New activity:

Intramonthly winds: tropical oceanic impacts and importance for coupled air-sea interaction

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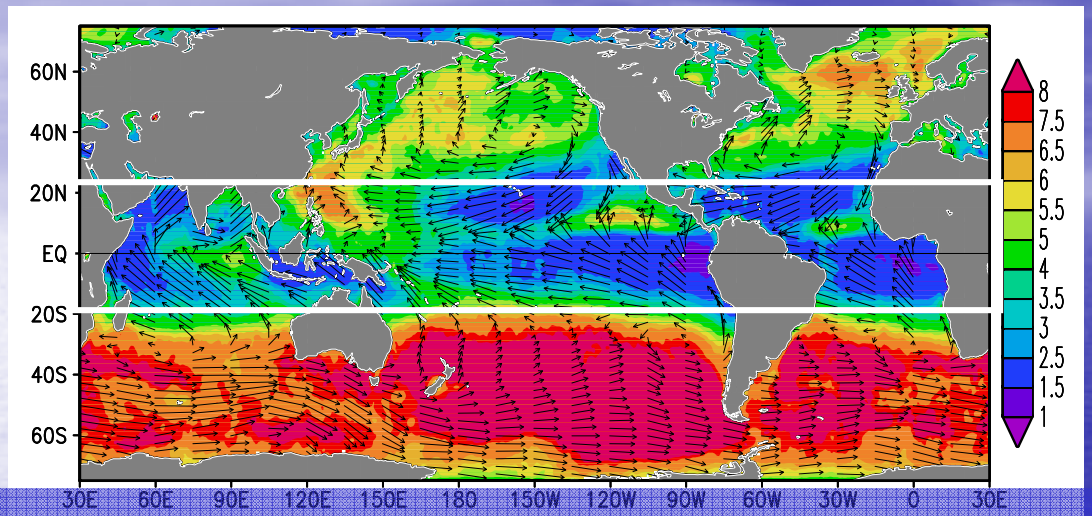
Motivation

- Impacts of intramonth variability (*Qiu et al., 2004*; *Kaplan et al., 2004; Lee & Liu, 2005; Han et al., 2006)*
- Underestimation of variability in reanalysis products (*Goswami and Sengupta, 2003*)

Organization of this project

- Analysis phase will characterize the variability of intramonth winds and surface fluxes
- Modeling phase: 1) oceanic response to intramonth forcing and 2) atmospheric response to varying surface conditions.

July winds



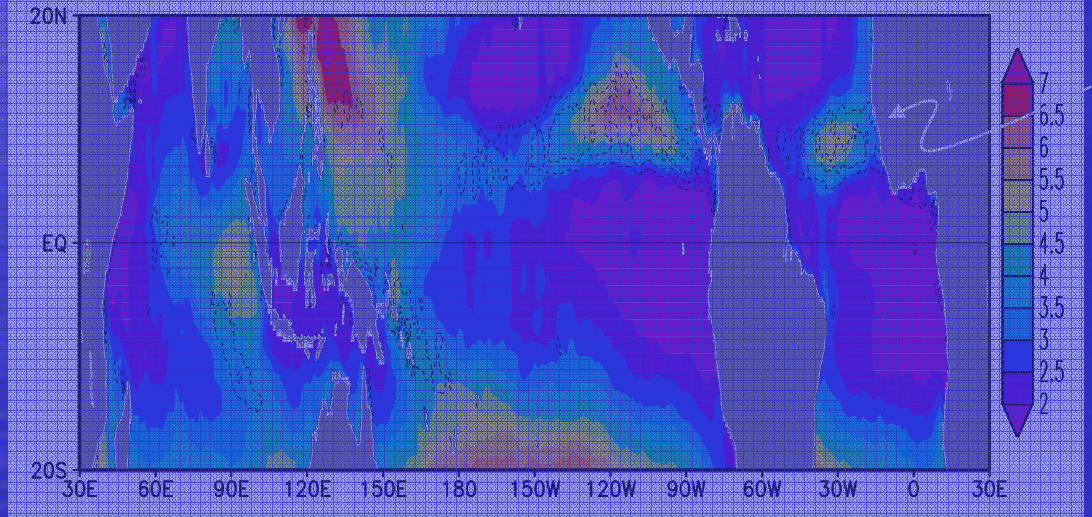
July mean wind (vectors)

&

Standard deviation of July wind speed about monthly mean

(based on 1999-2004 QuikSCAT data)

