

# Performance of Mixed Layer Models in the Mediterranean Sea

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# Report Documentation Page

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## The vertical mixing models in HYCOM

- KPP** → Large et al. (1994)
- GISS** → Canuto et al. (2002)
- MY2.5** → Mellor and Yamada (1982)
- KT** → Kraus and Turner (1967)
- PWP** → Price et al. (1986)

*We would like to answer the question:*

How do these different mixed layer models perform under a given atmospheric forcing?

# Ocean Model

- **HYbrid Coordinate Ocean Model (HYCOM)**
- **Ocean basin:** Mediterranean Sea
  - 20–layers
  - 3 m top layer thickness
- **Model resolution:**  $1/25^\circ \cos(lat) \times 1/25^\circ$ 
  - average grid resolution is  $\approx 3.5$  km.
- **Heat fluxes:**
  - Shortwave radiation attenuation: turbidity
  - Blackbody longwave radiation correction
  - Bulk formulae for latent and sensible heat based on model SST

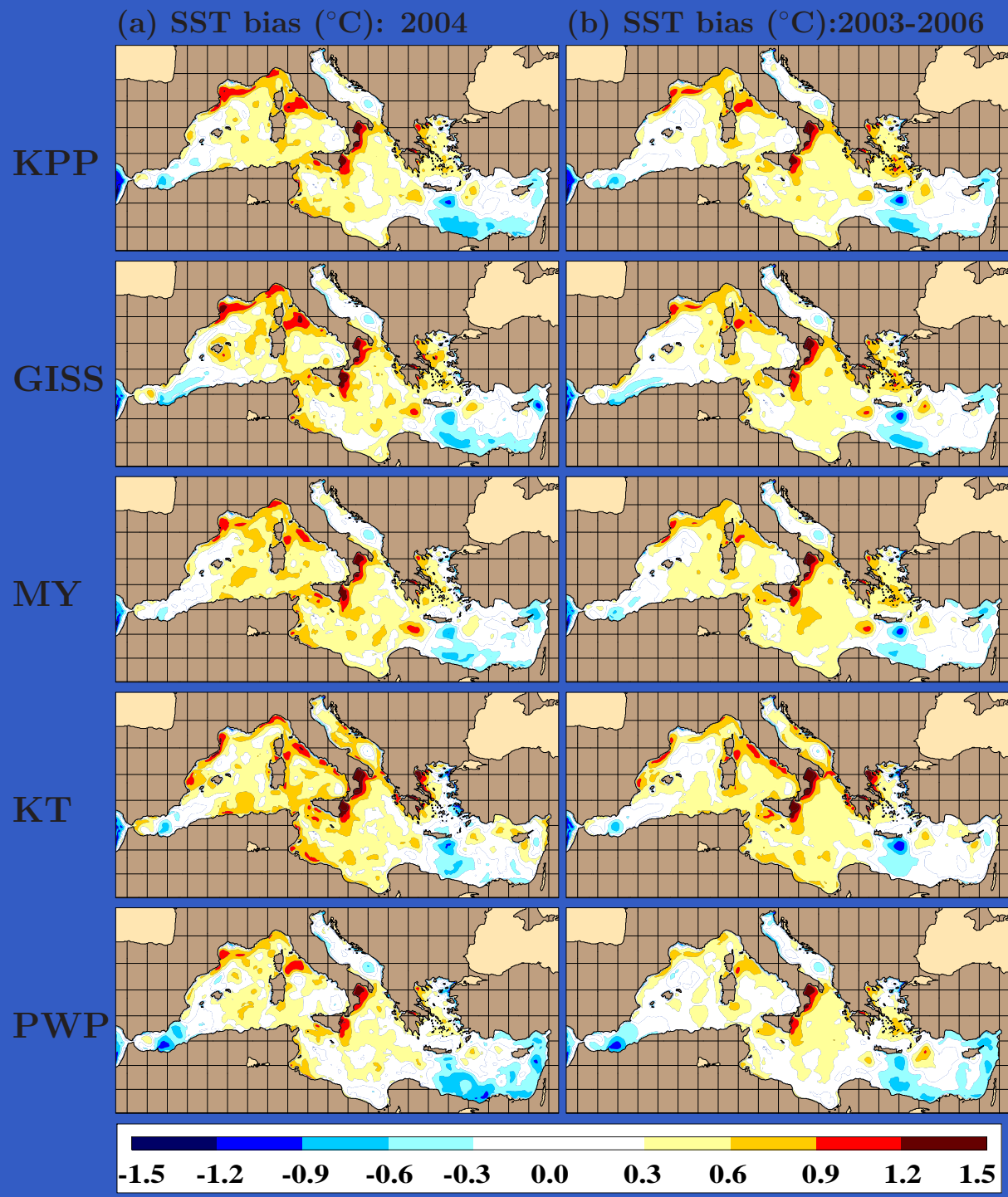
# Mediterranean Sea HYCOM simulations

<b>Simulation period</b>	2003 through 2006
<b>Atmospheric forcing</b>	3 hourly NOGAPS
<b>T and S initialization</b>	GDEM3 climatology
<b>Data assimilation</b>	None
<b>Relaxation to SST</b>	None
<b>Relaxation to salinity</b>	sea surface salinity

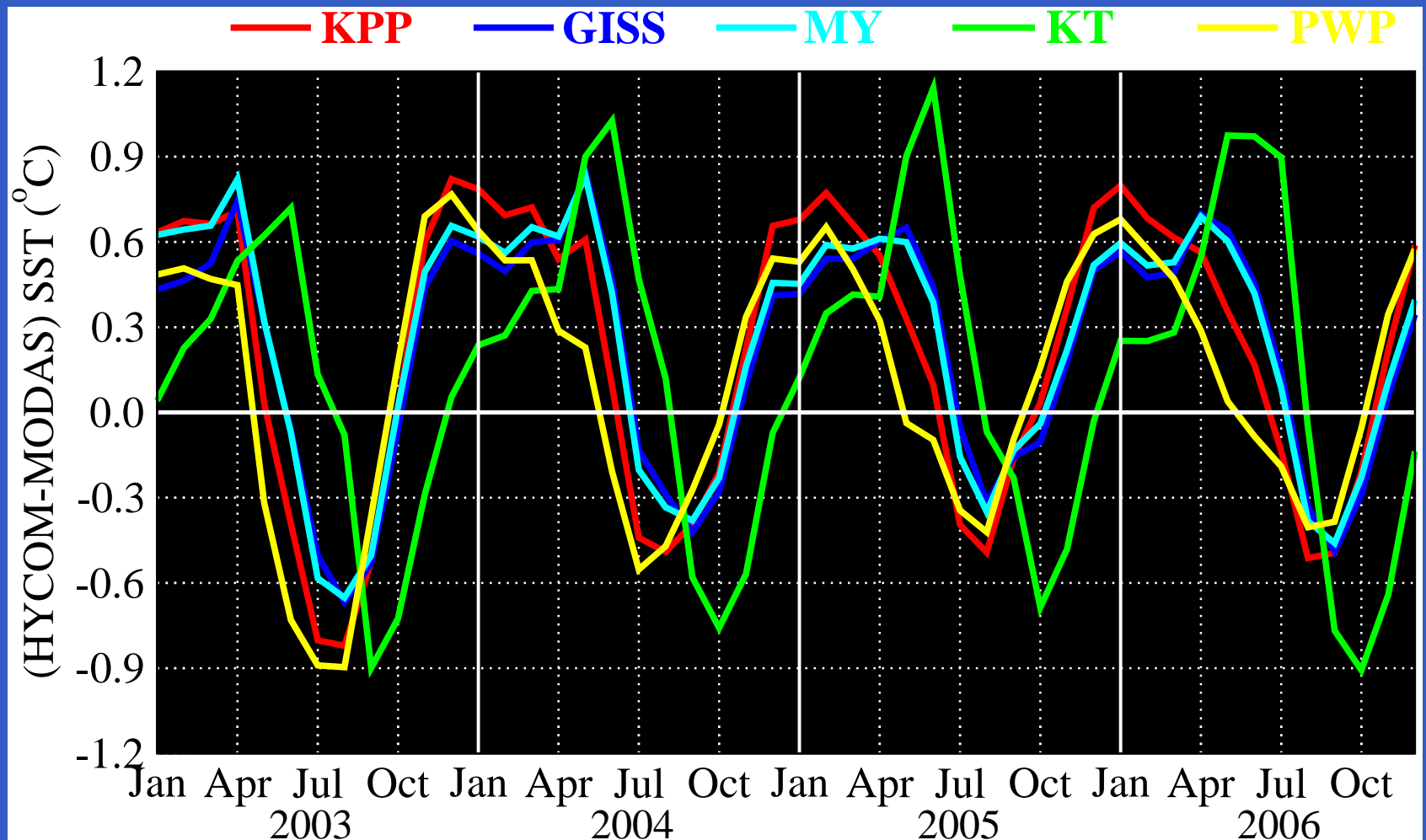
**NOGAPS:** Navy Operational Global Atmospheric  
Prediction System

