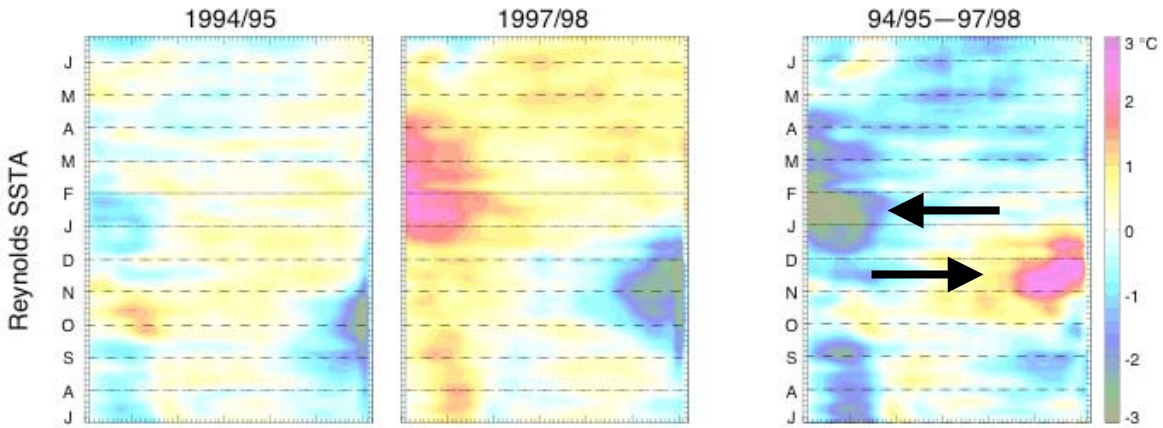
Climate Scale Interactions in the Indo-Pacfic Tropical Basins

Jean-Philippe Boulanger, Albert Fischer, Julie Leloup, Matthieu Lengaigne and many co-auhors…

- Role of an MJO event in the termination of the 1994-1995 Indian Dipole Event
- Role of the March 1997 WWE in El Niño onset
- WWE activity and ENSO dynamics
- Conclusions

ECWMWF/CLIVAR Workshop on Simulation and Prediction of Intra-seasonal Variability with emphasis on the MJO, 3-6 November 2003

Interannual anomalies of SST and Taux during the 1994-1995 and 1997-1998 Dipole events



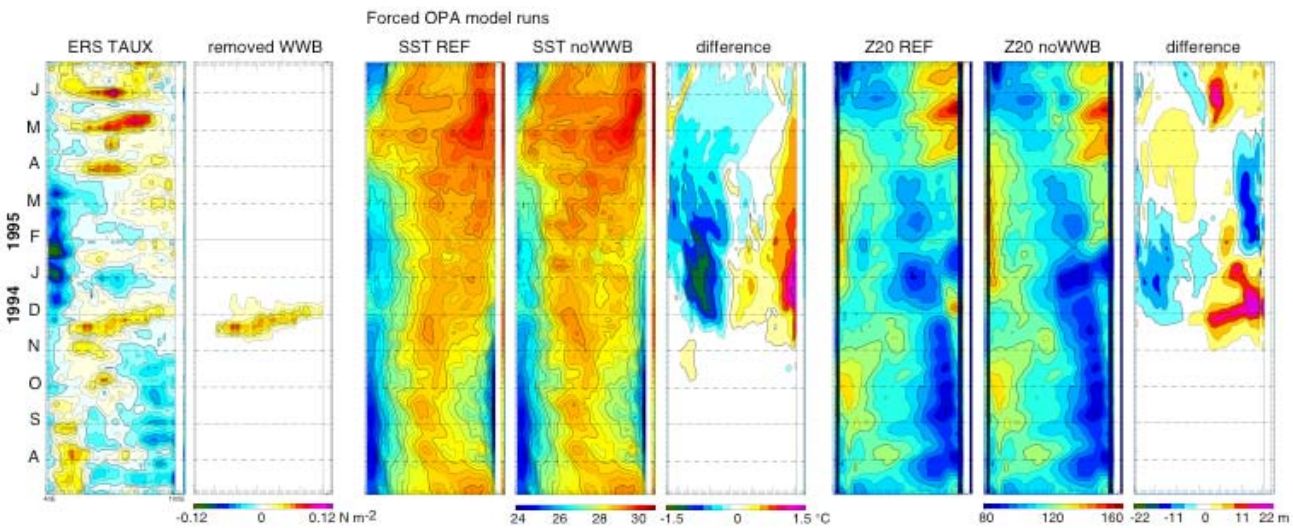
Strategy :

1- Study the impact of the Nov 1994 MJO in an ocean model (OPA model)

2- Study the atmospheric sensitivity to the oceanic impact of the Nov 1994 MJO (LMDZ)

