# Does the intra-seasonal variability (ISV) impact the cold tongue development in the eastern equatorial Atlantic?


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# OUTLINE

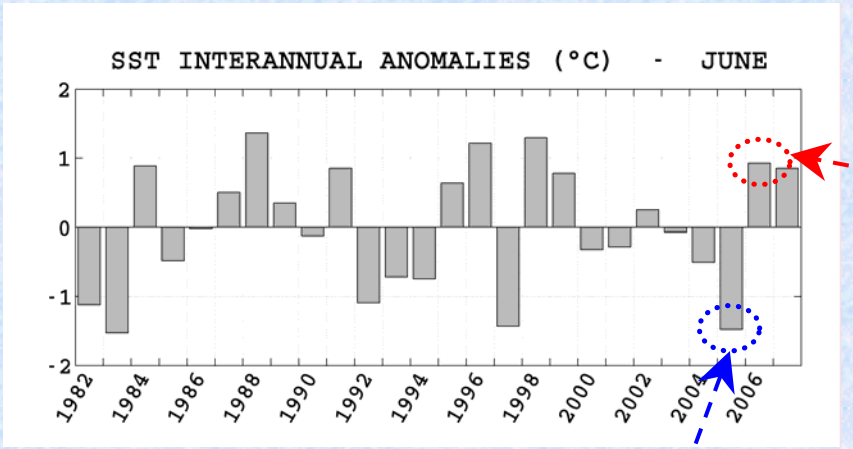
**I. Example of the equatorial cold tongue onset in 2005 and in 2006**

***(Marin et al., JPO 2009)***

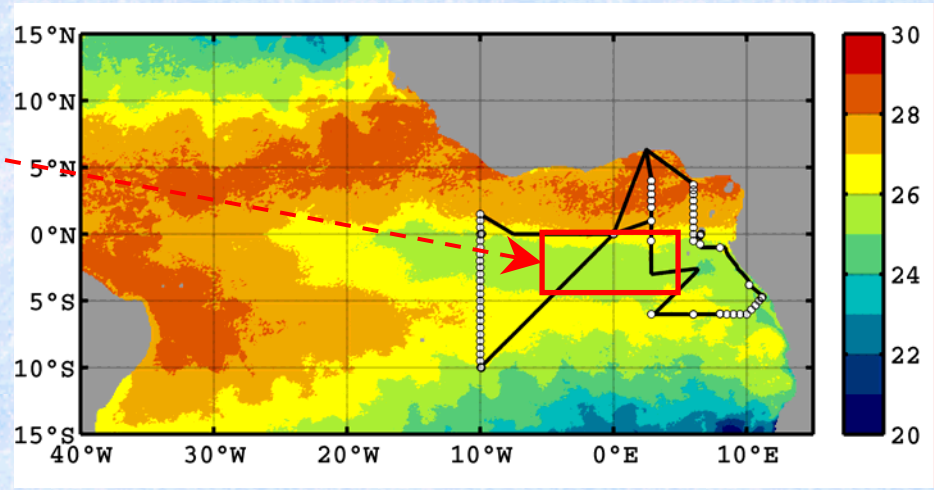
**II. Properties of the ISV in the eastern equatorial Atlantic**

**III. Impact of the ISV for the surface mixed-layer heat budget**

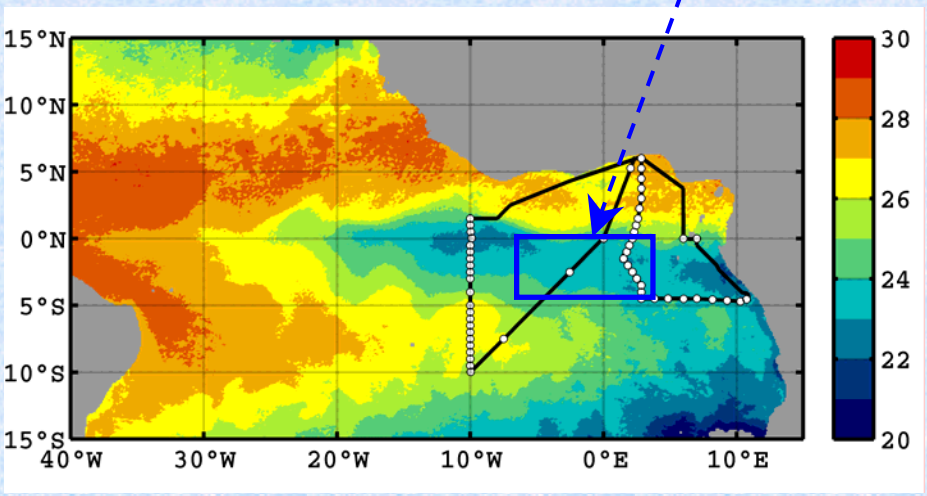
# Interannual variability of the Atlantic cold tongue in 2005-2006