**GDEM:** Generalized Digital Environmental Model (v3)

# Mean SST Bias from Mixed Layer Models

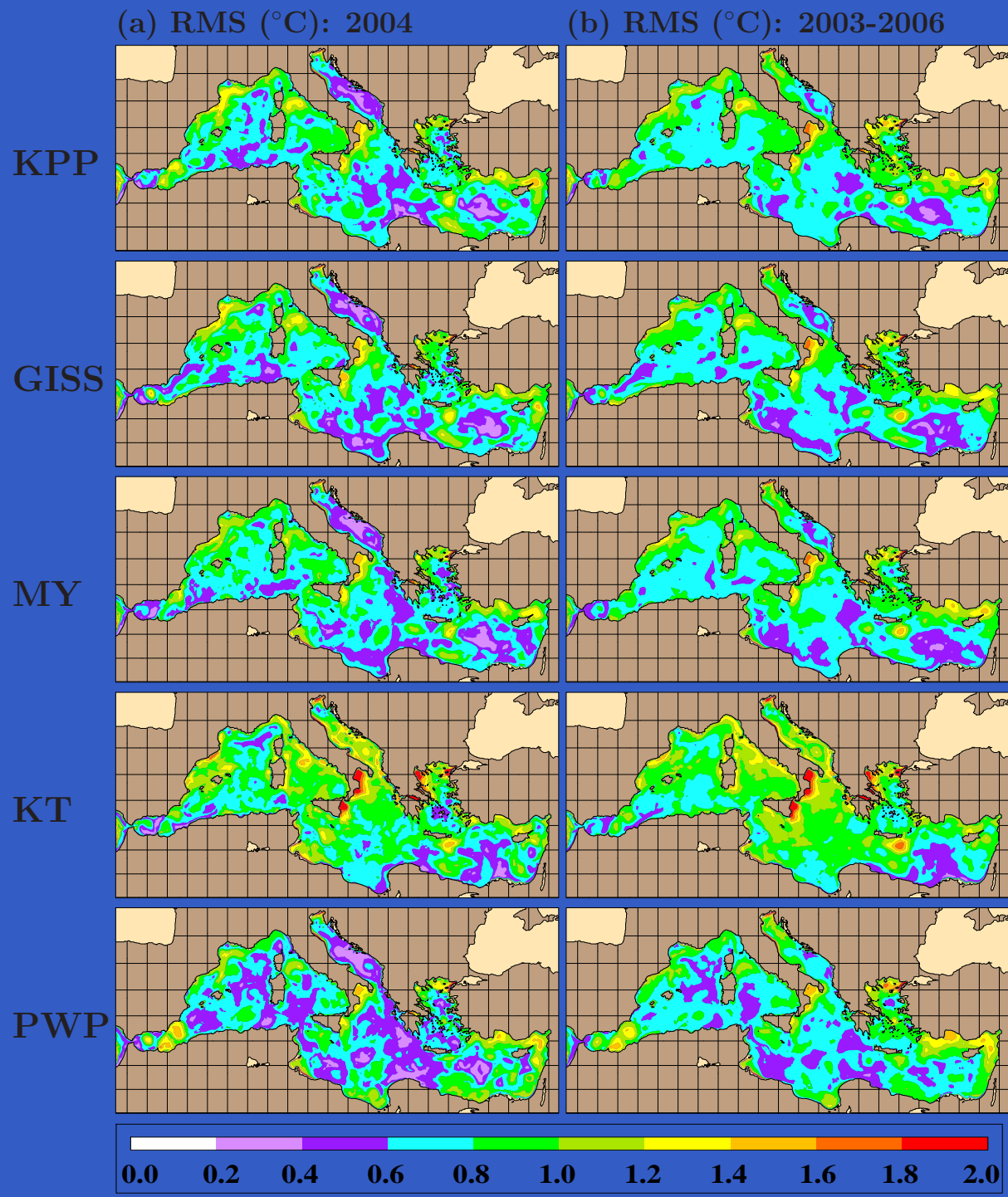


# Basin-Averaged Monthly Mean SST Bias: 2003–2006



Annual mean bias is  $\approx 0.1^\circ\text{C}$  from all models.

