

Modelling of the Eastern Pacific tropical water dynamics in a global eddy-resolving numerical experiment

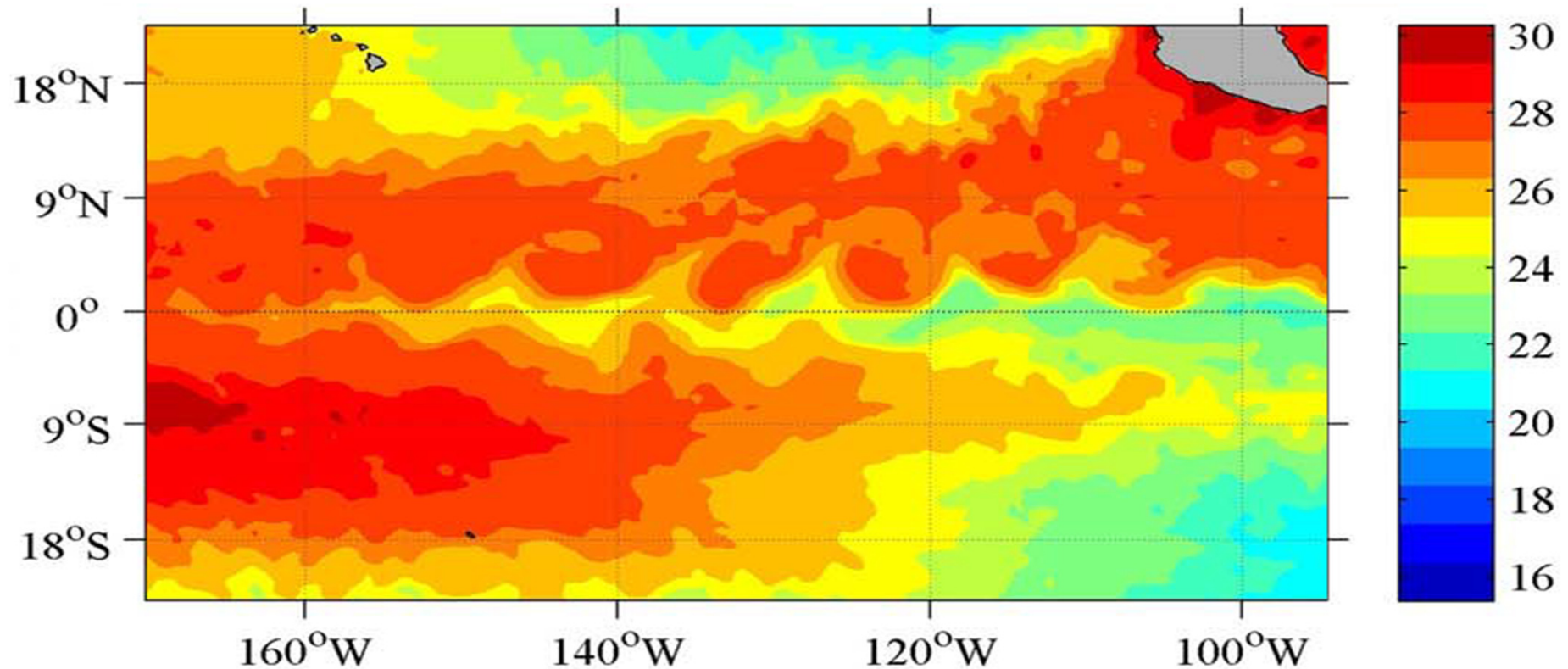
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R.A. Ibrayev