Role of an MJO event in the termination of the 1994-1995 Indian Dipole Event

OPA model response at the equator to the MJO zonal wind stress signal



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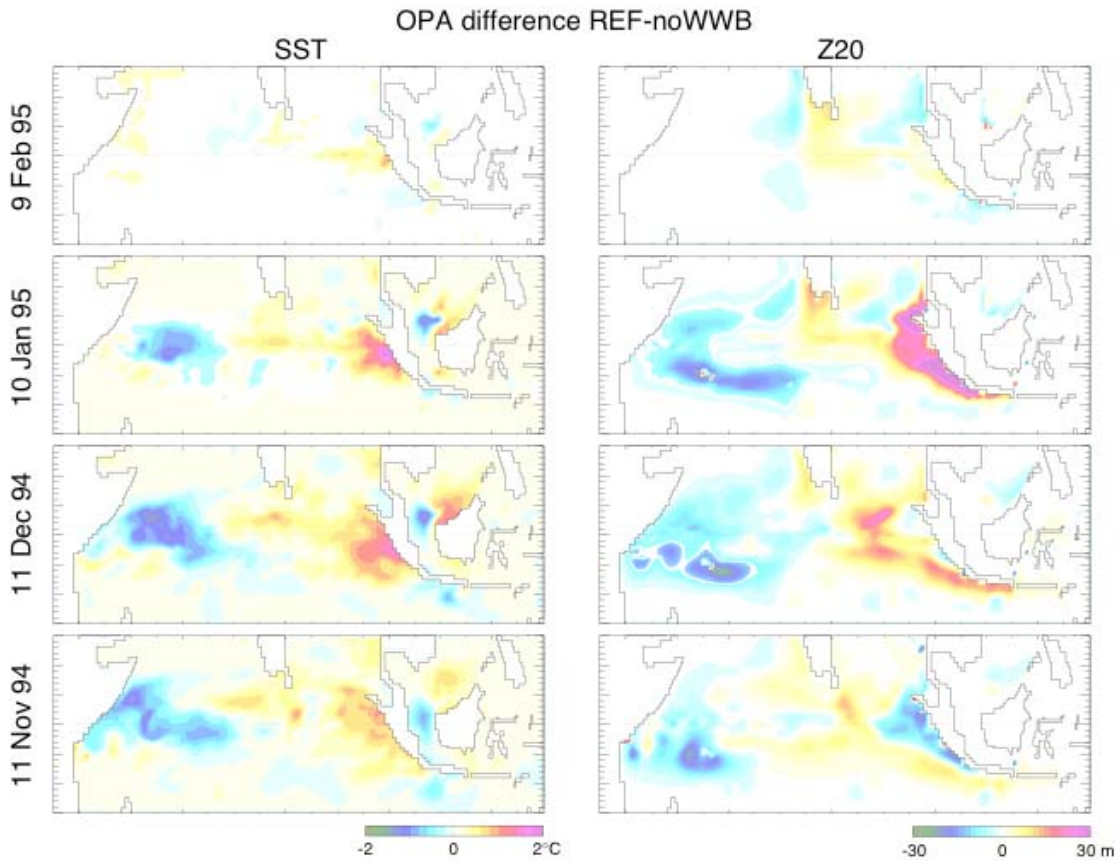
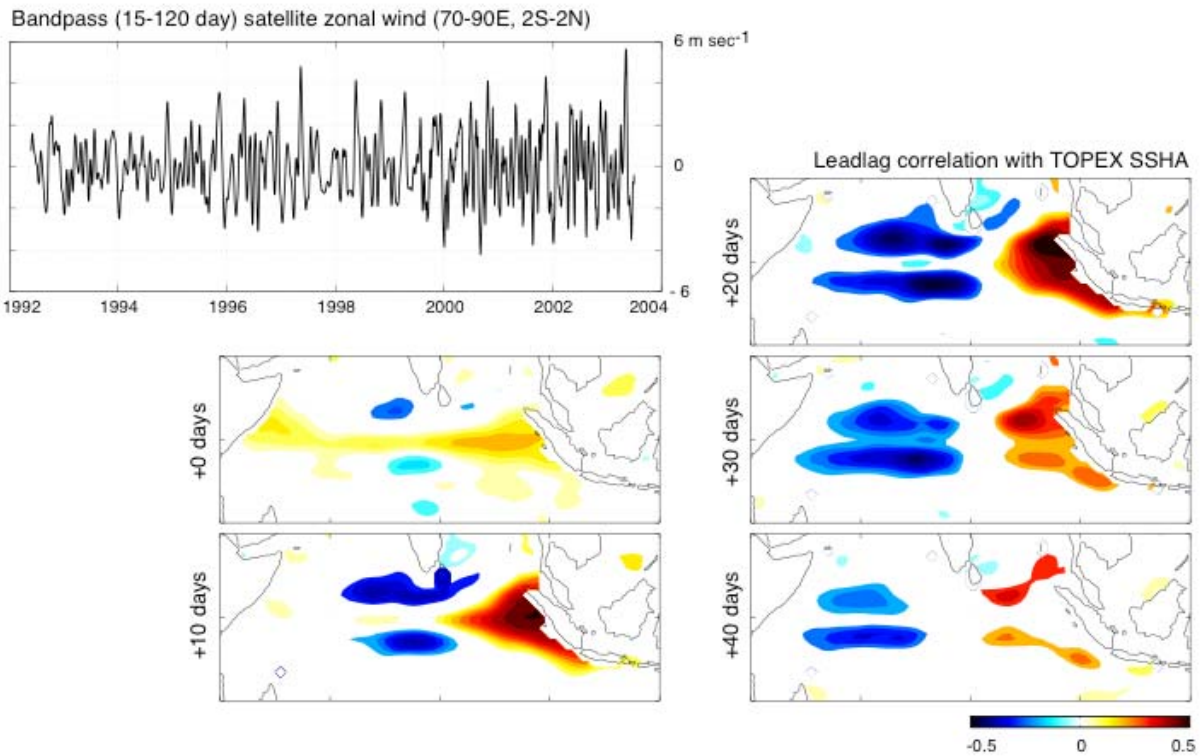
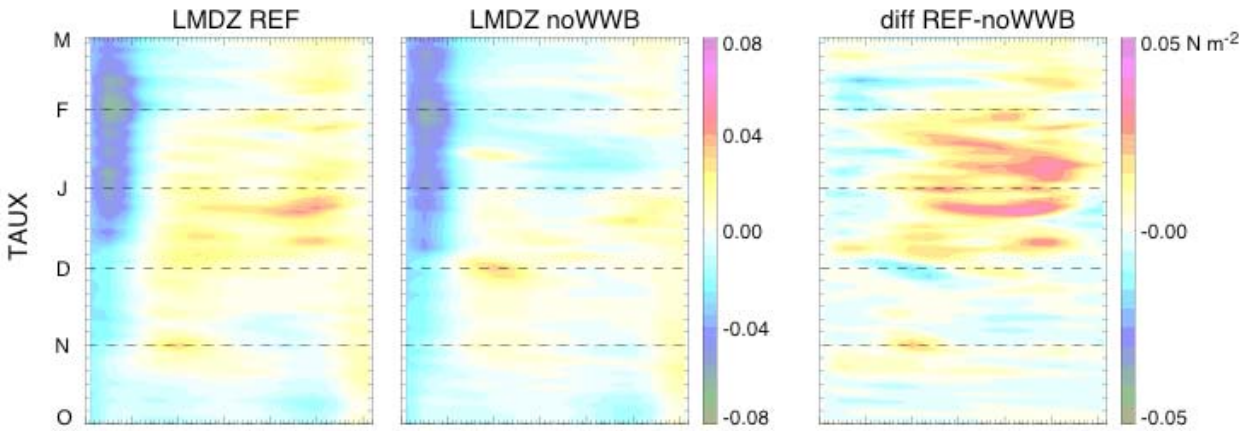
Role of an MJO event in the termination of the 1994-1995 Indian Dipole Event



