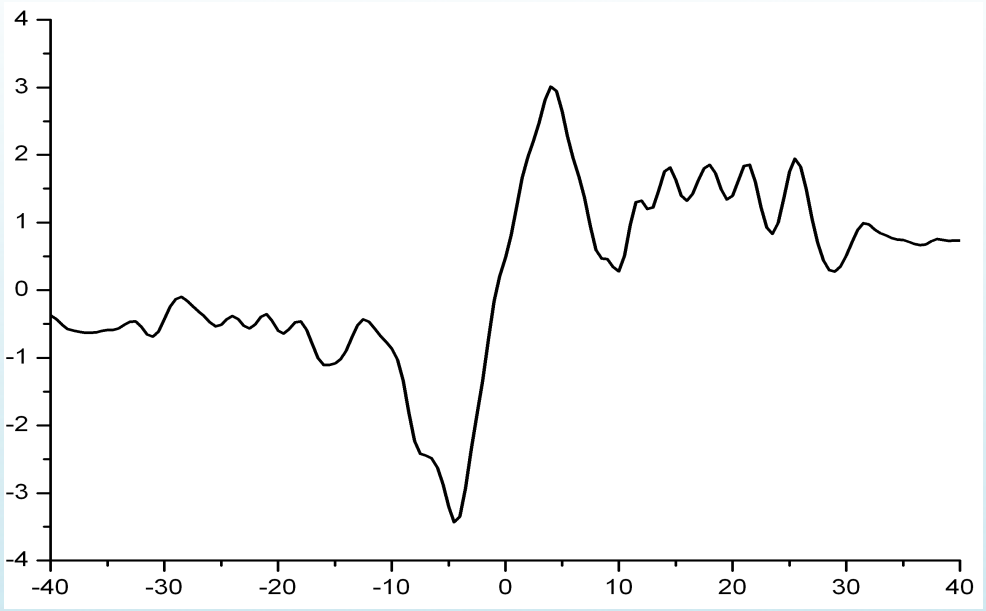
INM – IO RAS model
0.1° resolution



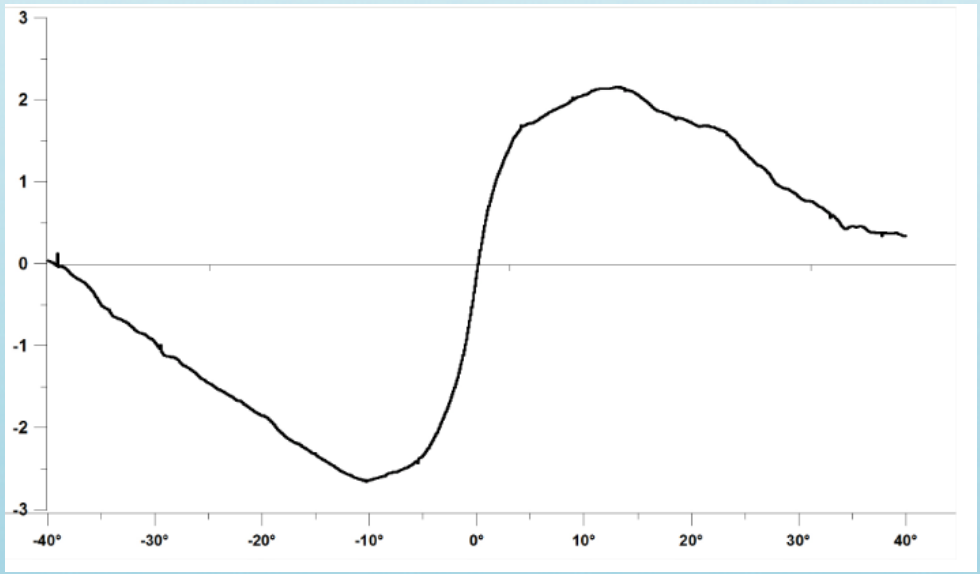
satellite image, NOAA

R.N. Khabeev, IO RAS

Meridional global ocean heat transport



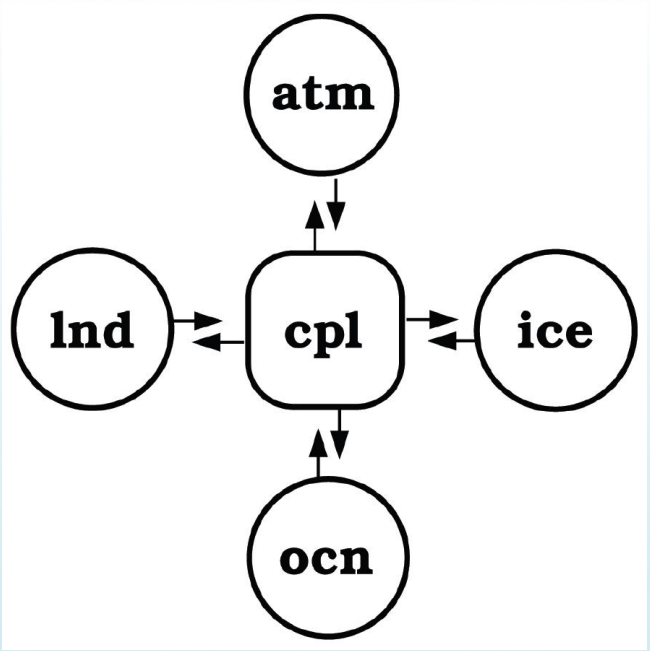