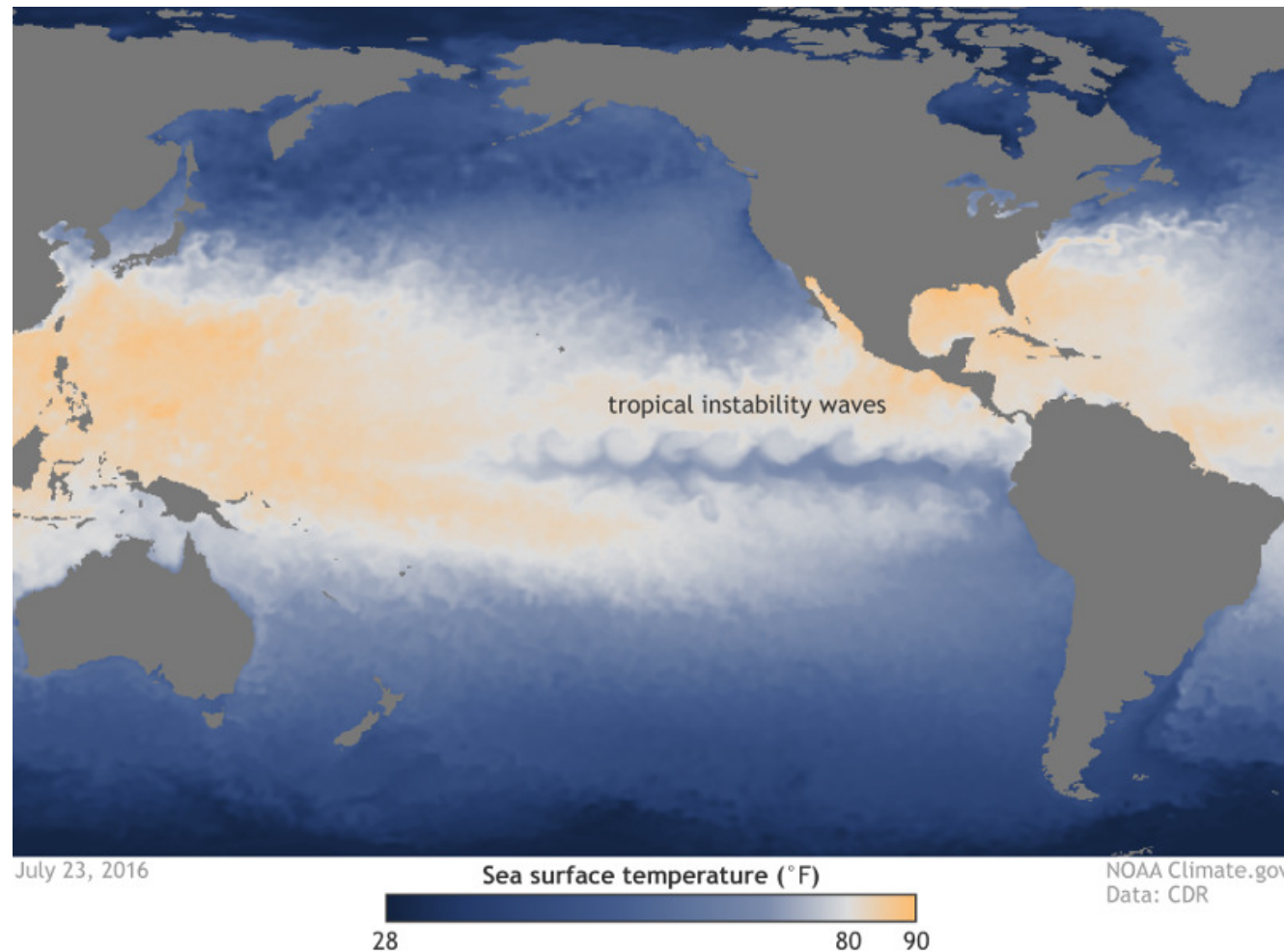


Tropical Pacific is characterized by tight coupling at the ocean-atmosphere interface and a significant contribution of the subseasonal variability to the ocean energy balance

- **Bad model** → rapid drift and unrealistic solution
- **Model validation** can be performed by simulating TIWs
- **Good model** → good simulation even with coarse external forcing data



Tropical instability waves seen in the SST field (25 June 2010, NOAA OISST analysis)



Perturbations of the near-surface temperature front on both sides of the Pacific “cold tongue”. They are supposed to form as a result of shear instabilities of the South Equatorial Current and are manifested in temperature jumps by 1–2°C with the period of 20–40 days and wavelength of 1000–2000 km. They are stronger during the boreal autumn while weakening in spring and during El Niño events.

5-year global high-resolution numerical experiment

INMIO general circulation
model with 0.1° resolution,
CORE-II atmospheric
conditions for 1978-1982

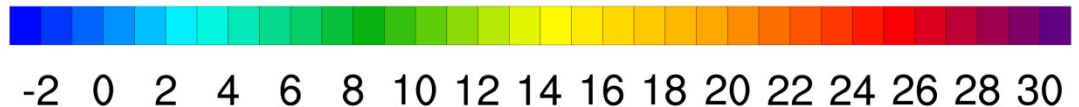
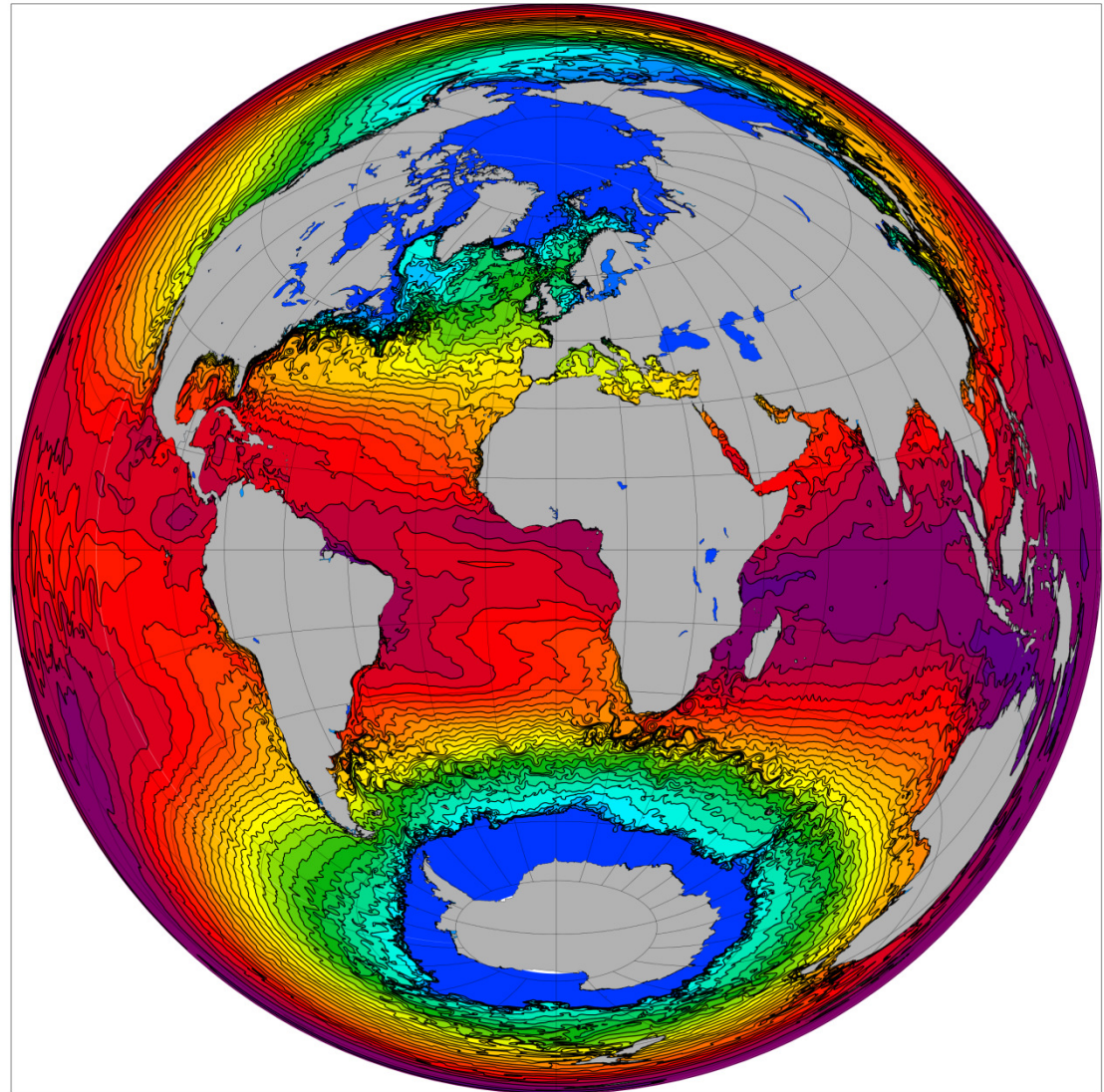
$$A_m = 0$$