Role of an MJO event in the termination of the 1994-1995 Indian Dipole Event

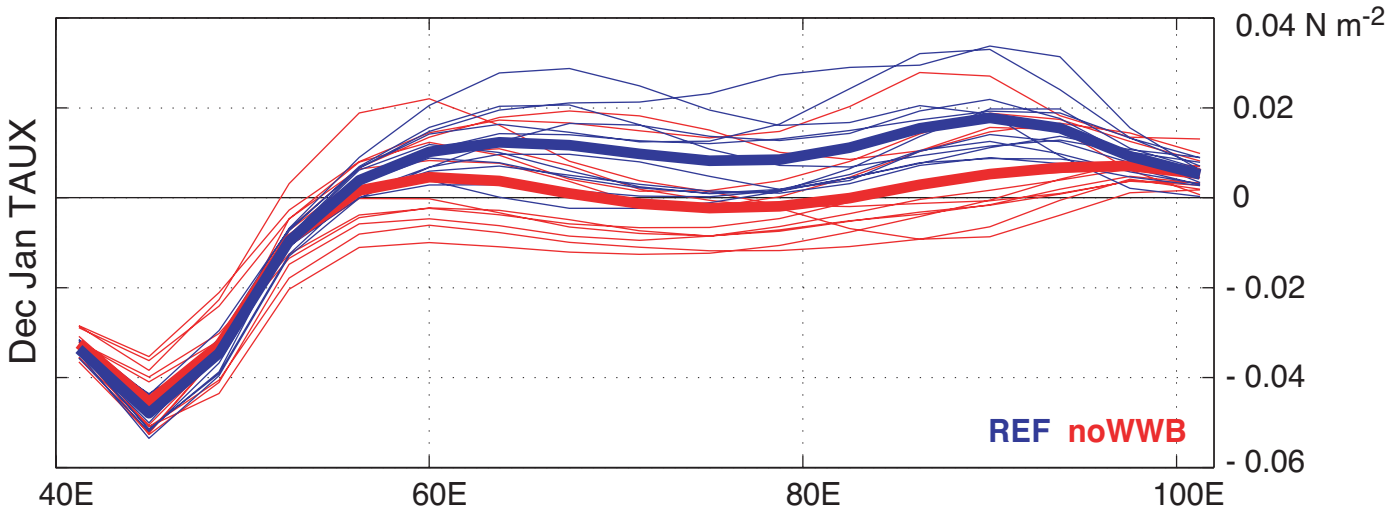


LMDZ Atmospheric response to the simulated OPA SST patterns

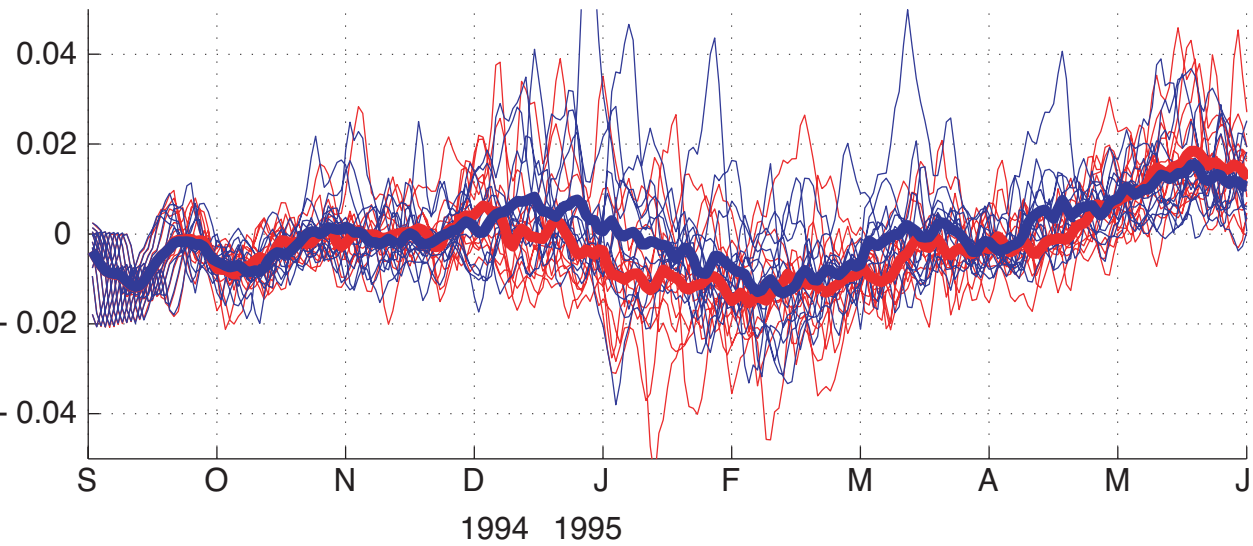