**SST SAFOSI (mid-June 2006 – EGEE3)**




**SST SAFOSI (mid-june 2005 – EGEE1)**

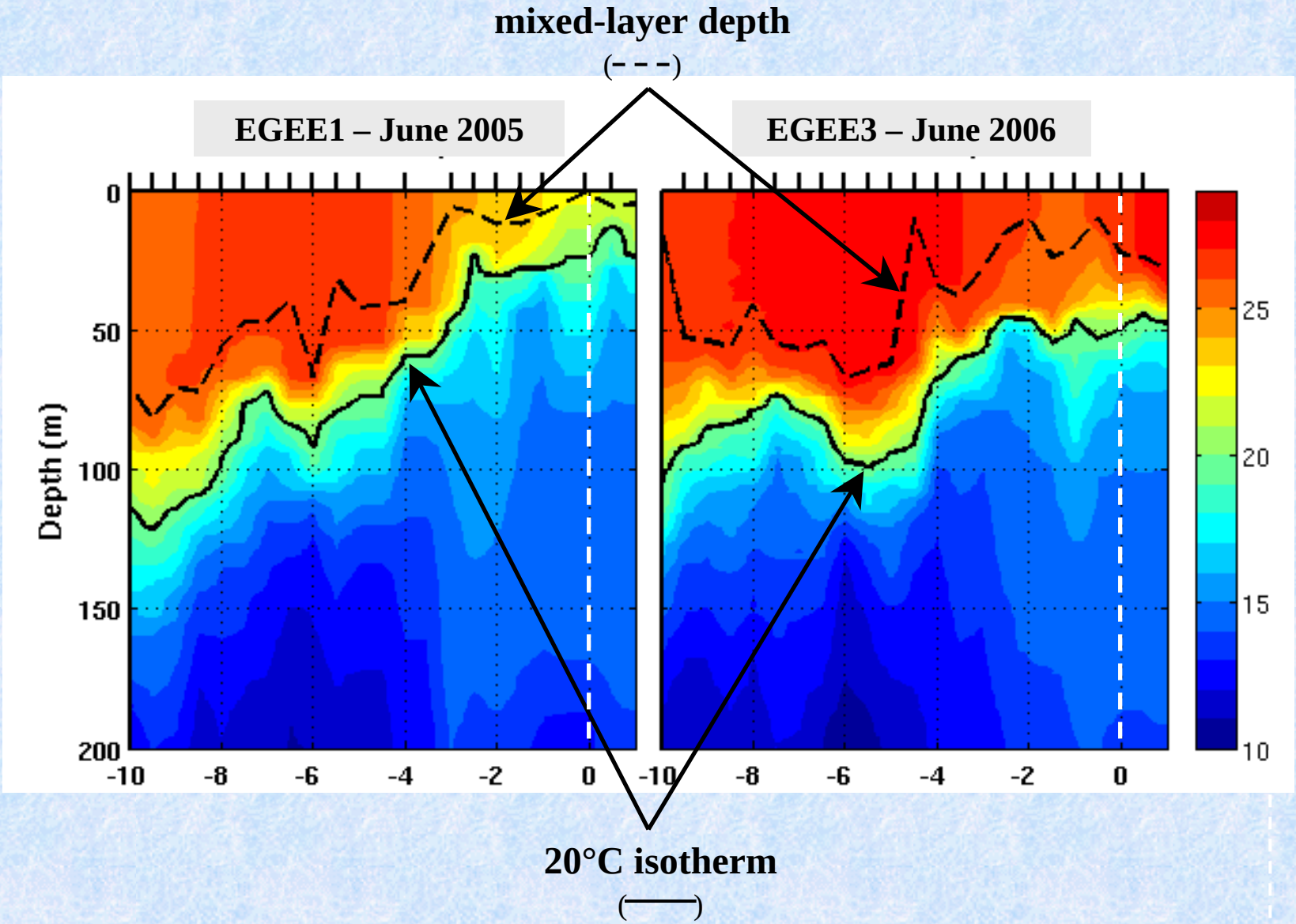



**Colder sea surface conditions in June 2005 than in June 2006**

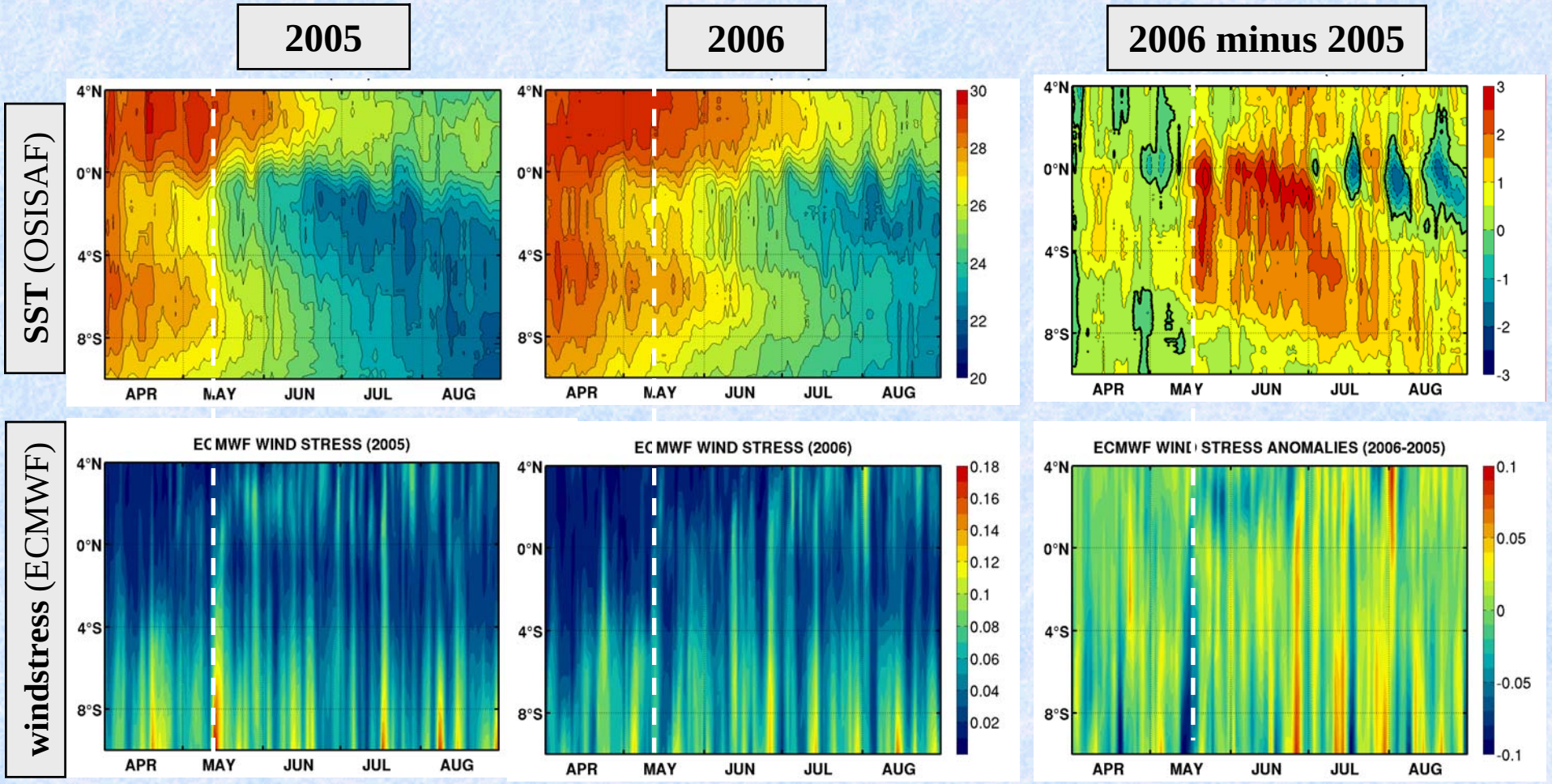
**2005-2006: extreme events for the SST interannual variability of the last 25 years**

***(Marin et al., 2009)***

# Hydrological conditions along 10°W during June 2005 and June 2006



# Time-latitude evolution of SST and wind stress magnitude (4°W-4°E)

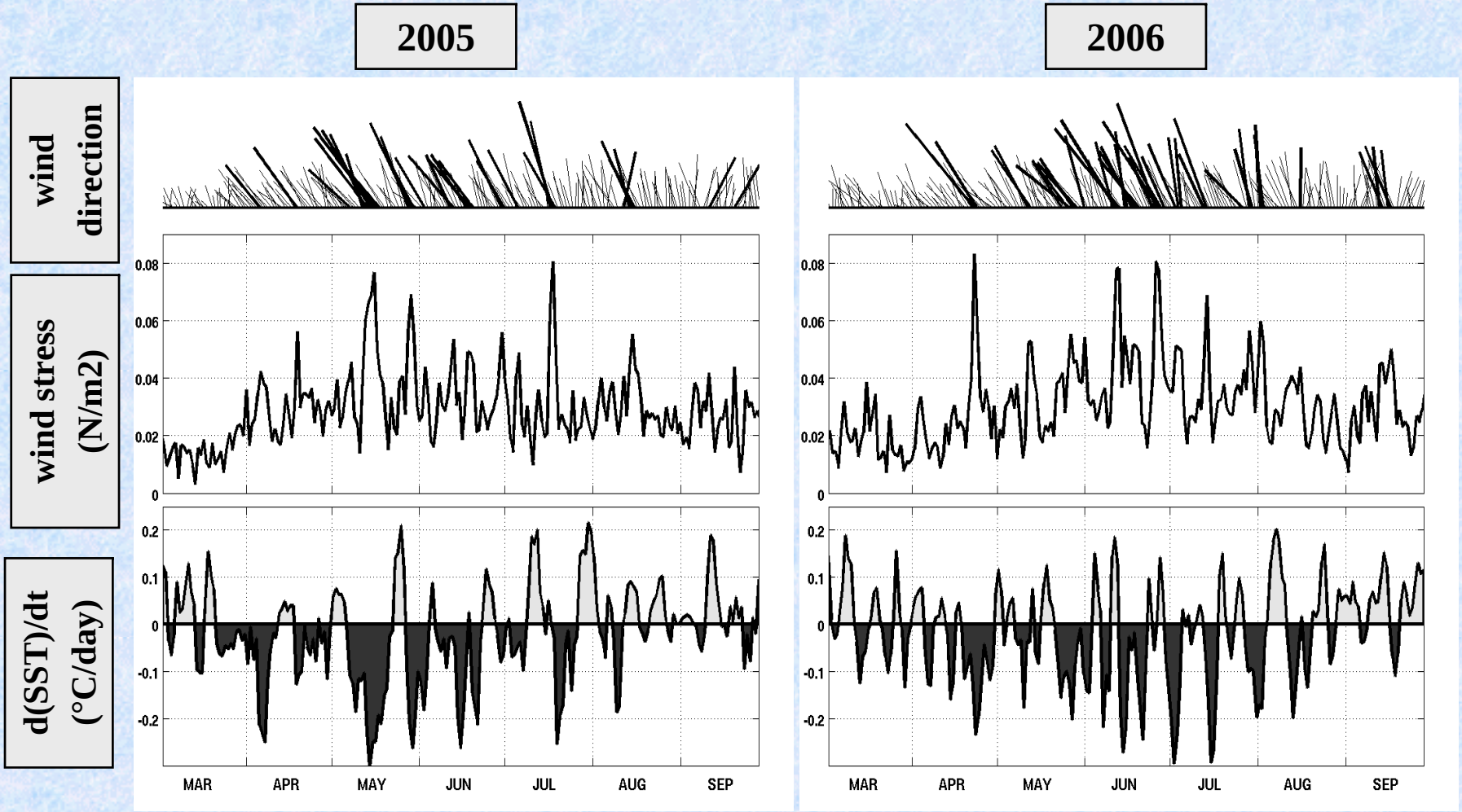



⇨ **rapid and intense cooling in 2005 in response to the intra-seasonal intensification of the winds**