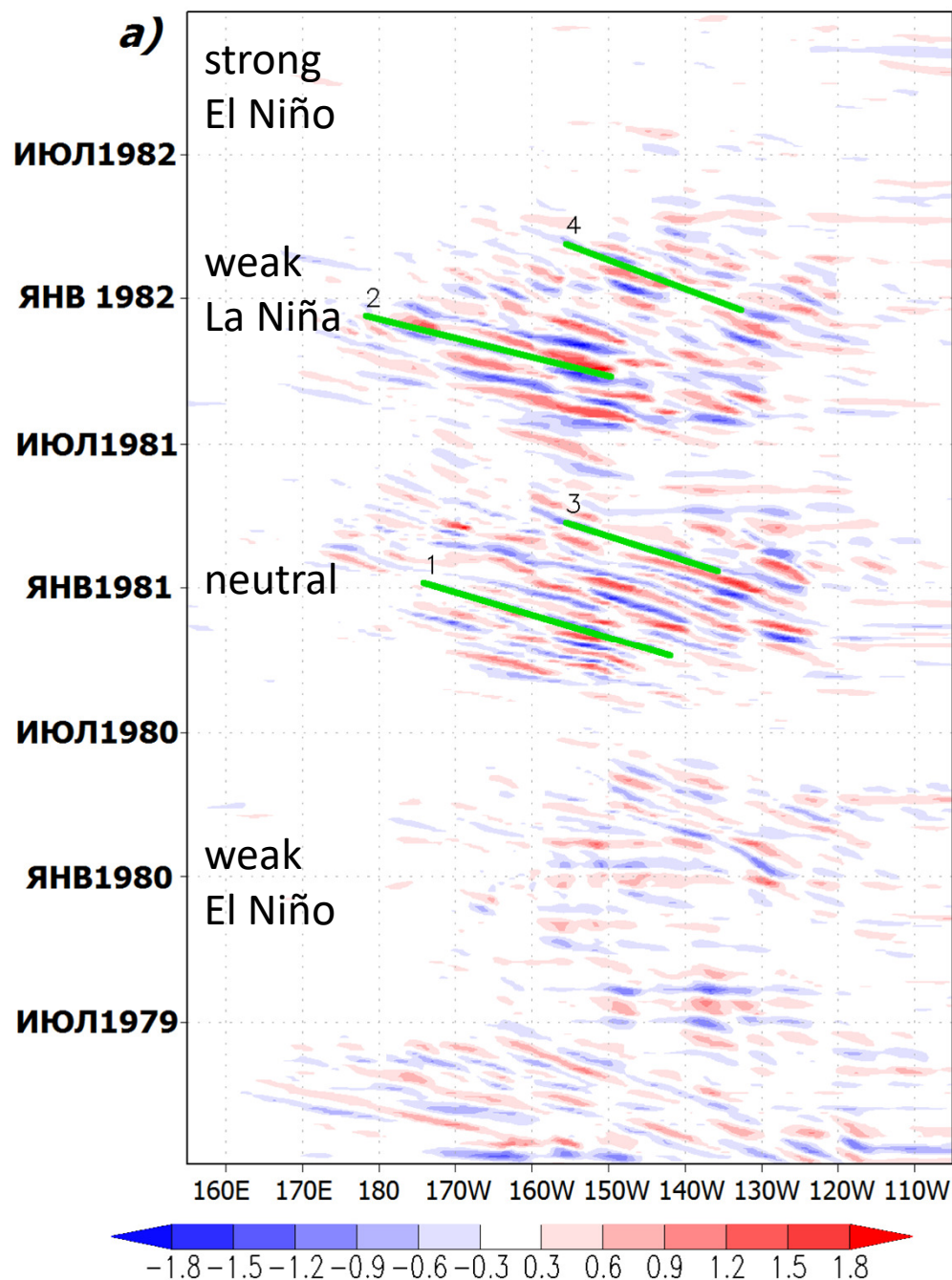
$$A_{m_bh} = -18 \cdot 10^9 \text{ m}^4/\text{s}$$

$$dt = 4 \text{ min.}$$

$$A_h = 100 \text{ m}^2/\text{s}$$

$$dt = 4 \text{ min.}$$





Модельная ТПО (°C) на широте 1°N
– аномалия относительно тренда,
обработанная Фурье-фильтром с
окном пропускания 10-60 дней.

Скорость распространения ВТН:
0.44-0.53 м/с осенью (отрезки 1 и 2)
0.34-0.41 м/с весной (отрезки 4 и 3).

Спутниковые данные 2010 г.
(De Boissésou et al., 2015):
0.62 м/с осенью,
0.48 м/с весной