LMDZ Atmospheric response to the simulated OPA SST patterns

LMDZ Indian Ocean zonal wind mean and ensemble



Indian Ocean zonal wind index (70-90E 2S-2N) time evolution



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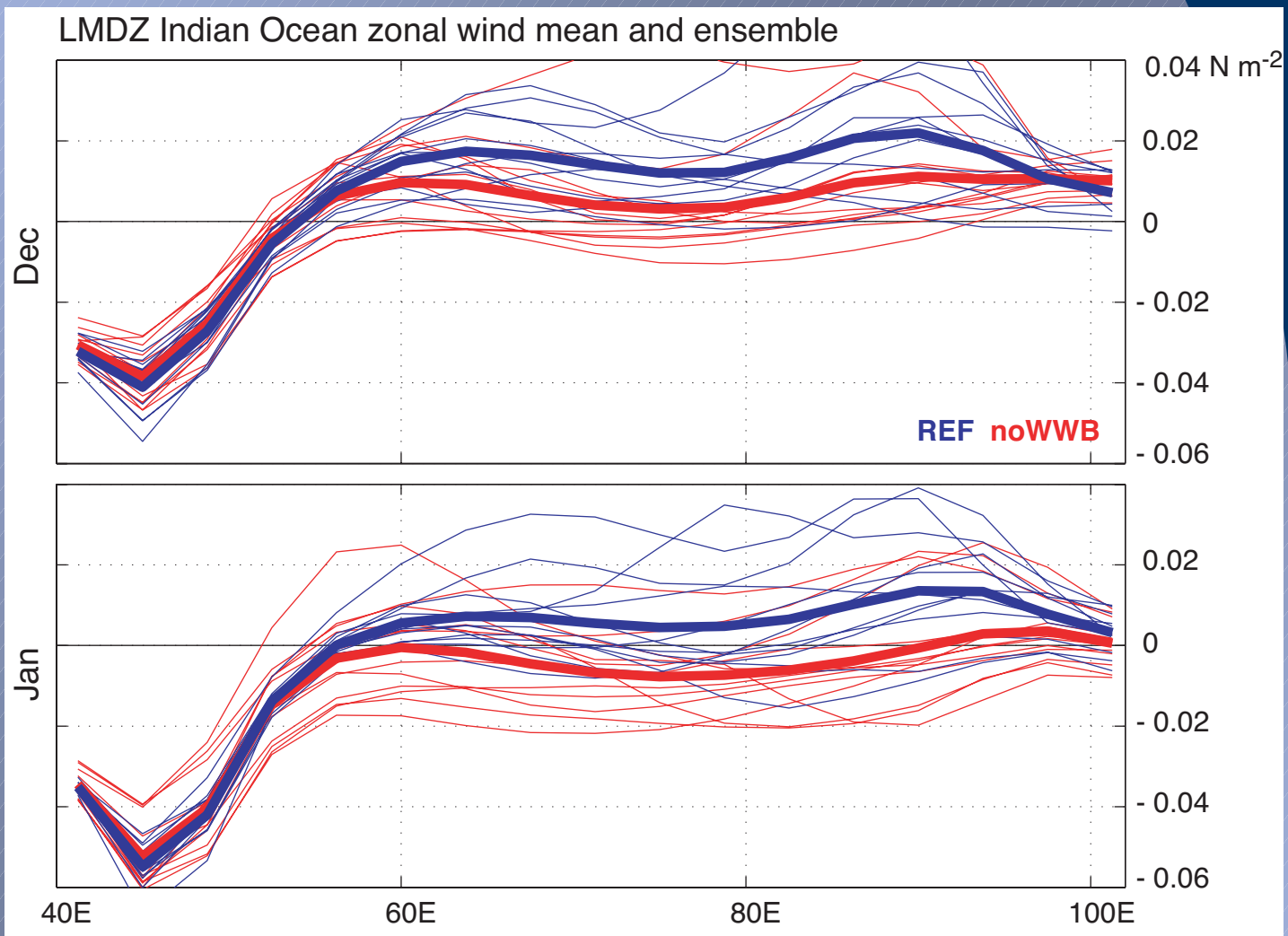