**+ intra-seasonal meridional migration of the SST front north of the cold tongue**

# SST cooling vs. intra-seasonal fluctuations of the wind stress magnitude

**(spatial average between 4°W-4°E and 4°S-0°N)**

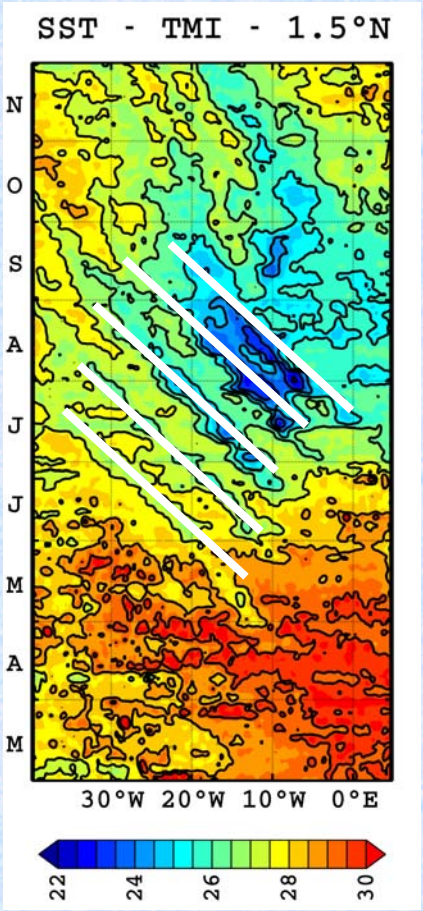


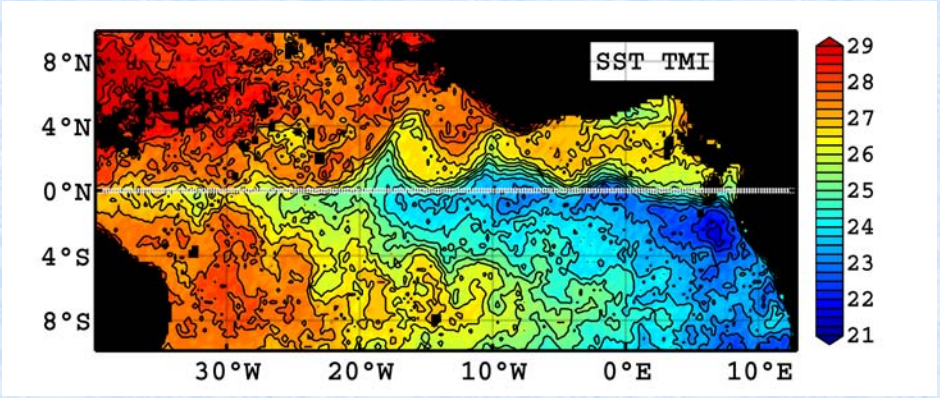

⇨ **Intense and short-duration cooling events through the cold tongue season**

# II. Properties of the intra-seasonal variability in the eastern Atlantic

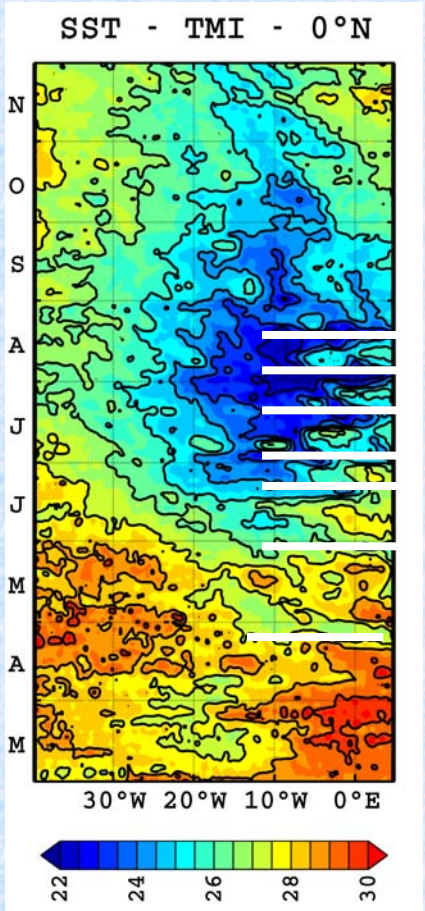
**SST distribution – 15 July 2006**

**1.5°N - 2006**




**0°N - 2006**




**standing intra-seasonal variability along the equator (east of 10°W)**

**vs.**

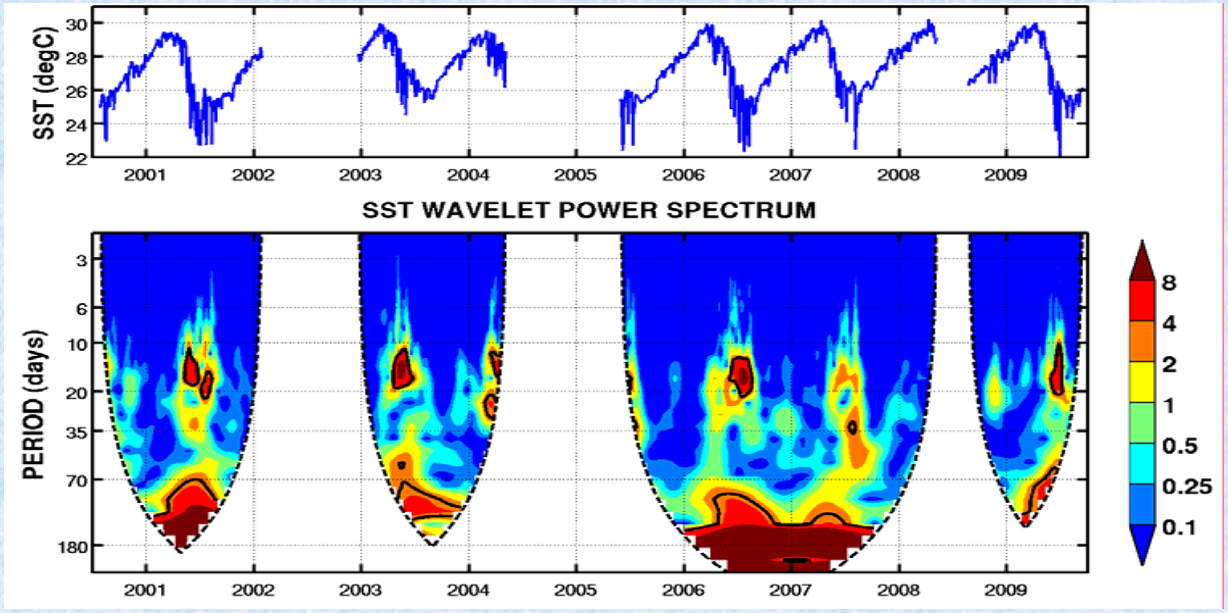
**westward-propagating Tropical Instability waves at 1.5°N (west of 10°W)**