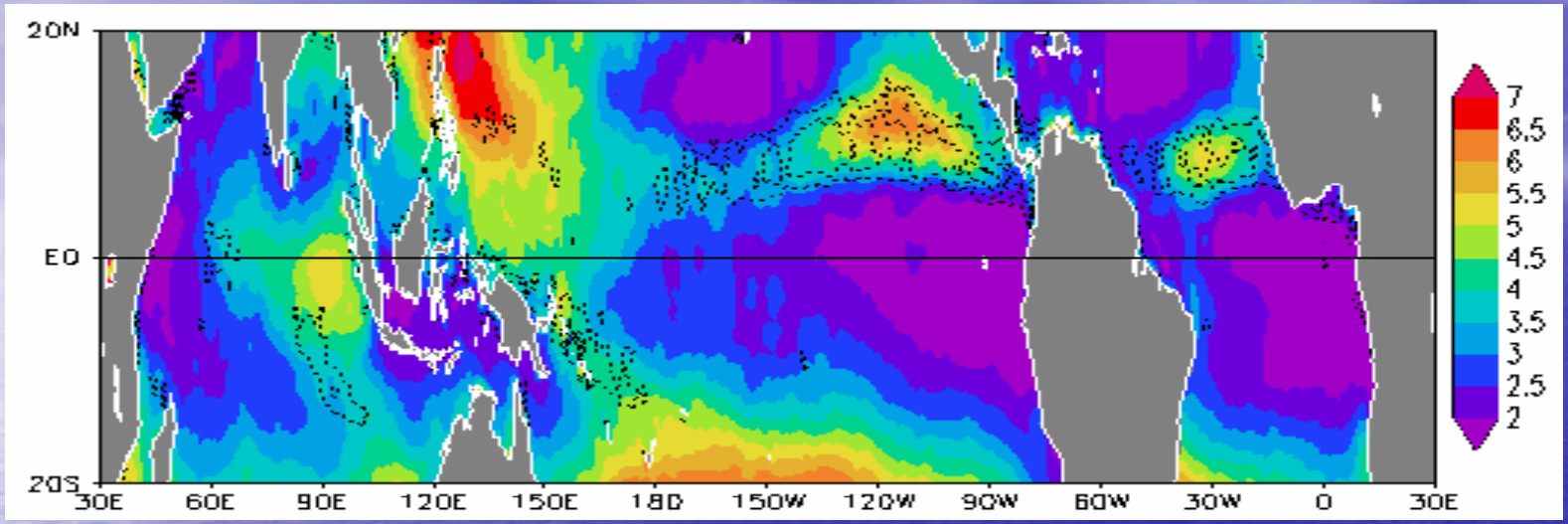
$\overline{10}$



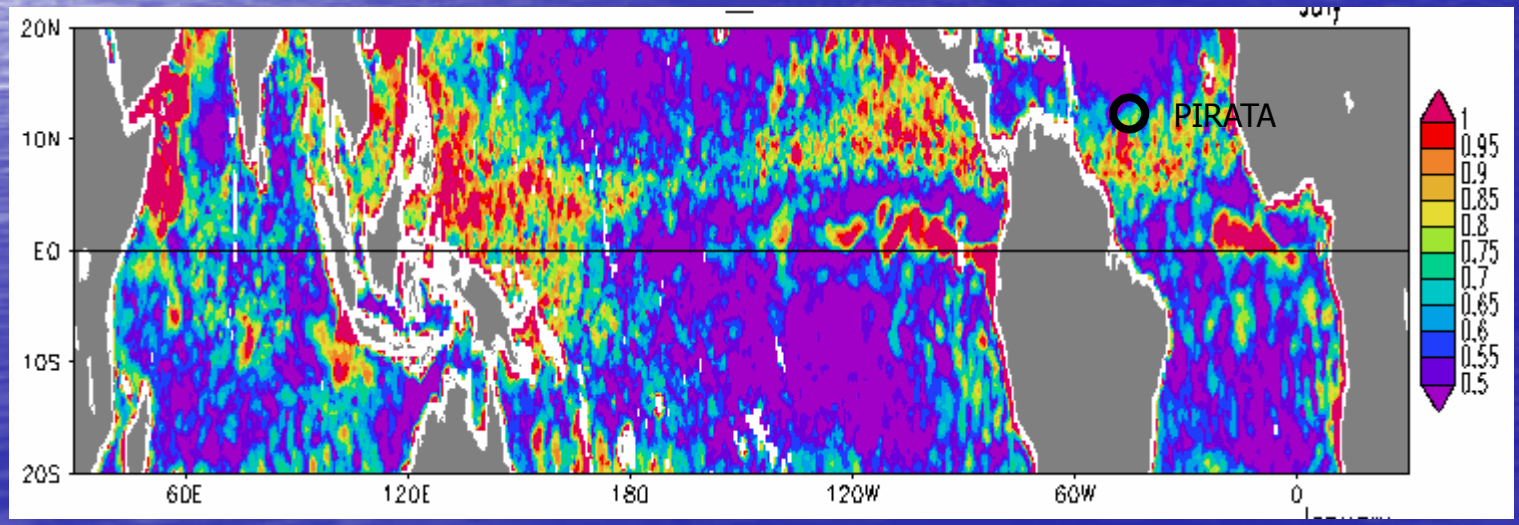
Wind convergence exceeding -5x10-6 1/s

20S-20N

Intramonth winds vs SST



Winds

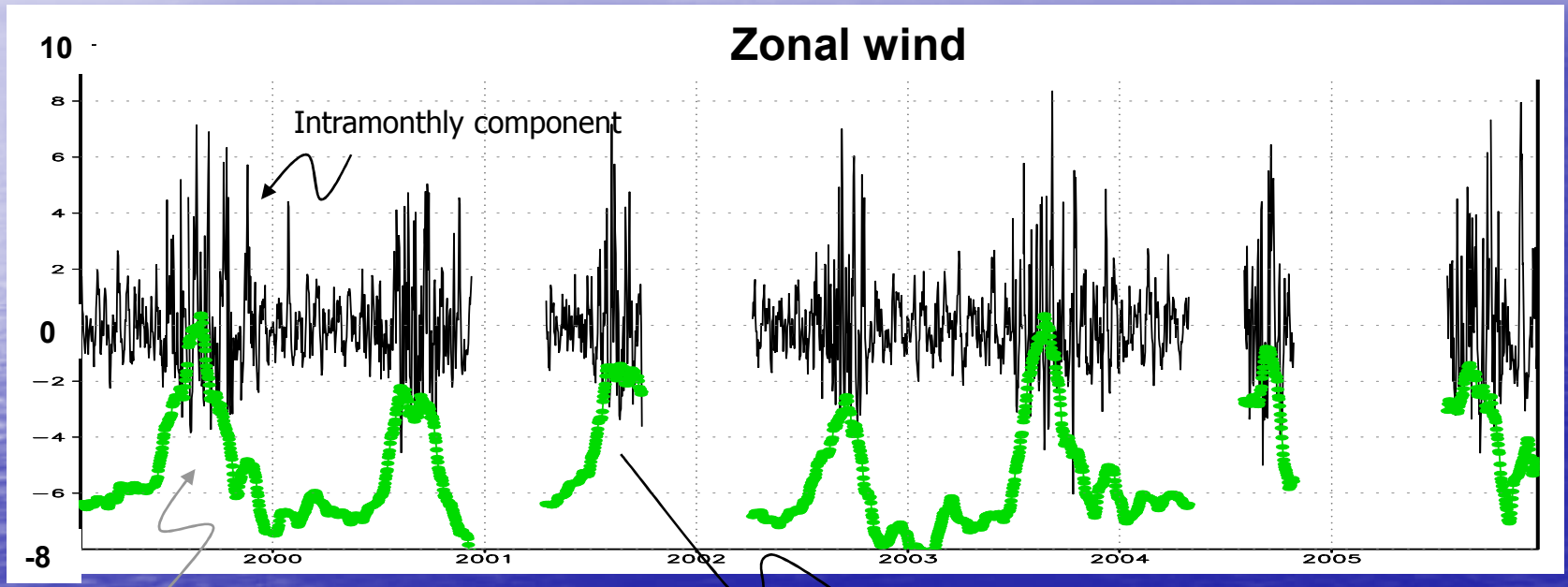