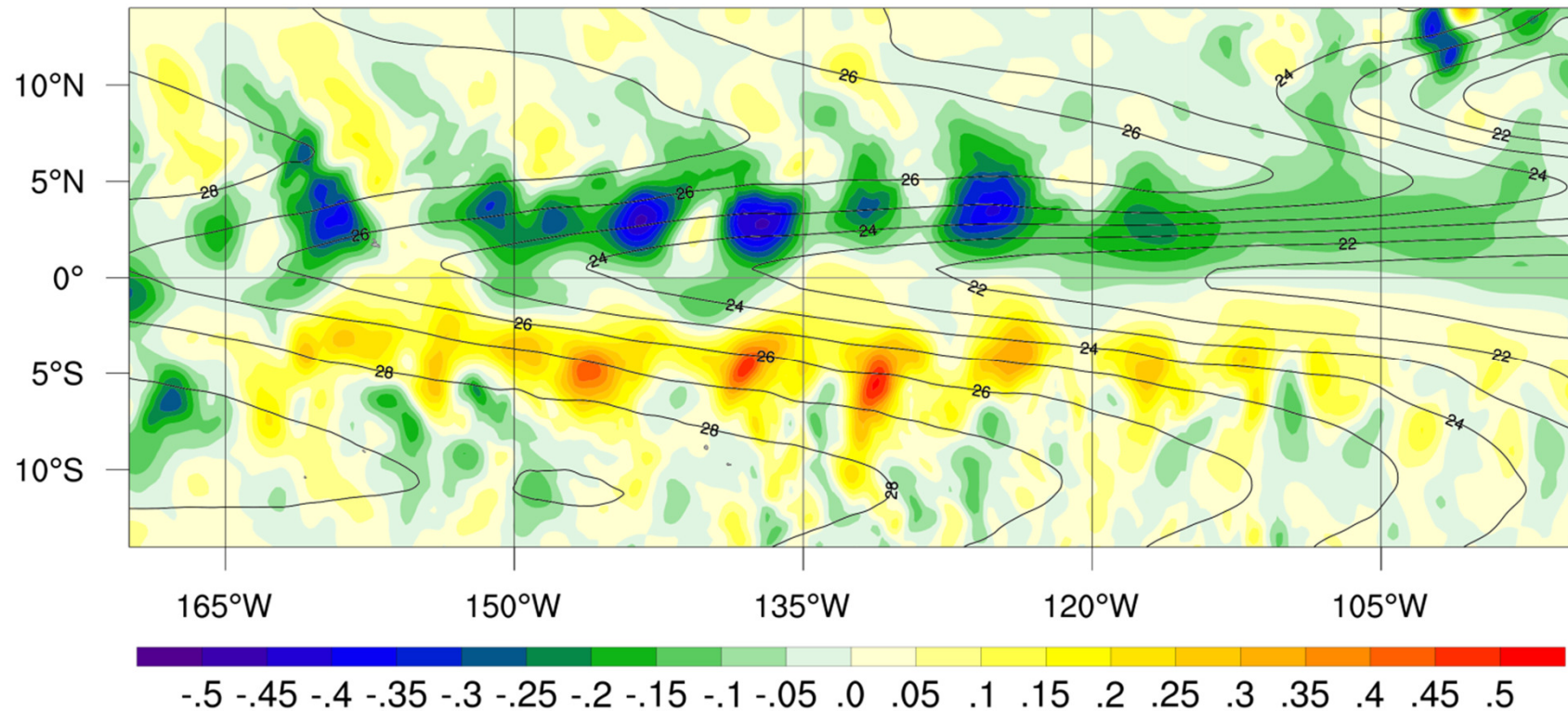
Eddy meridional heat transport

$$Q_E = \underbrace{\iint \rho C_P \theta V dz dx}_{\text{полный явный МПТ}} - \underbrace{\iint \rho C_P \langle \theta \rangle \langle V \rangle dz dx}_{\text{МПТ среднего потока}} - \underbrace{\iint A_h \rho C_P \nabla \theta dz dx}_{\text{параметризованный вихревой МПТ}}$$