***Athié et Marin (2008)***

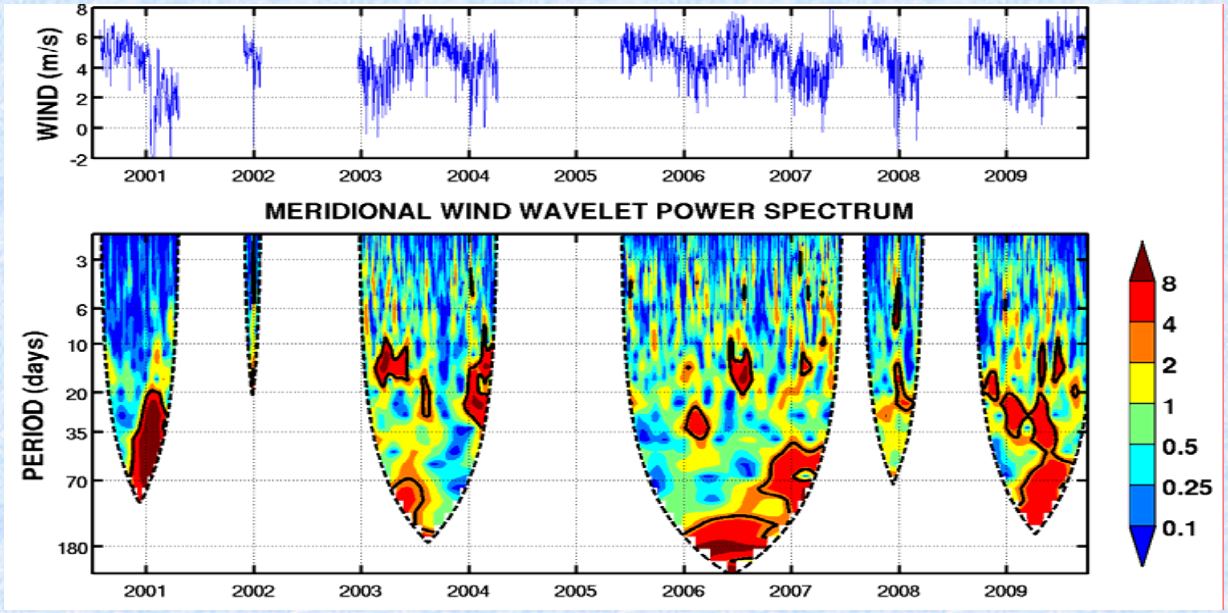
**PIRATA mooring**

**(0°N – 0°E)**

**Sea Surface Temperature**




**Meridional winds**



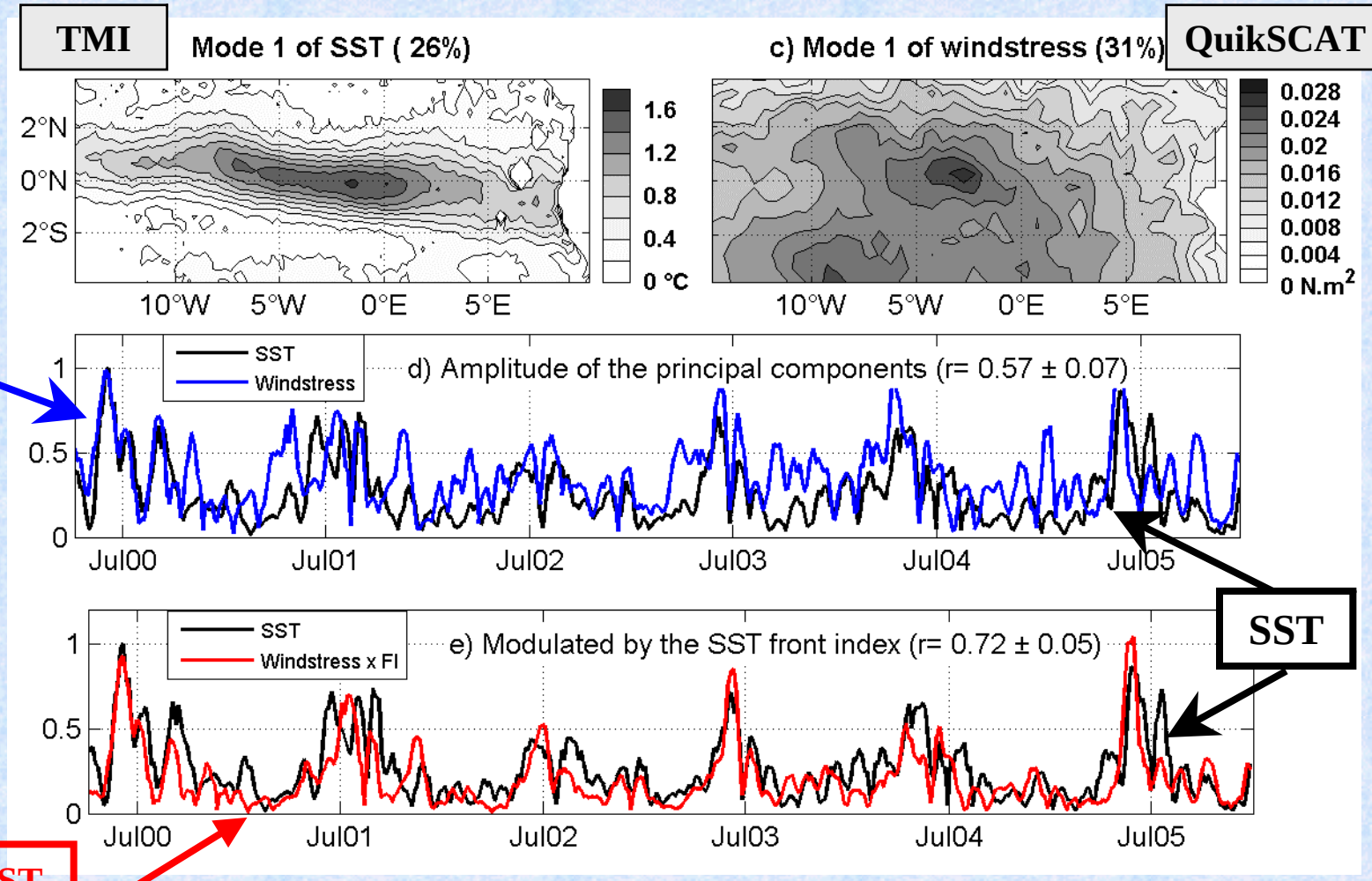

⇨ **Predominance of a wind-forced 15-day variability at 0°N-0°E**

***(see also Garzoli, 1987; Houghton and Colin, 1987; Han et al., 2008)***

# EOF analysis of the 10-20 day variability in the Gulf of Guinea (15°W-10°E – 4°S-4°N)

**Spatial modes**

**Temporal evolution**




**windstress**

**SST**

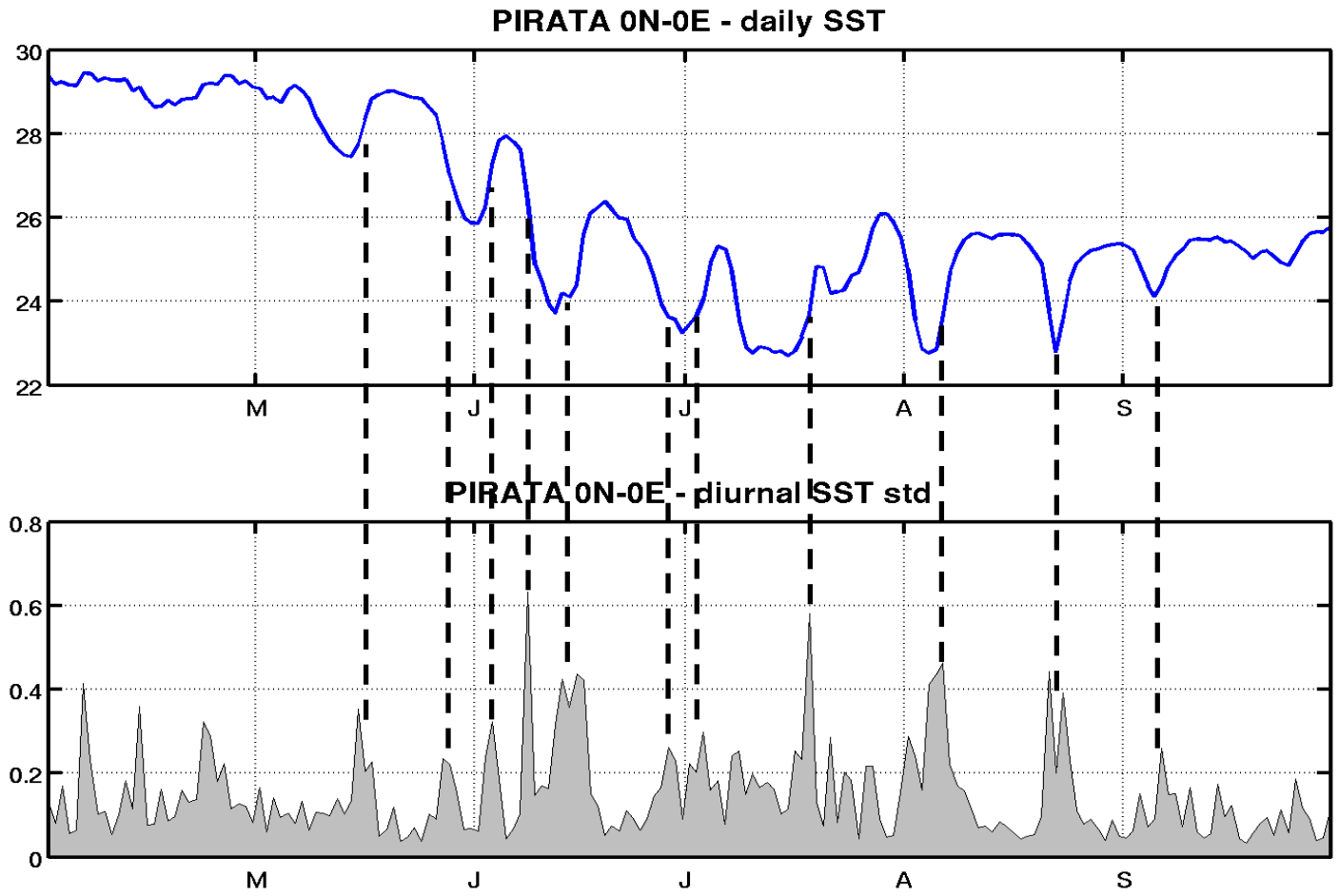