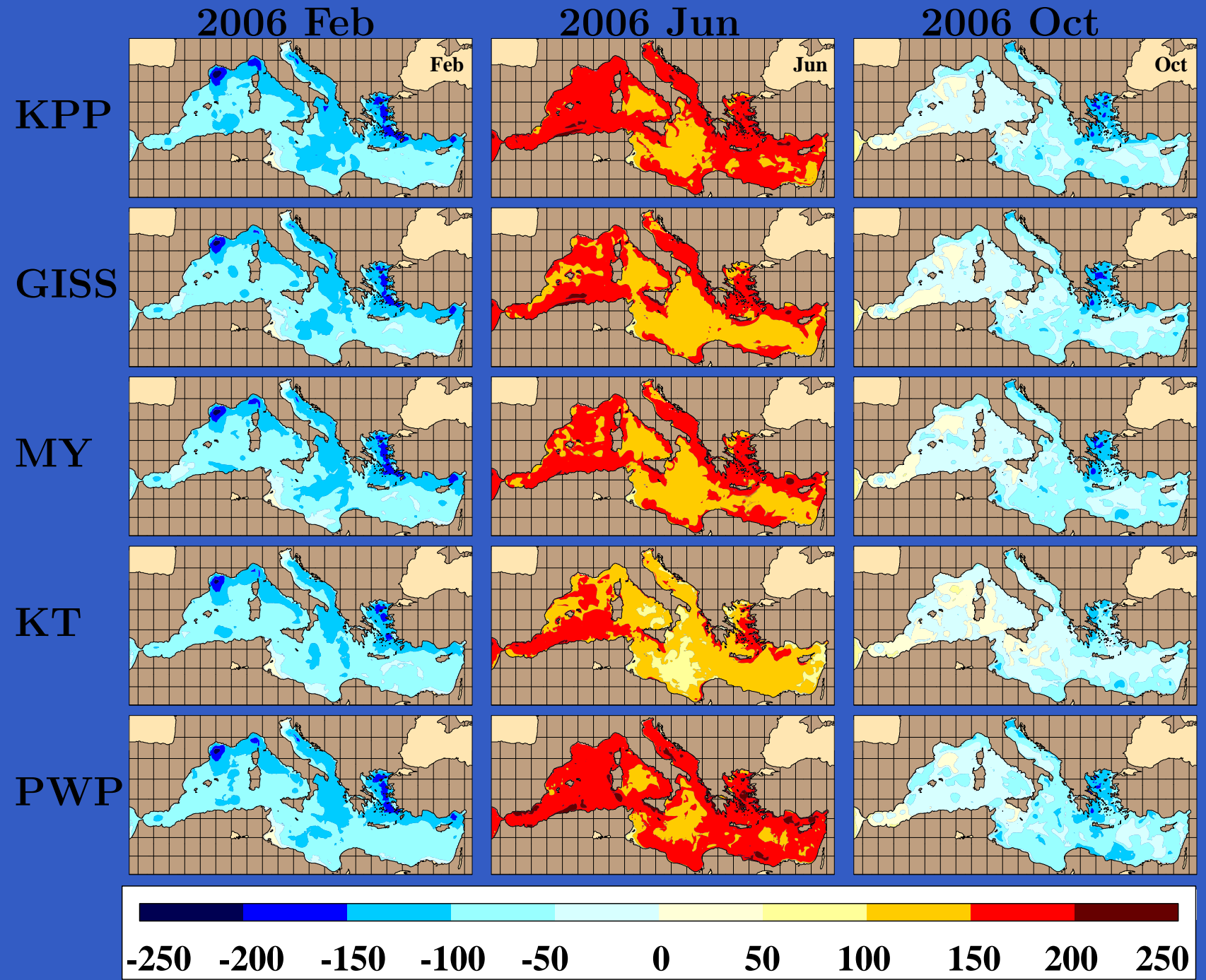
# RMS SST Difference from Mixed Layer Models