полный явный
МПТ

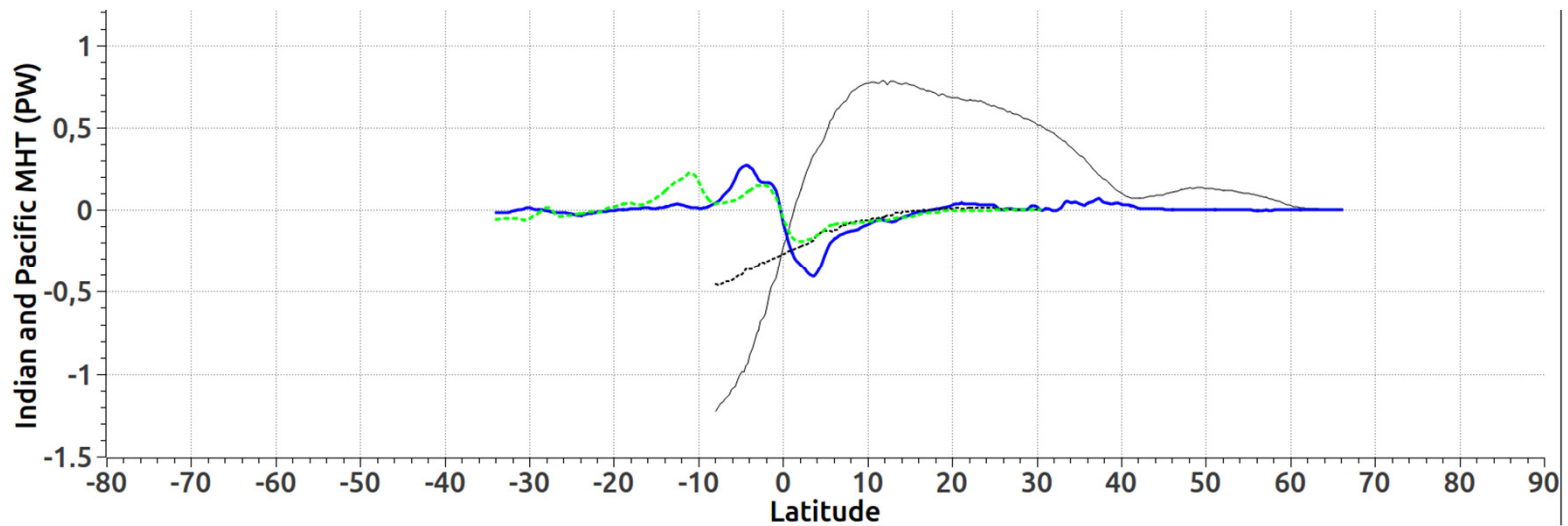
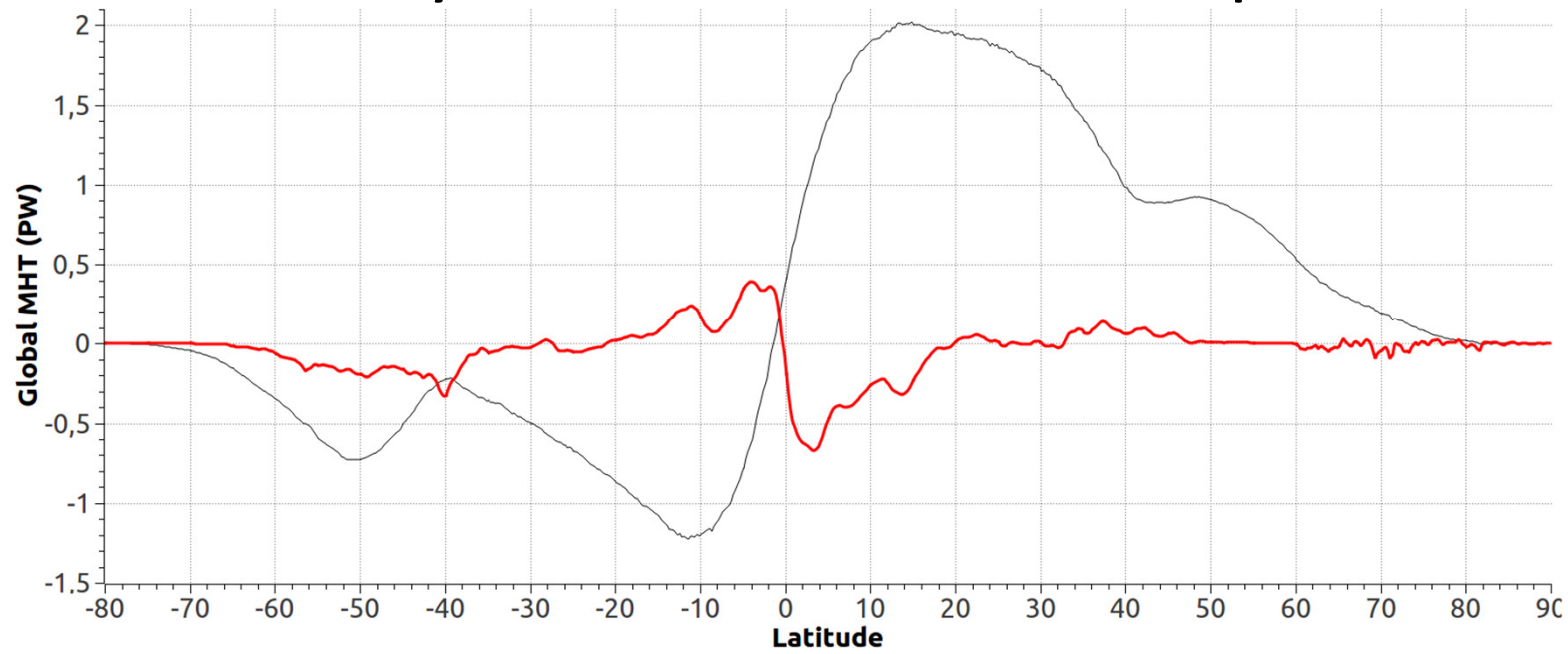
МПТ среднего
потока