- **Role of the March 1997 WWE in El Niño onset**

Observations

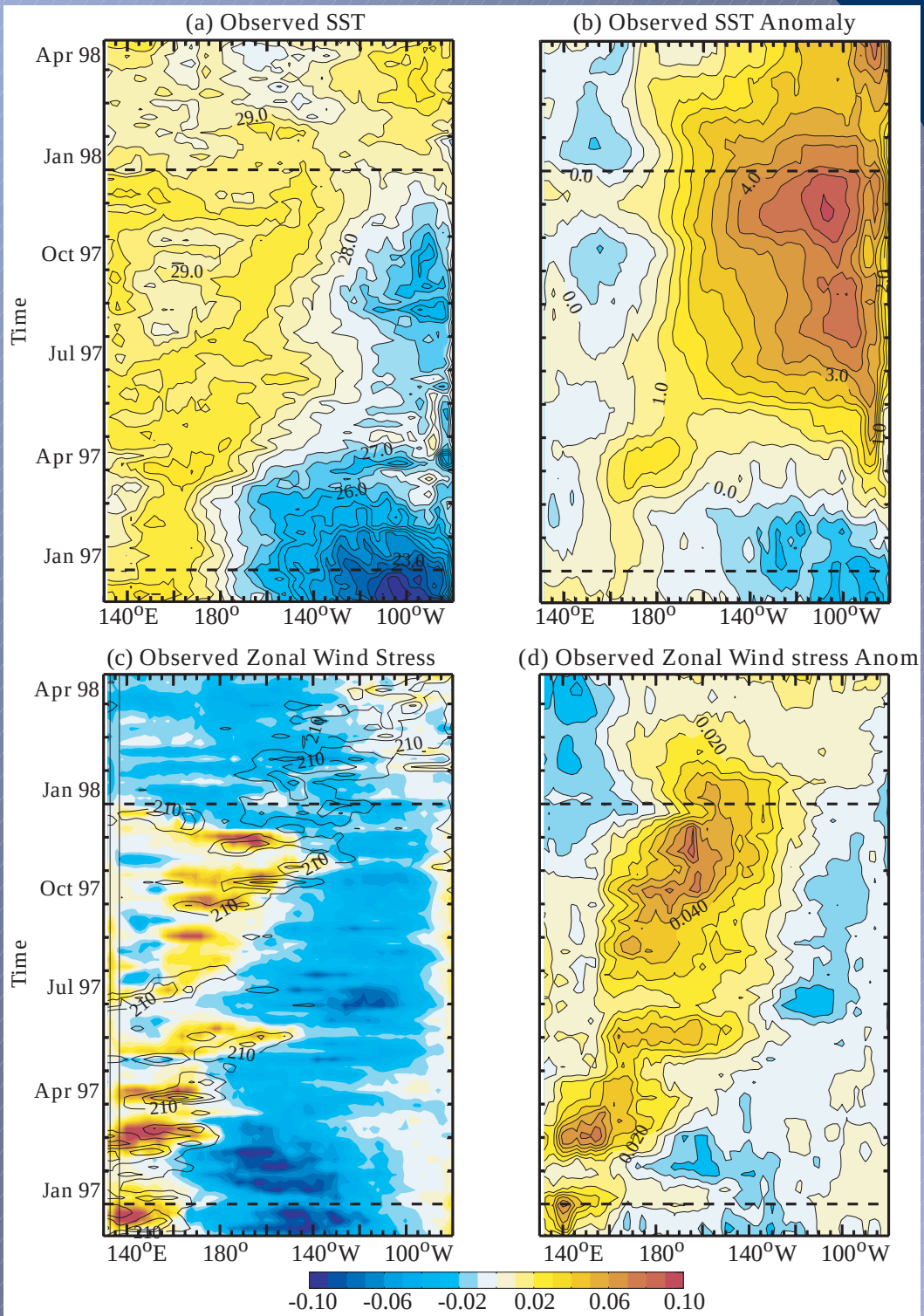
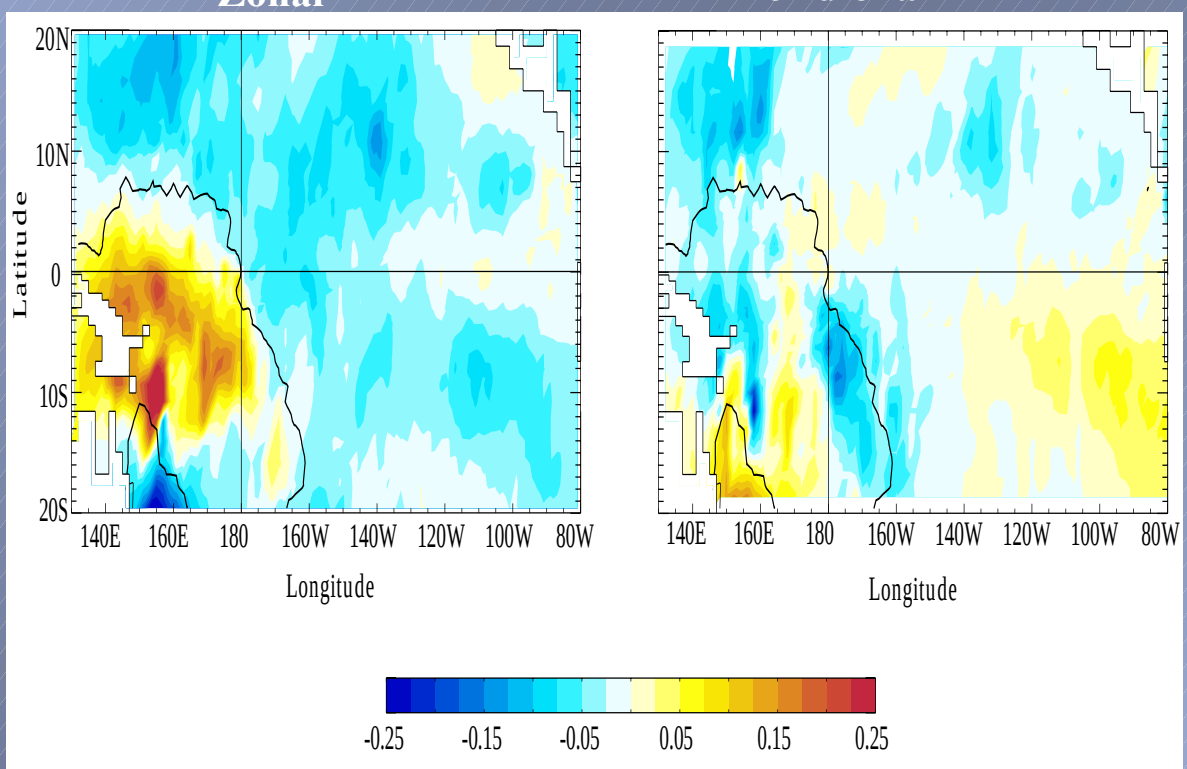