SST

3-dy TMI

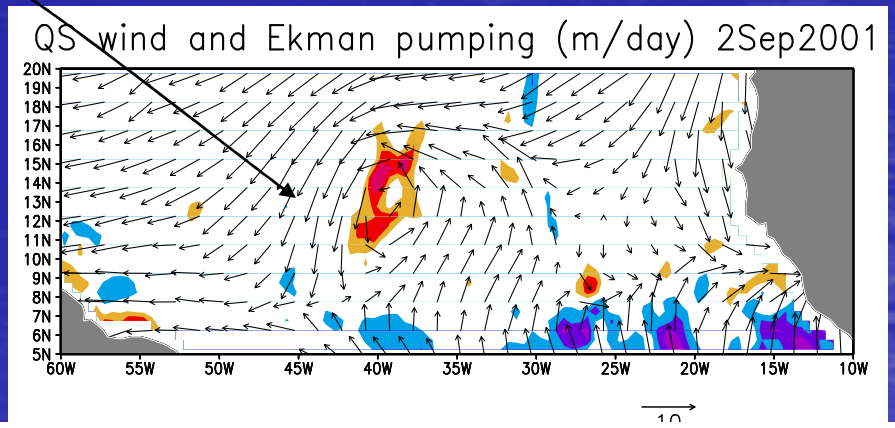
Period of analysis:1997-2005

Winds at 12N, 38W



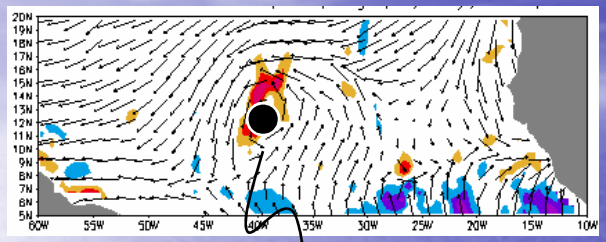
Variability increases when monthly avg winds weaken