**Windstress * SST front magnitude**

**⇨ The 10-20 day variability is wind-forced, but seasonally-modulated by the presence of the SST front north of the cold tongue**

**+ potential role of the ocean/atmosphere coupling (de Coetlogon et al., QJRMS 2010)**

# Potential impact of 15-day variability on the diurnal cycle?

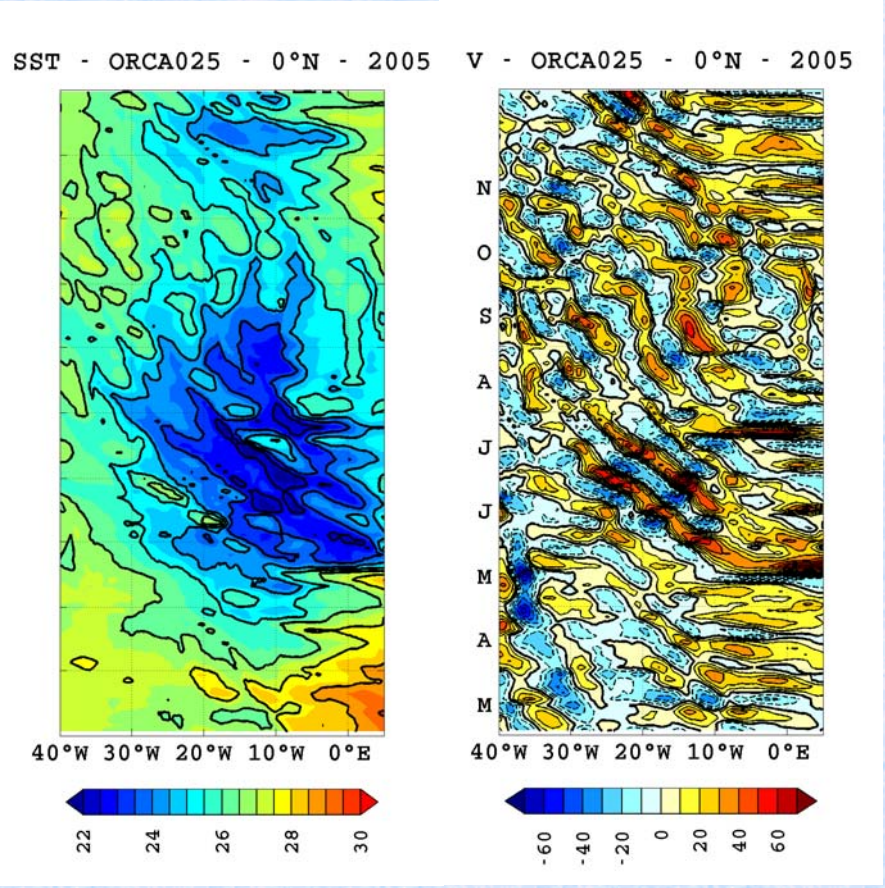
**2001**



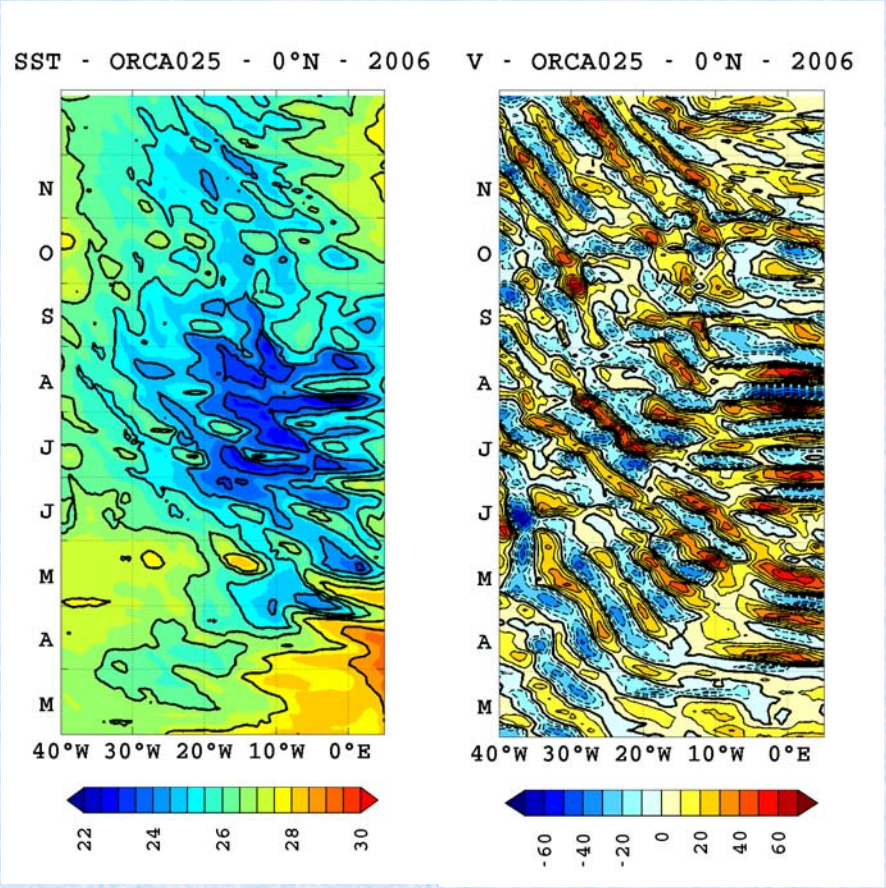
# III. Impact of the 15-day variability on the surface mixed-layer heat budget