1° × 0.5° × 32 levels



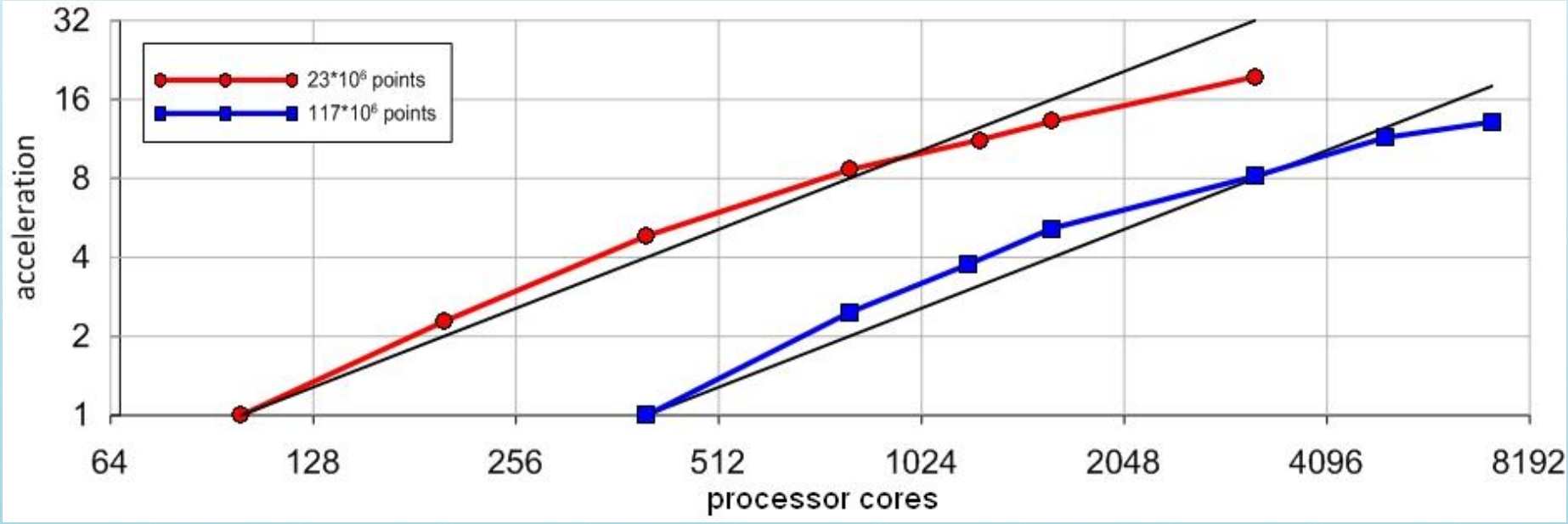
0.1° × 0.1° × 49 levels

MHT, PW

latitude



INM – IO RAS
Coupled modelling system



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Thank you for attention!