Time →

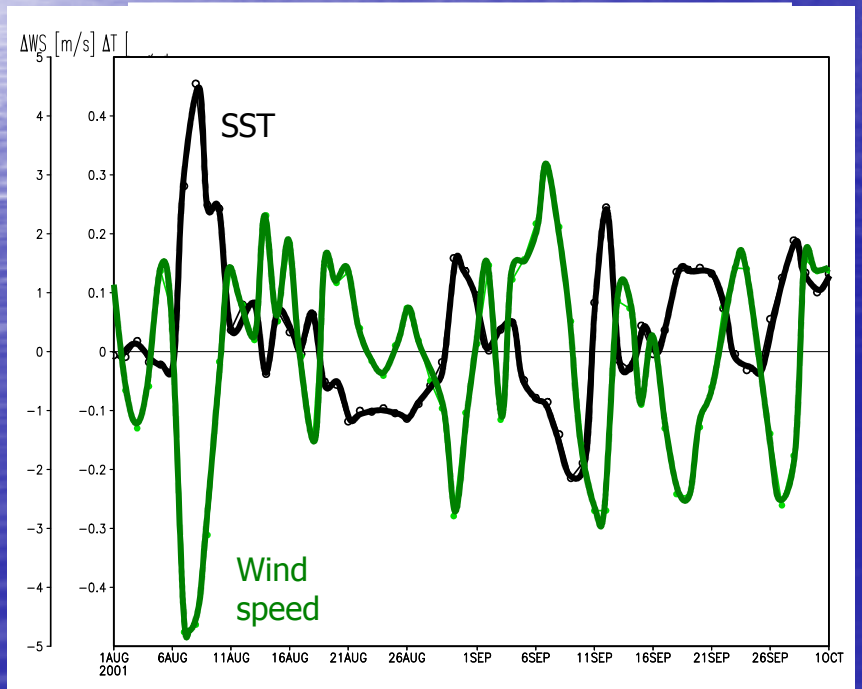


Red: 1m/dy upwelling

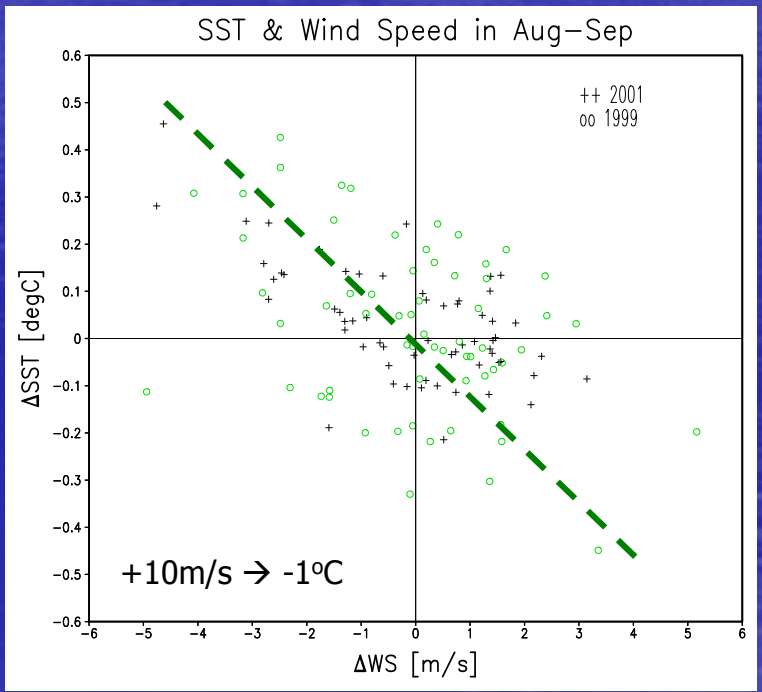
Intramonthly wind events vs SST

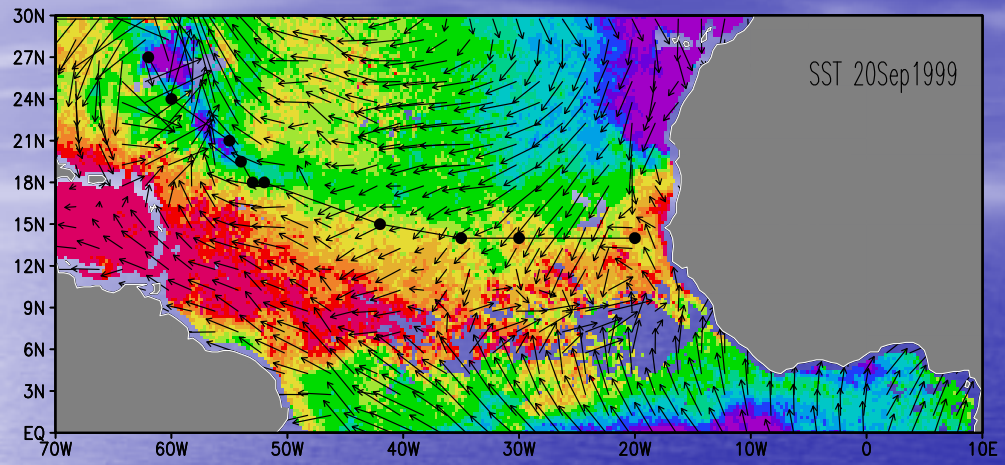


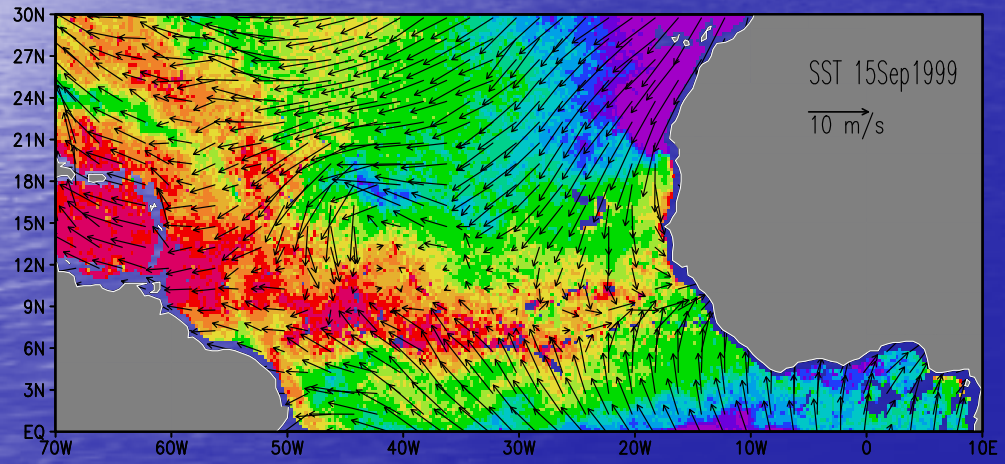
Time series of SST, wind speed



Scatter diagram of Aug-Sep SST vs wind speed for a couple of years




SST 20Sep1999
30N
27N
24N
21N
18N
15N
12N
9N
6N
3N
EQ
70W
60W
50W
40W
30W
20W
10W
0
10E


SST 15Sep1999
10 m/s
30N
27N
24N
21N
18N
15N
12N
9N
6N
3N
EQ
70W
60W
50W
40W
30W
20W
10W
0
10E


29.8
29.4
29
28.6
28.2
27.8
27
26.6
26.2
25.8
25.4
25

Chen et al. (1994) hyrid coordinate 1D mixed layer model

TKE Equation

$$w_{1\,1/2}h_1(b_1 - b_2) = 2mu^{*3} + h_1[(1+n)B_0 - (1-n)|B_0|]/2 + B_1, \quad (1.2)$$