Figure 11

Zonal and meridional wind stress on March, 14th, 1997



Strategy :

1- Study the impact of the March 1997 WWE in an ocean model (OPA model)

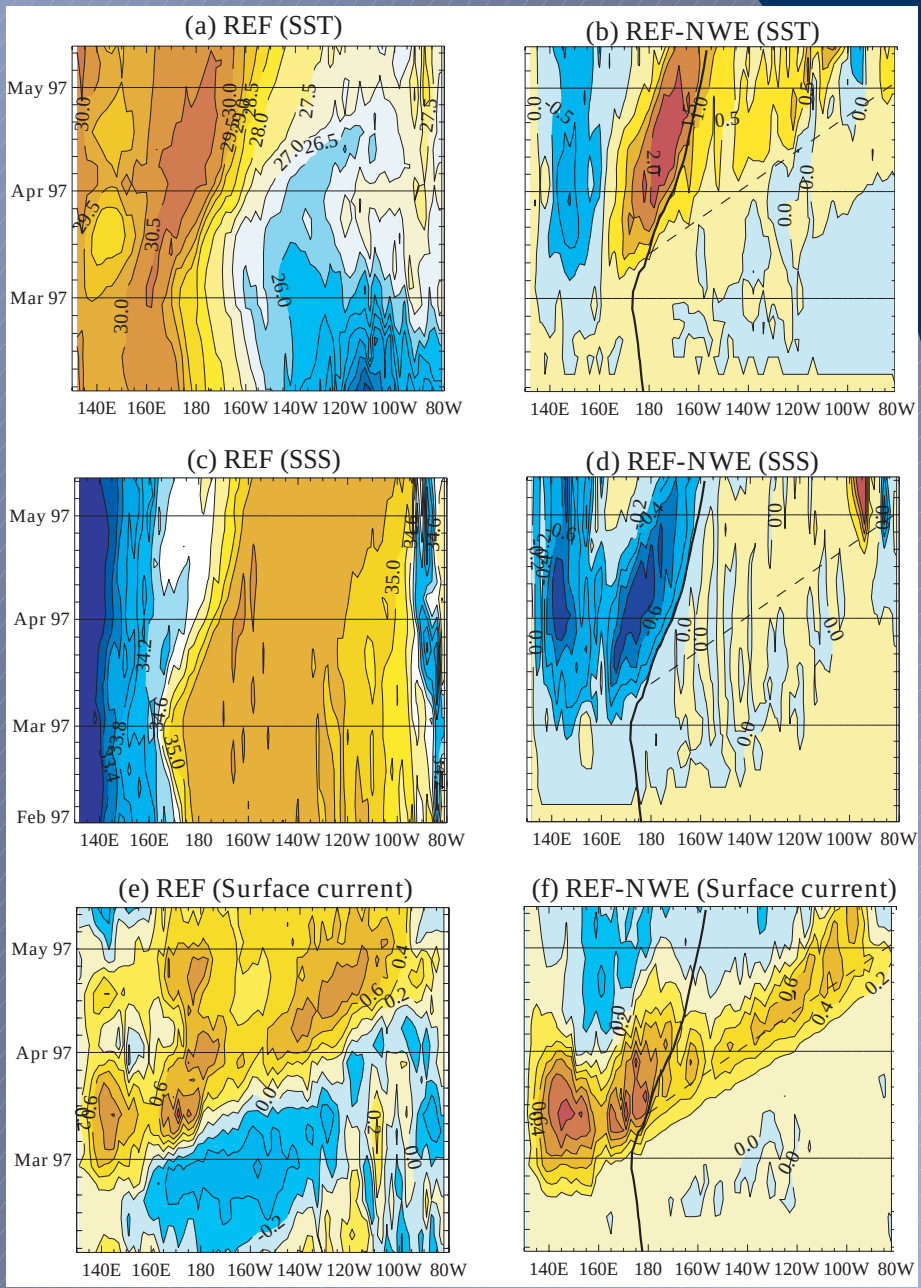
2- Study the atmospheric sensitivity to the oceanic impact of the March 1997 WWE (Hadam)

3- Study the impact of the March 1997 WWE in a coupled model (HadOPA)

Role of the March 1997 WWE in El Niño onset

- **Three oceanic responses in SST**
  (1) warming along the Kelvin wave path
  (2) large warming along the EEWP
  (3) cooling in the western Pacific