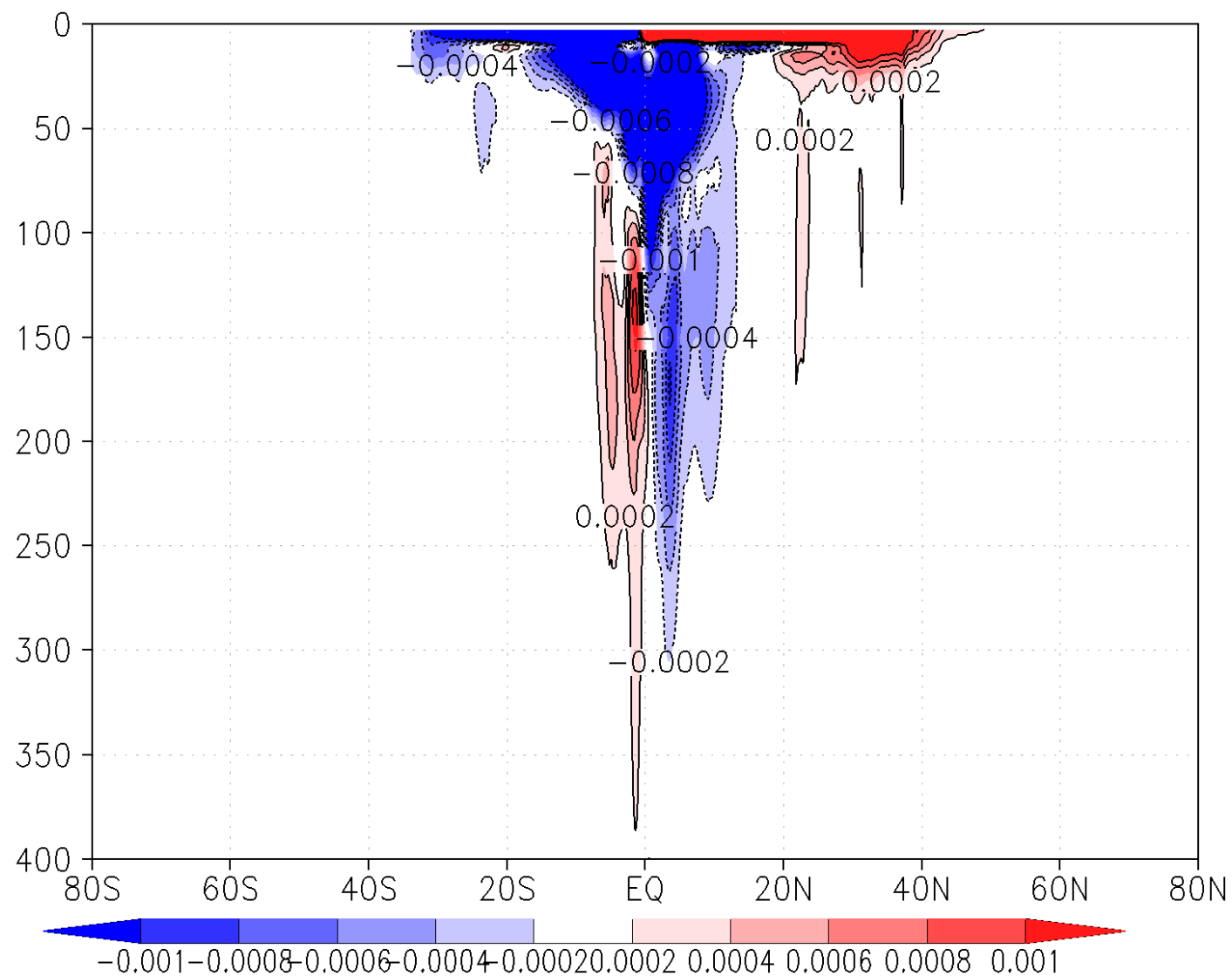
параметризованный
вихревой МПТ



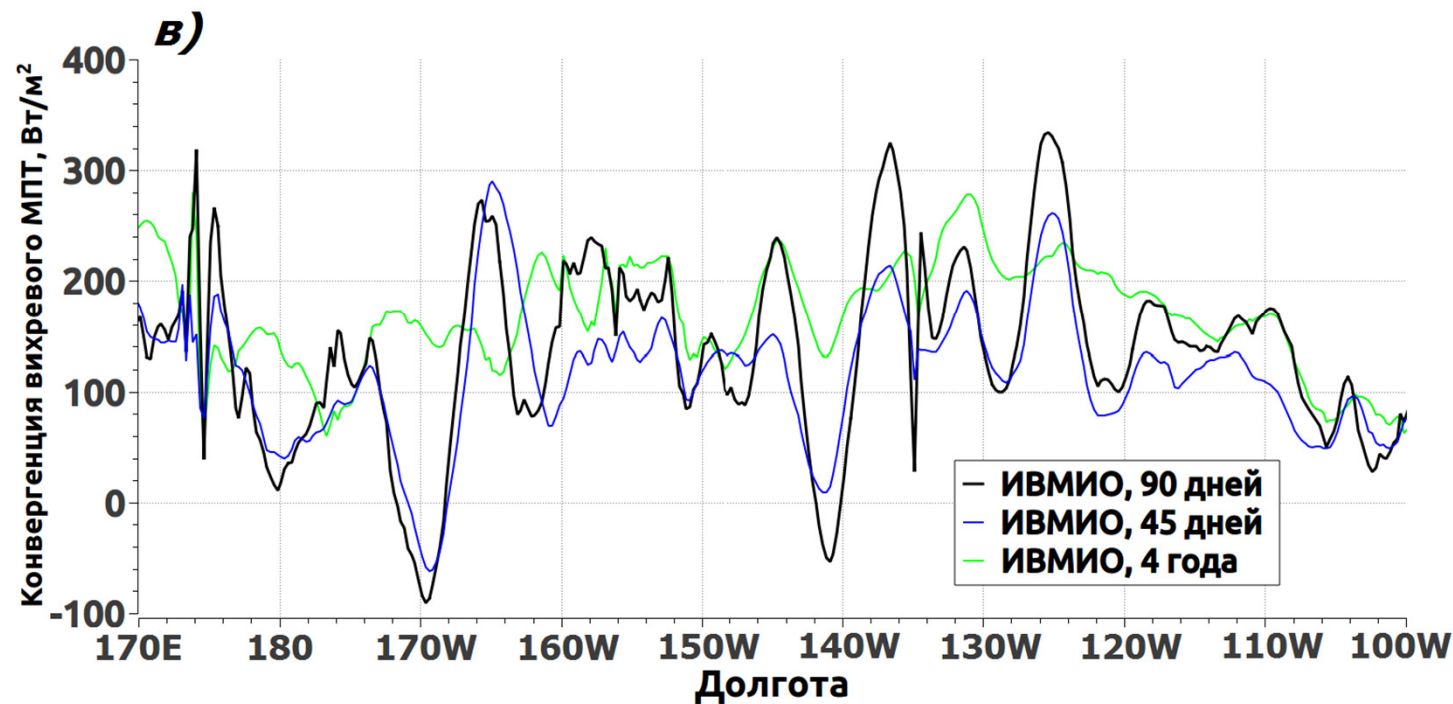
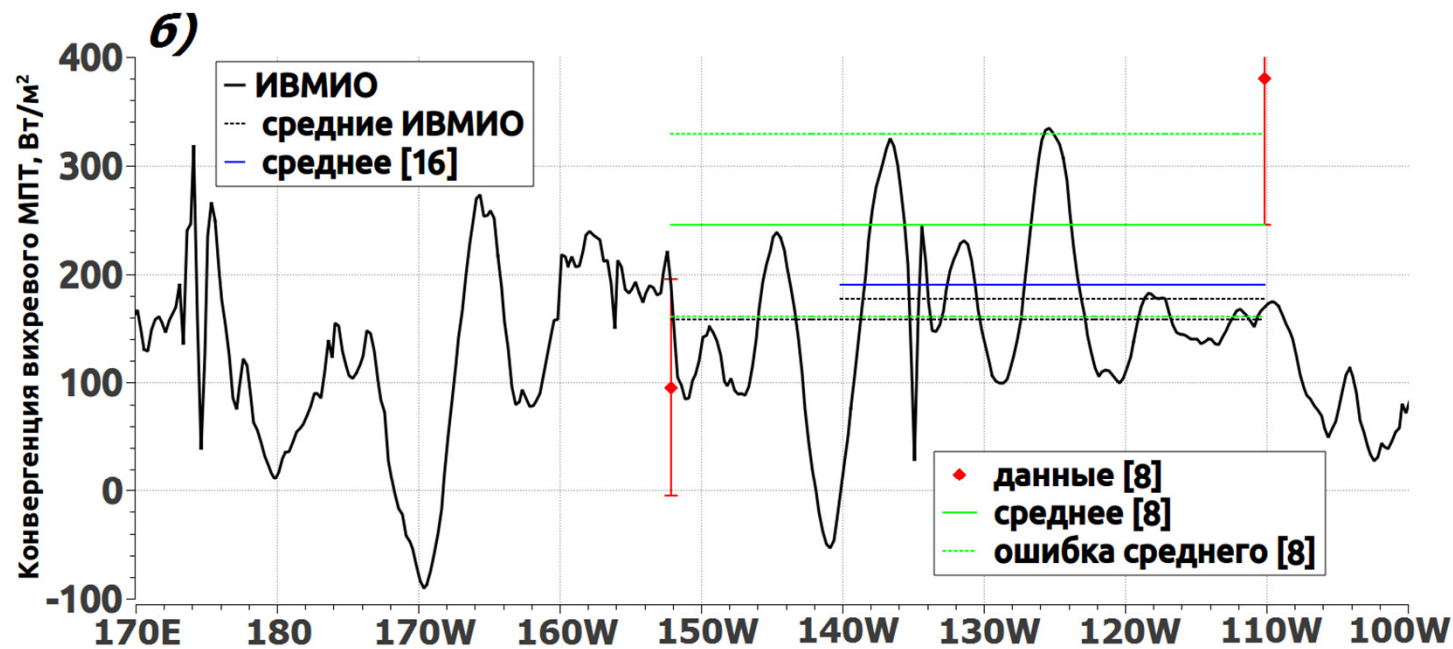
Вихревой МПТ ($\times 10^8$ Вт/м) и температура 100-метрового слоя океана