where

$$B_1 = rI_0[h_1 e^{-h_1/h_r} - 2h_r(1 - e^{-h_1/h_r})],$$

Richardson # - dependent mixing

$$F'_k = F_k - (1 - R_g/R_c) \times (F_k - F_{k+1})h_{k+1}/(h_k + h_{k+1})$$

$$F'_{k+1} = F_{k+1} + (1 - R_g/R_c) \times (F_k - F_{k+1})h_k/(h_k + h_{k+1}), \quad (1.9)$$

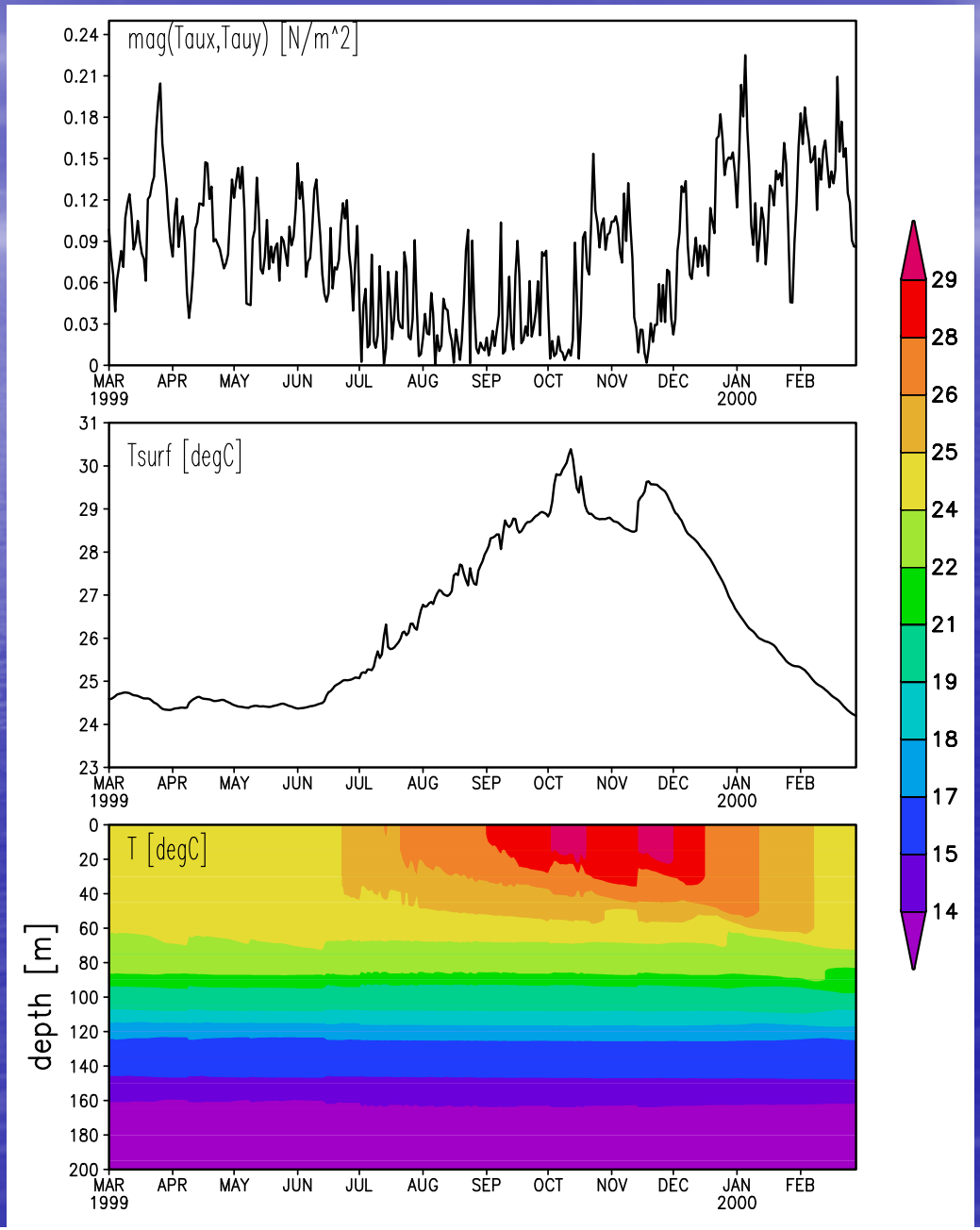
where F represents the variable to be mixed and $(\quad)'$ is the value after mixing. These equations are chosen