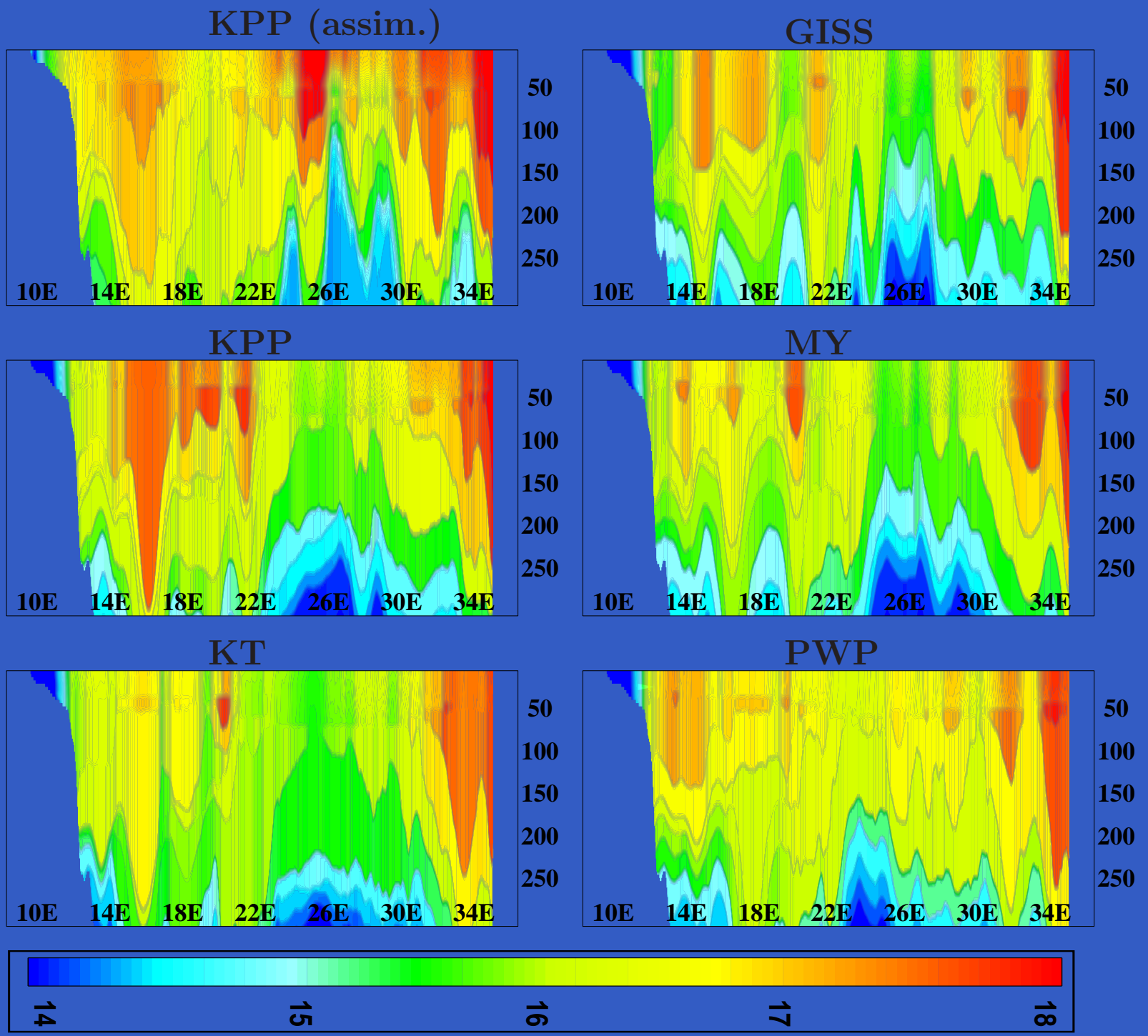
# Basin-Averaged RMS SST Difference (°C) by Year

	2003	2004	2005	2006	2003-2006
KPP	0.86	0.78	0.79	0.78	0.81
GISS	0.79	0.76	0.76	0.76	0.78
MY	0.83	0.75	0.74	0.75	0.78
KT	0.88	0.88	0.90	0.96	0.91
PWP	0.90	0.73	0.74	0.73	0.79

# Net surface heat flux ( $\text{W m}^{-2}$ )



# Subsurface temperatures ( $^{\circ}\text{C}$ ): February 2006



# Summary and Conclusions

- All mixed layer models perform similarly:
  - validation against MODAS SST
  - 0.8°C RMS difference
- Upwelling from each model varies.
- Changes in the net surface heat flux
  - 50 W m<sup>-2</sup> difference from KT
- Future work:
  - mixed layer depth analysis
  - comparisons to ARGO, WOA profiles