Eddy meridional heat transport



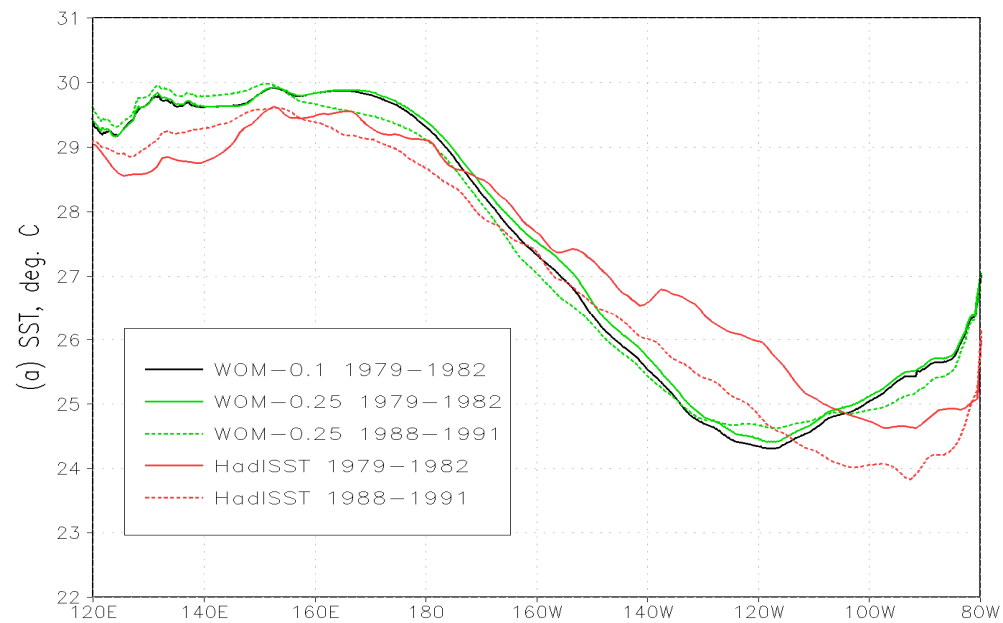


Проинтегрированный по долготе вихревой МПТ (ПВт/м) для
Мирового, Атлантического, Тихого и Индийского океанов