**OPA - ORCA simulation (1/4° resolution, forced by ECMWF atmospheric fluxes, 3-day outputs)**

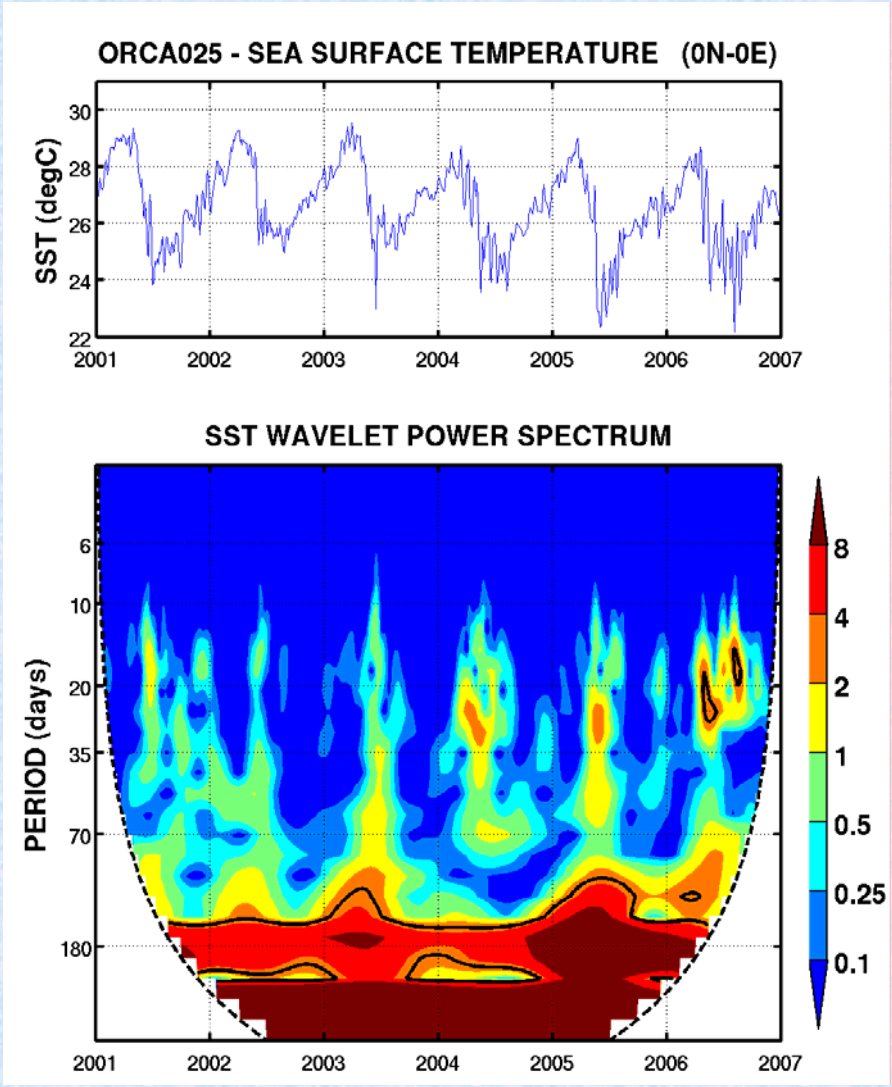
**2005**

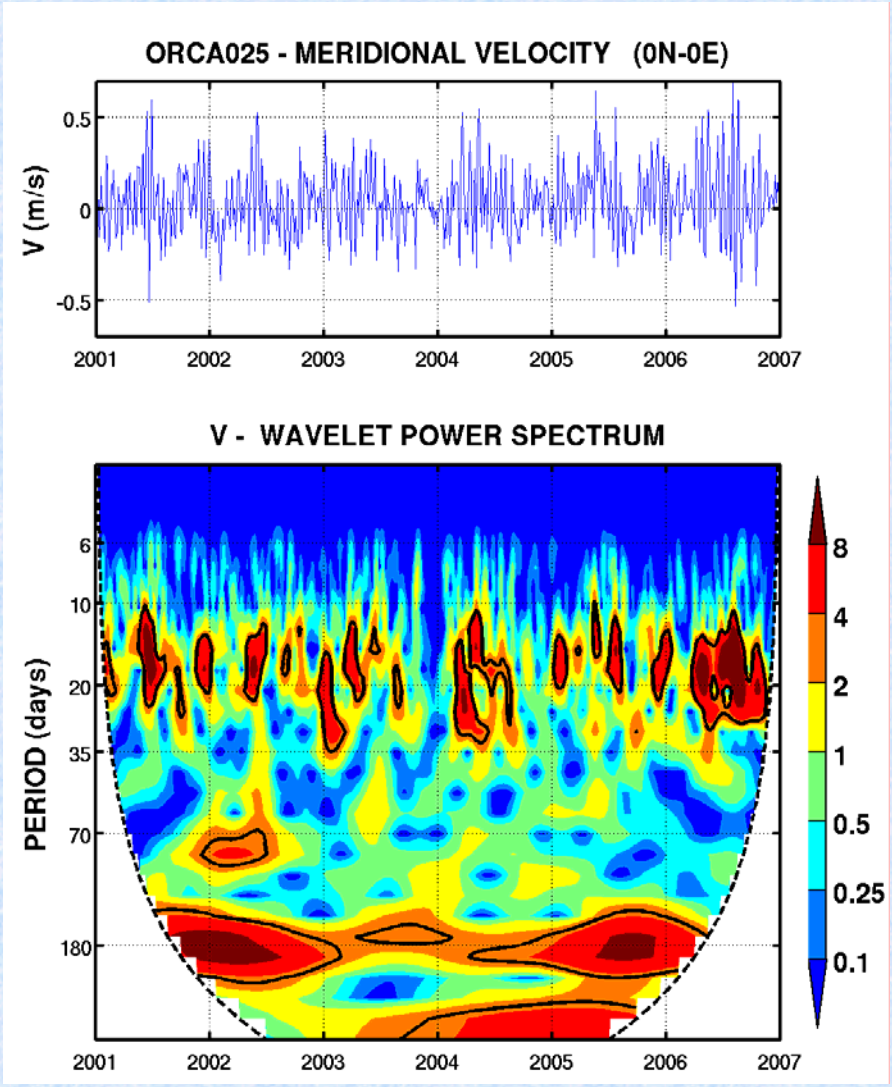



**2006**

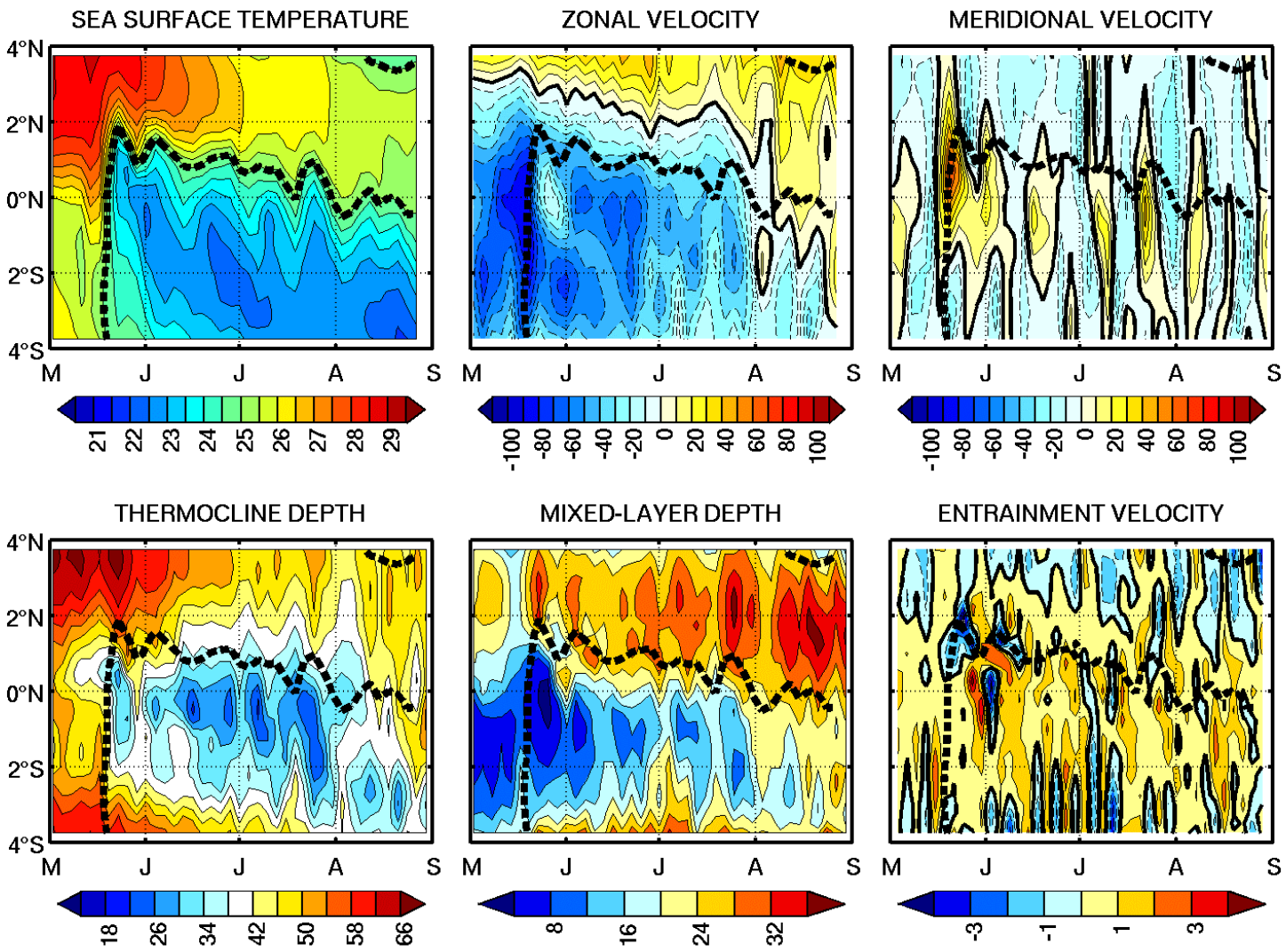


# Wavelet spectrum of SST and V at 0°N-0°E from ORCA025 model

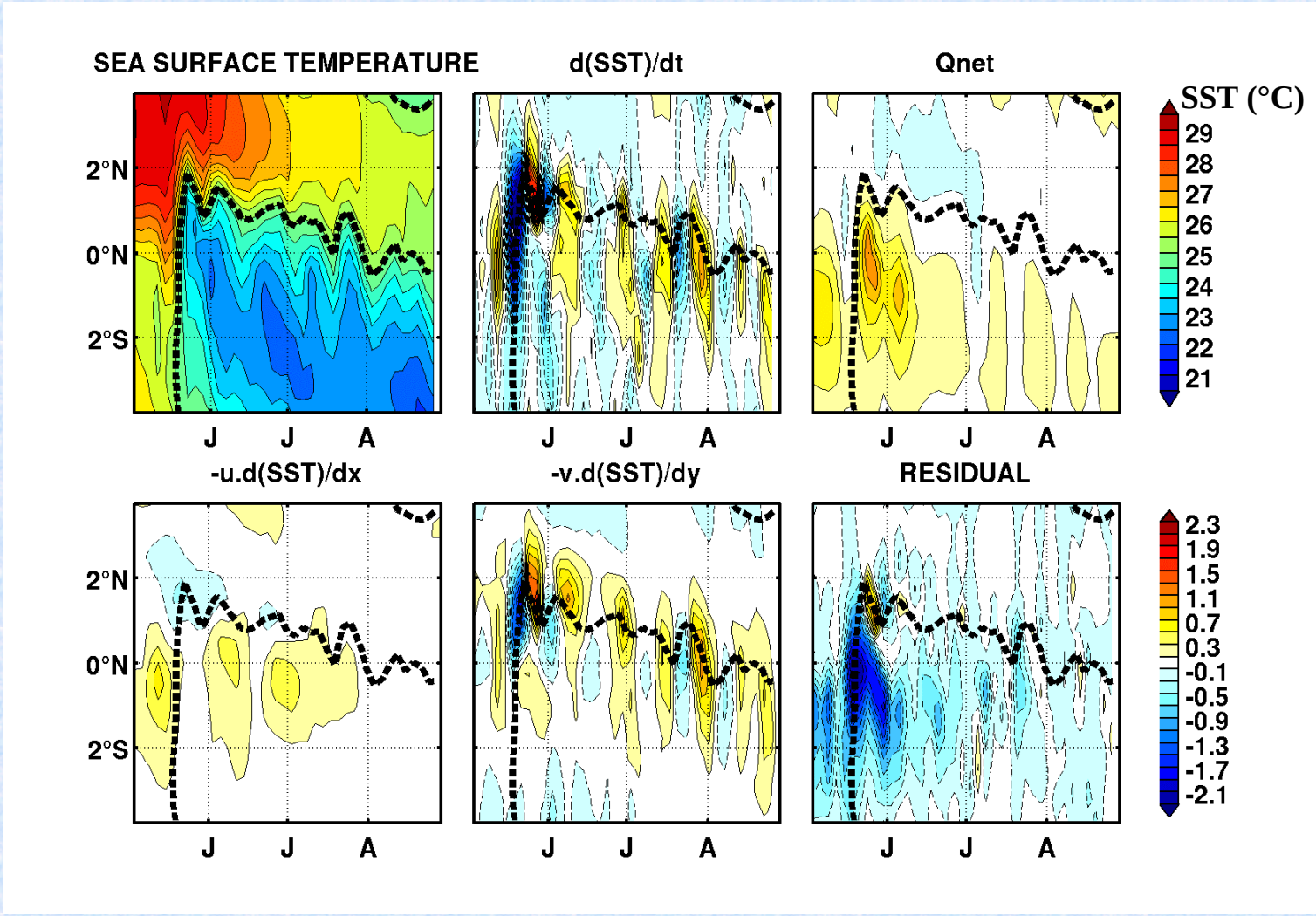


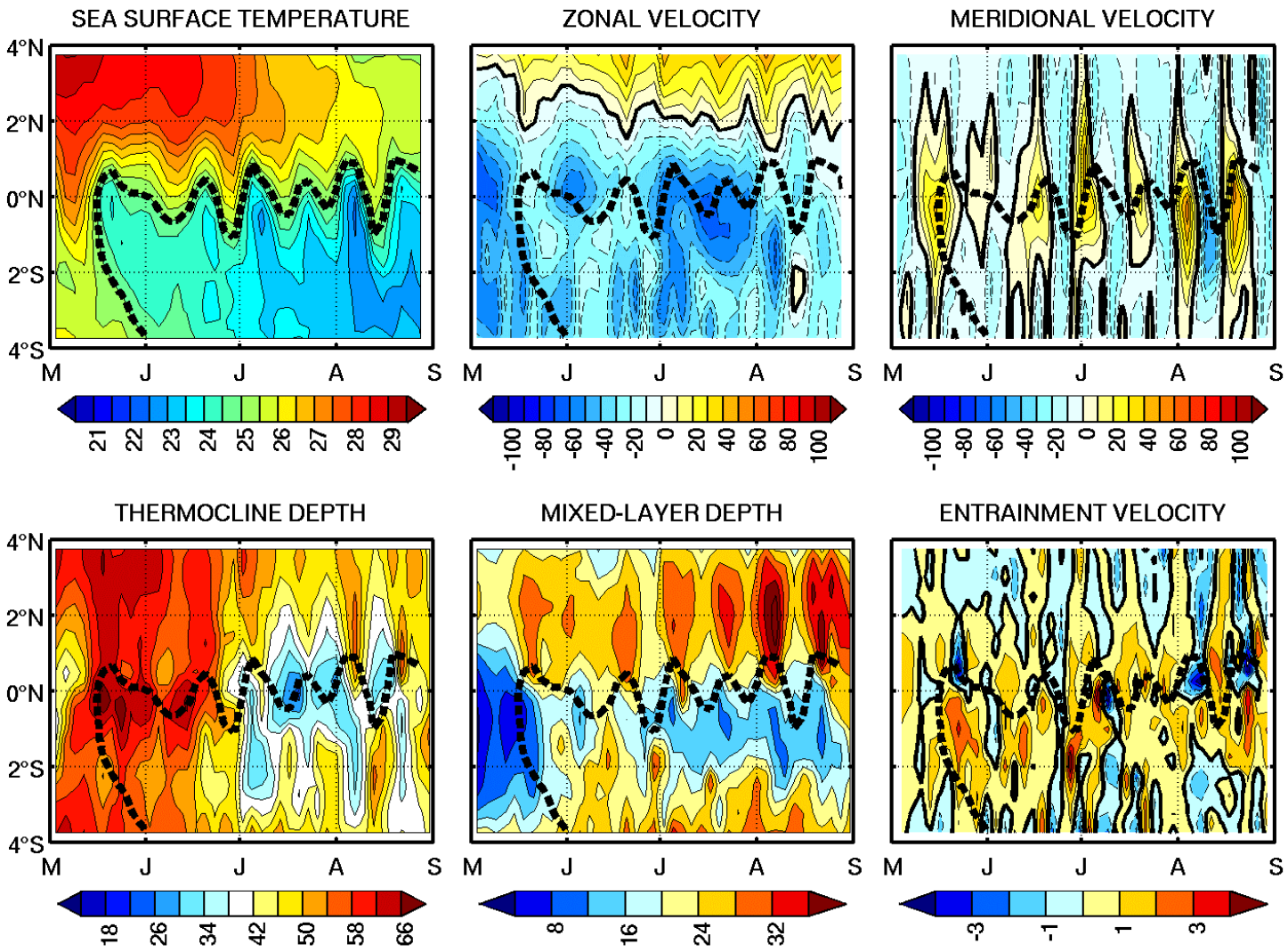
# Mixed-layer oceanic fields along 0°E (2005)



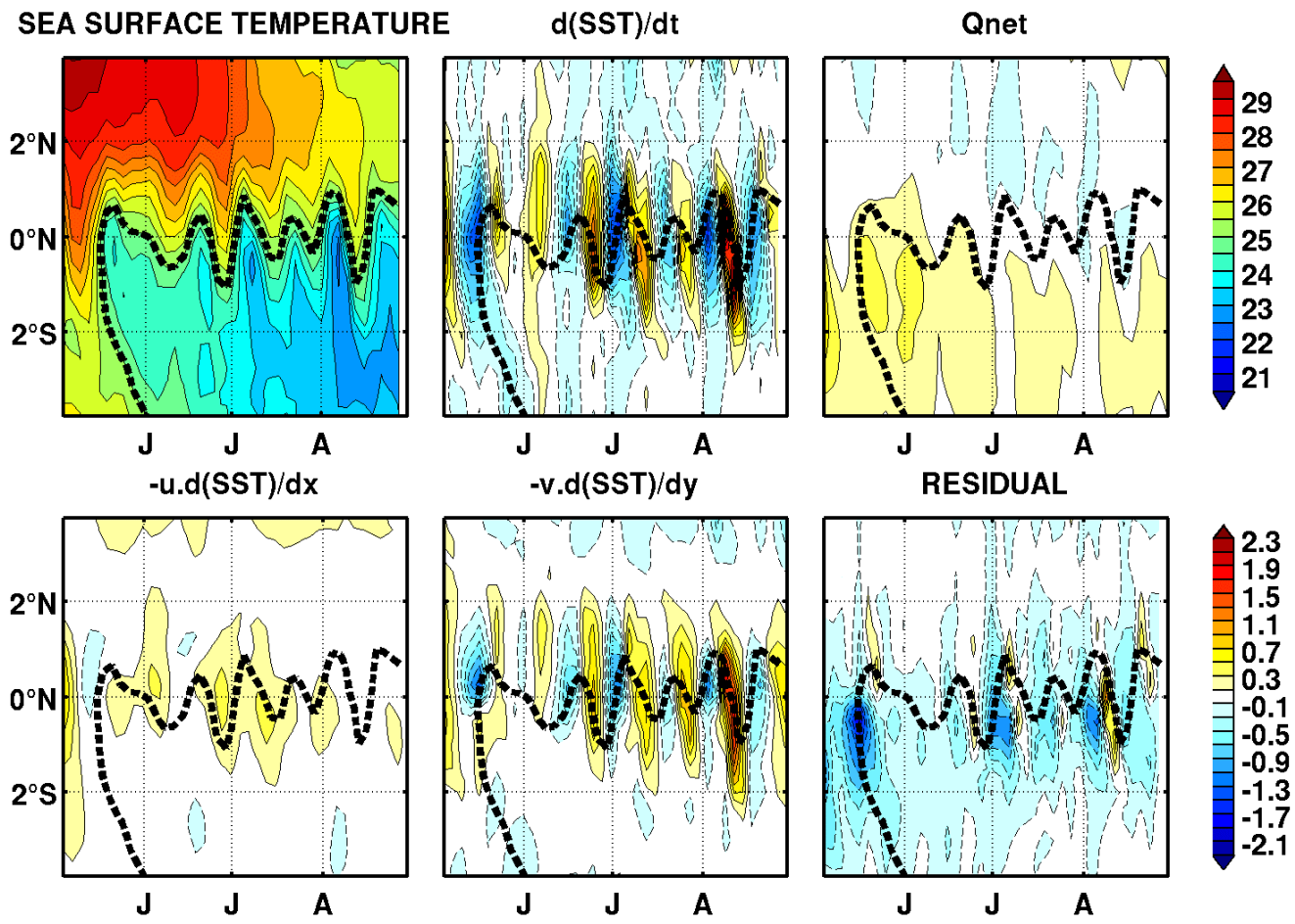
# MIXED-LAYER HEAT BUDGET – 4°W-4°E - 2005



# Mixed-layer oceanic fields along 0°E (2006)



# MIXED-LAYER HEAT BUDGET – 4°W-4°E - 2006




⇨ **intra-seasonal cooling south of the equator due to the susburface and associated with the back-and-forth migration of the SST front across the equator**

## Concluding remarks

1. ***Comparison of the equatorial cold tongue onsets in 2005 and 2006***

   **predominant local impact of a stronger-than-usual intra-seasonal intensification of SouthEasterlies in 2005 for the early onset of the cold tongue**

2. ***Predominance of a 15-day wind-forced variability in the Gulf of Guinea***

3. ***Main impacts of the 15-day variability for the SST for mixed-layer heat budget***

   a) **meridional migration of the SST front north of the cold tongue**

   b) **intra-seasonal subsurface cooling south of the equator**

## Open questions

1. ***mechanisms for the generation of this 15-day variability?***

2. ***ocean-atmosphere coupling associated with this 15-day variability:***

   ***(de Coetlogon et al., QJRMS 2010)***