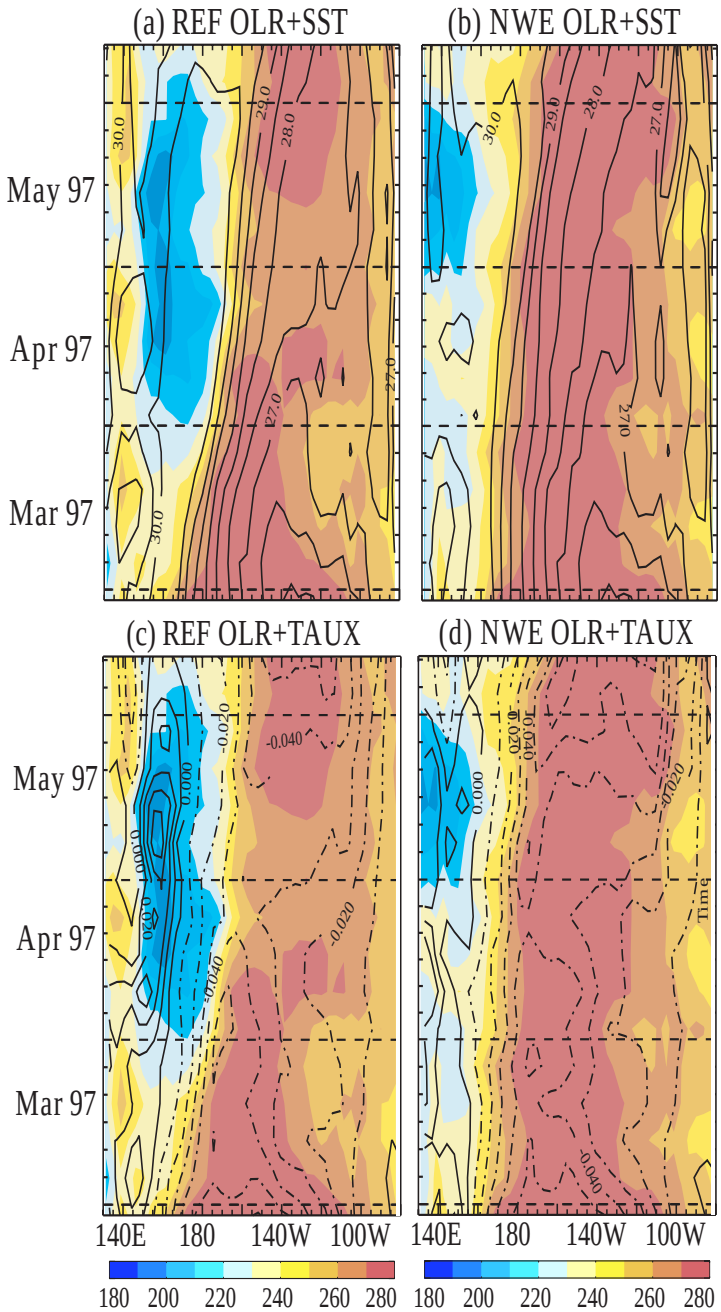
- **Strong zonal currents at the EEWP associated to anon-linear response of the thermo-halo-dynamical front and the wind-forced zonal currents**



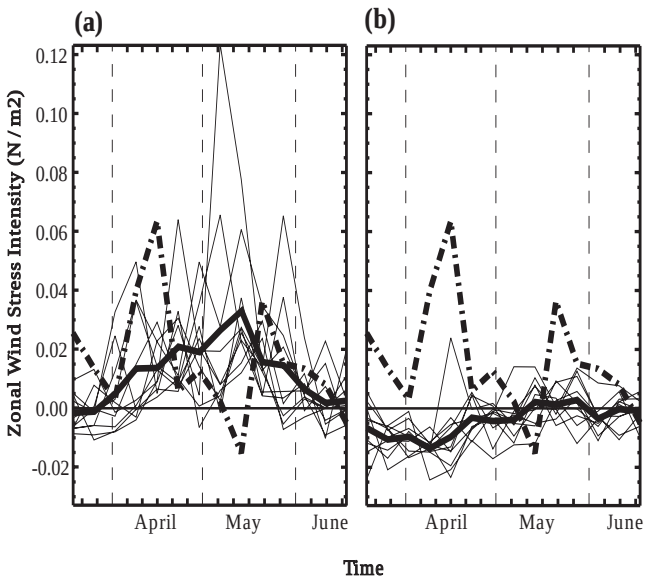
Atmospheric response to the simulated SST patterns

- Strong convection near 160°E in REF

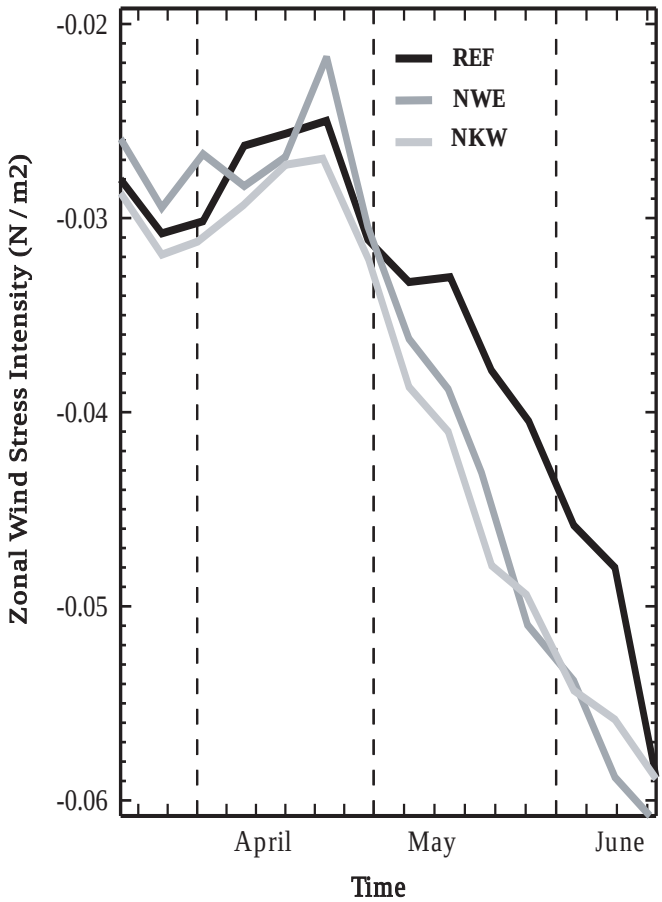
- Large westerly winds near 160°E in REF