Control simulation 12N, 38W

Wind speed

SST

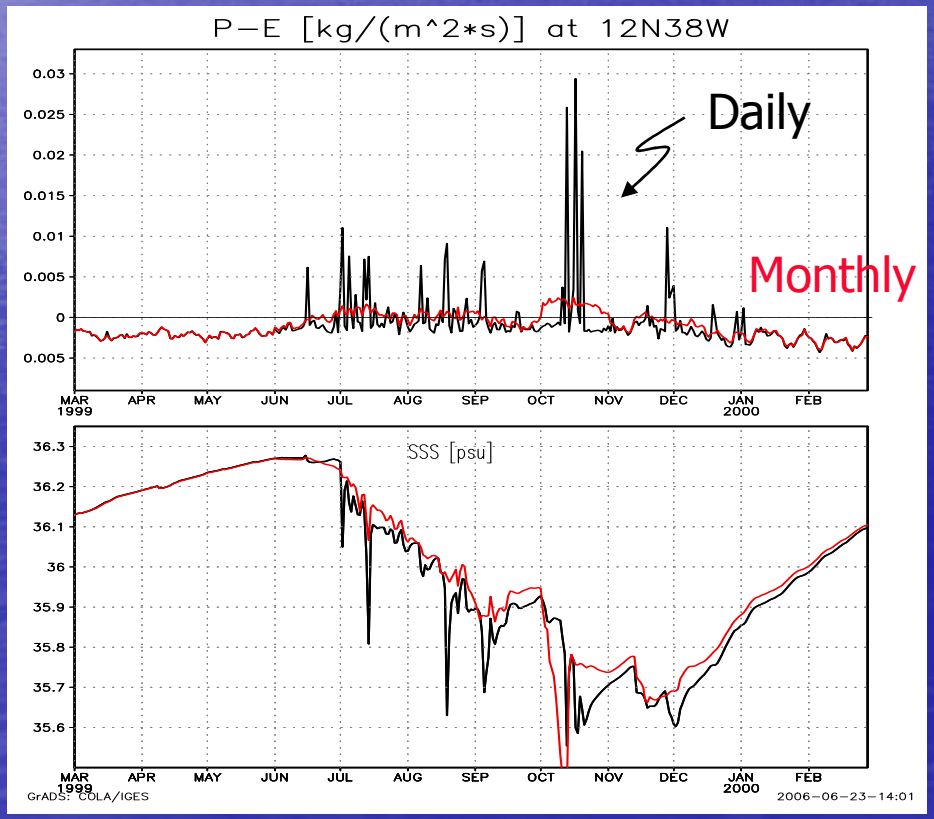
T(z,t)