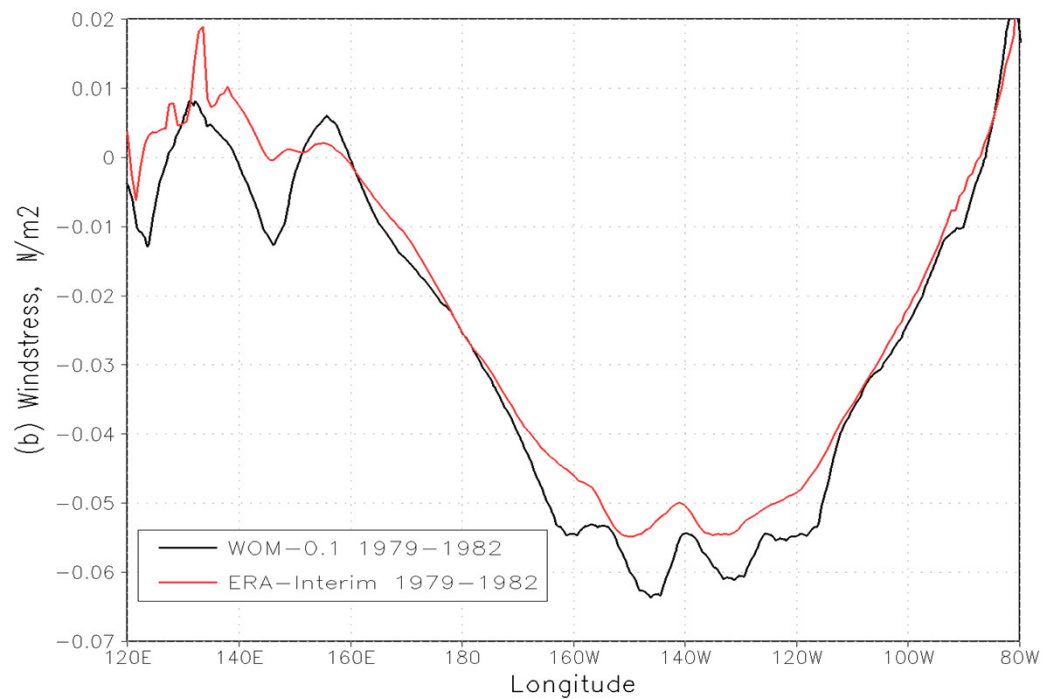


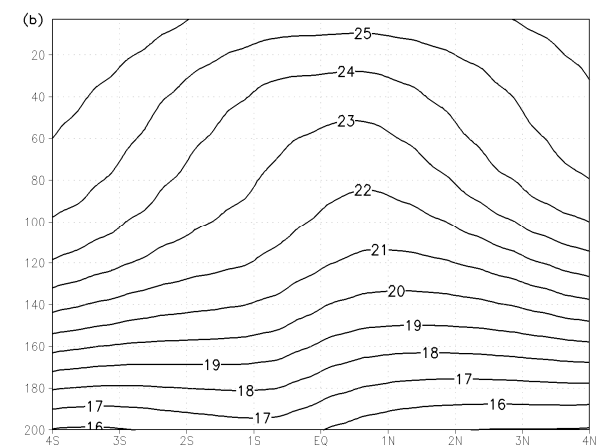
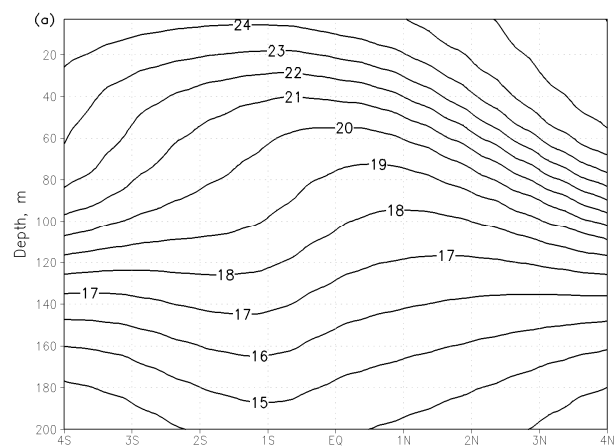
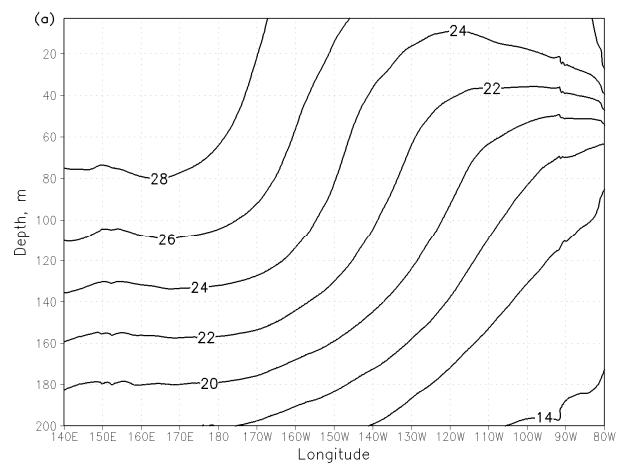
[8] Bryden & Brady, J. Mar. Res., 1989

[16] Jayne & Marotzke, J. Phys. Oceanogr., 2002

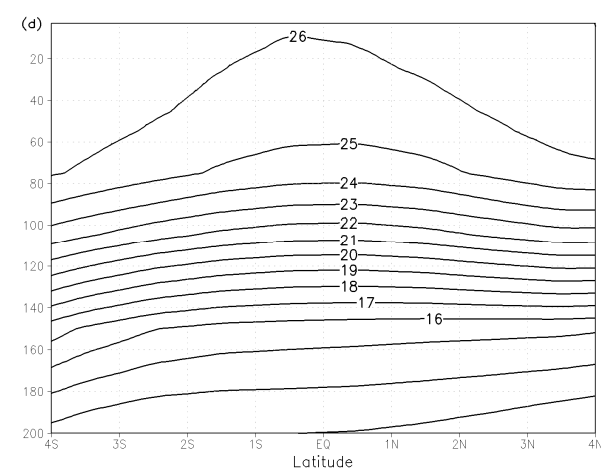
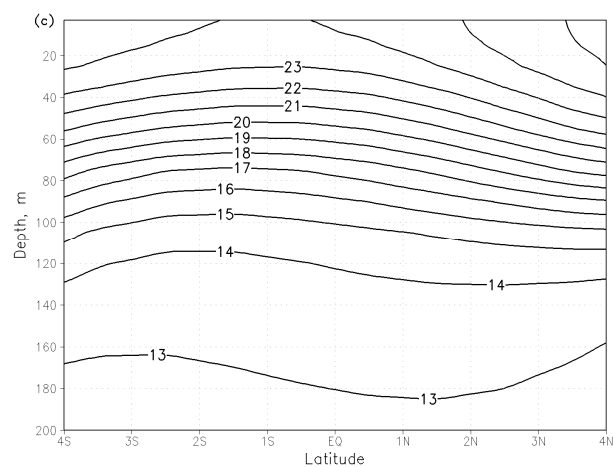
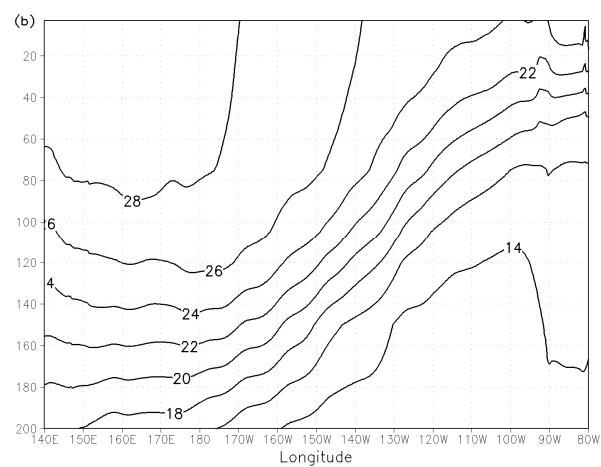


Температура поверхности океана,
напряжение трения ветра,
осреднённые в полосе 2°S – 2°N





термоклин в модели



термоклин в климатологии WOA09



экватор



110°W



140°W

Характерные ошибки моделей:

- Занижение скорости распространения ВТН

Спасибо за внимание!

<http://model.ocean.ru>