Impact of eliminating intramonthly P-E

P-E

SSS

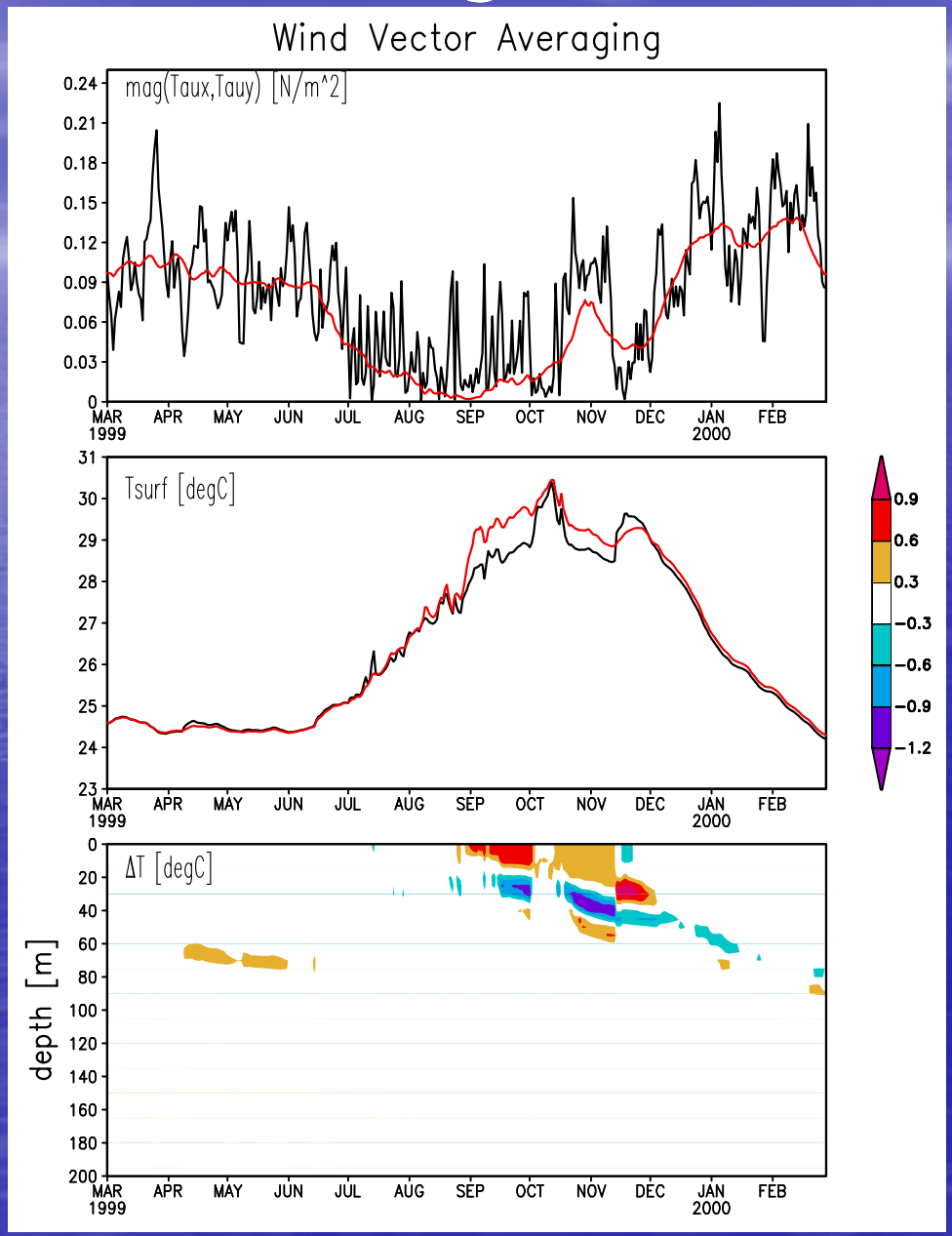


Impact of eliminating intramonthly winds

Wind speed

SST

$\Delta T(z,t)$

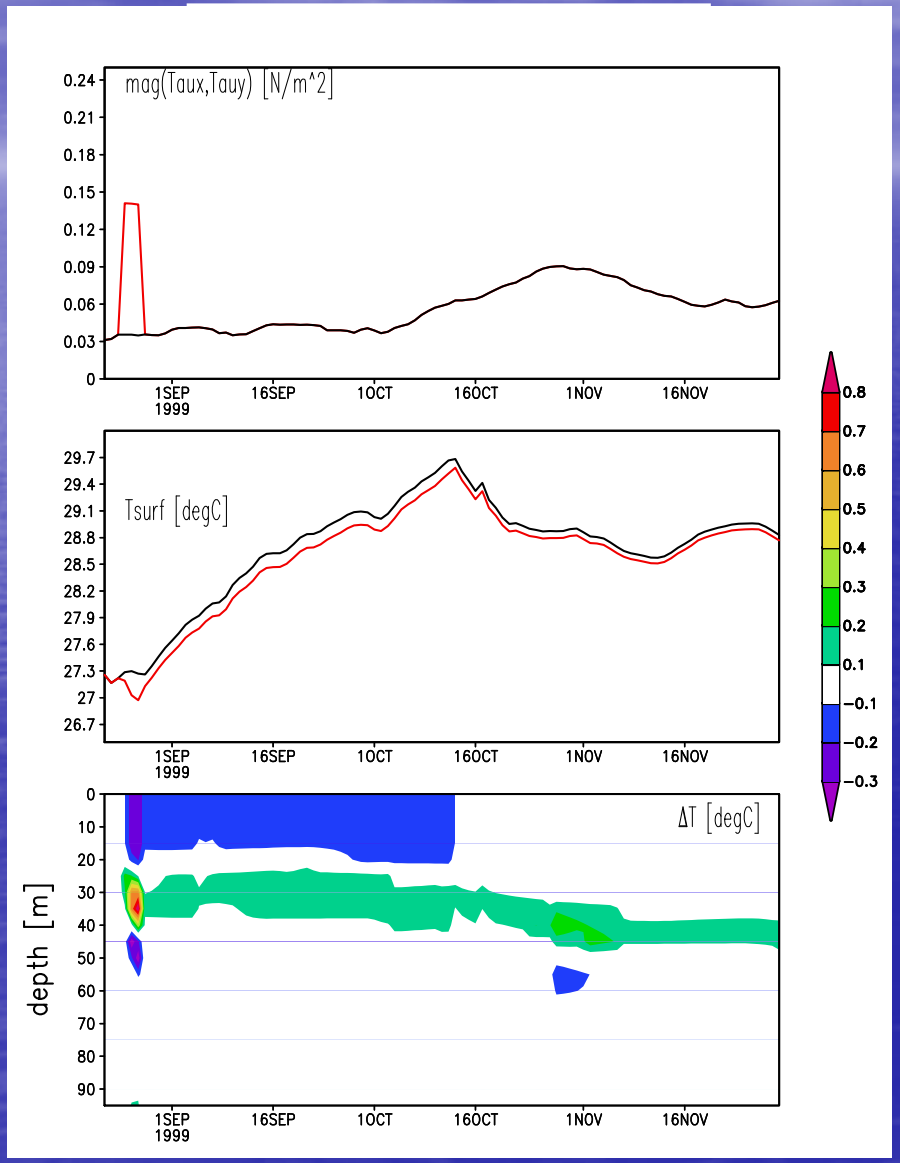


Model response to 3-dy wind burst 12N, 38W

Wind speed

SST

$\Delta T(z,t)$



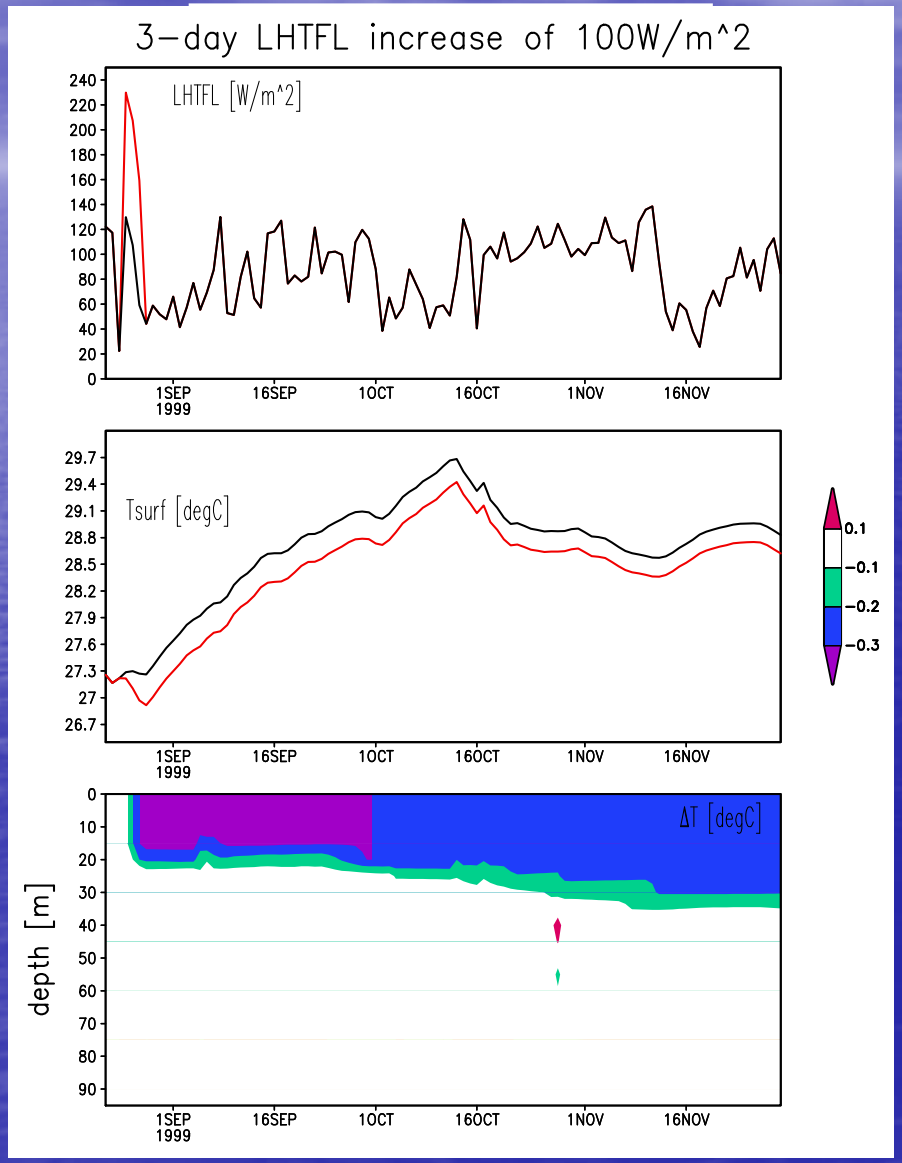
Time →

Model response to 3-dy 100W/m^2 LH loss 12N, 38W

Wind speed

SST

$\Delta T(z,t)$

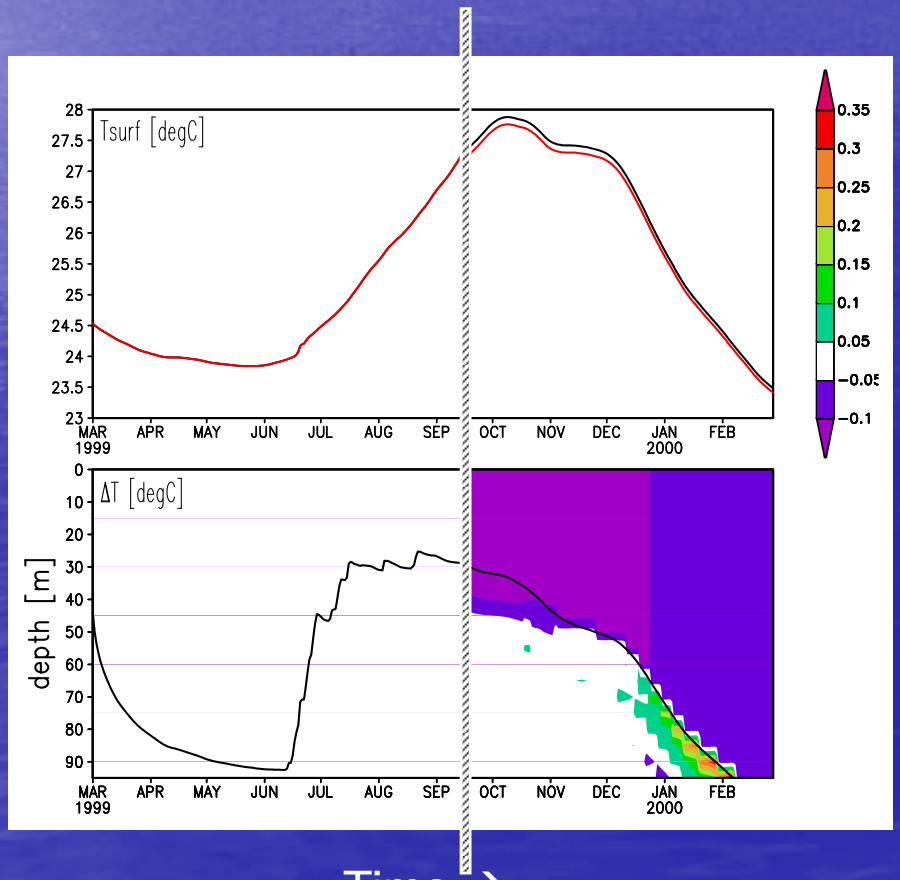


Time →

Model response to 3-dy 1m/dy Ekman pumping 12N, 38W

SST

$\Delta T(z,t)$



Time →

Simple heat budget

$$h\partial T / \partial t = w_e \Delta T_e$$

$$\delta T = \frac{\delta t w_e \Delta T_e}{h} \approx 0.15C$$

Some conclusions

- Intramonthly wind stress variations give rise to ~ 0.5C SST changes
- Intramonthly latent heat flux changes may giver rise to ~ 0.3C SST changes
- Intramonthly entrainment velocity probably is not so important

What's up next

- Continued examination of the expanding PIRATA array (and NTAS) as well as TAO with the 1D mixed layer model. Shortwave fluxes
- Work with Dalin to begin exploring the mesoscale atmospheric model