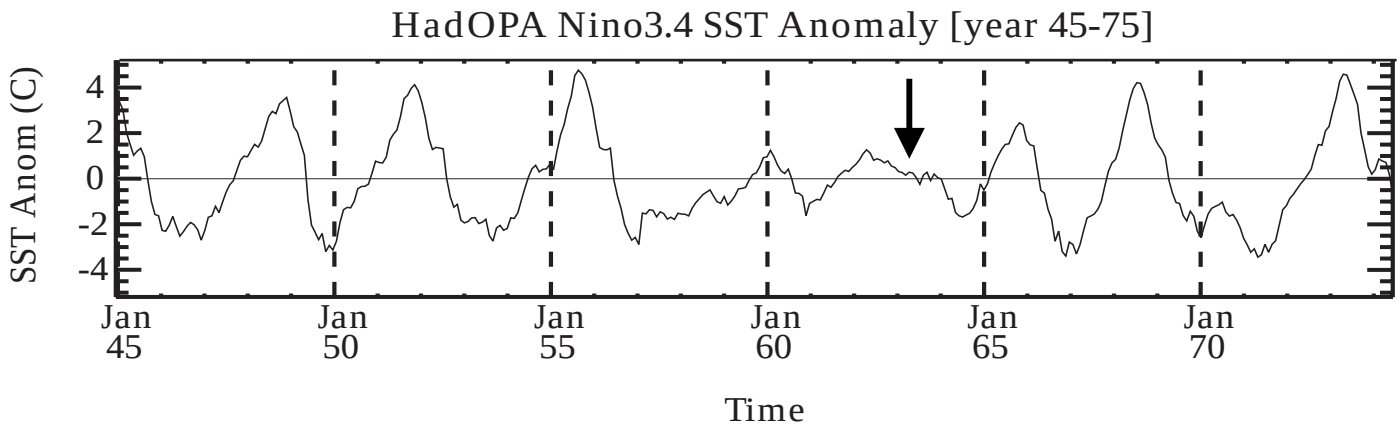
Stronger WWE activity in REF than in NWE: positive feedback

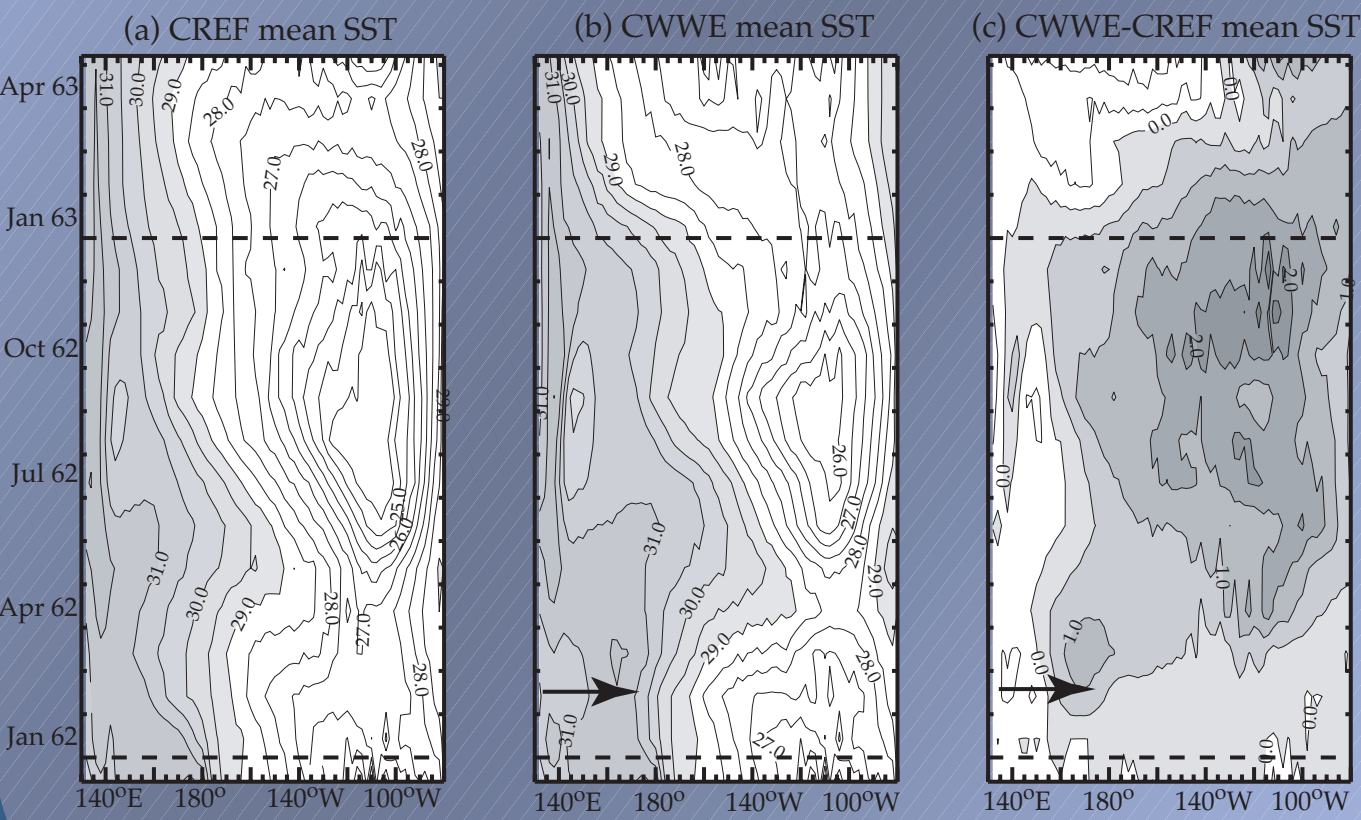


Eastern Pacific warming leads to a reduction of the Trade Winds

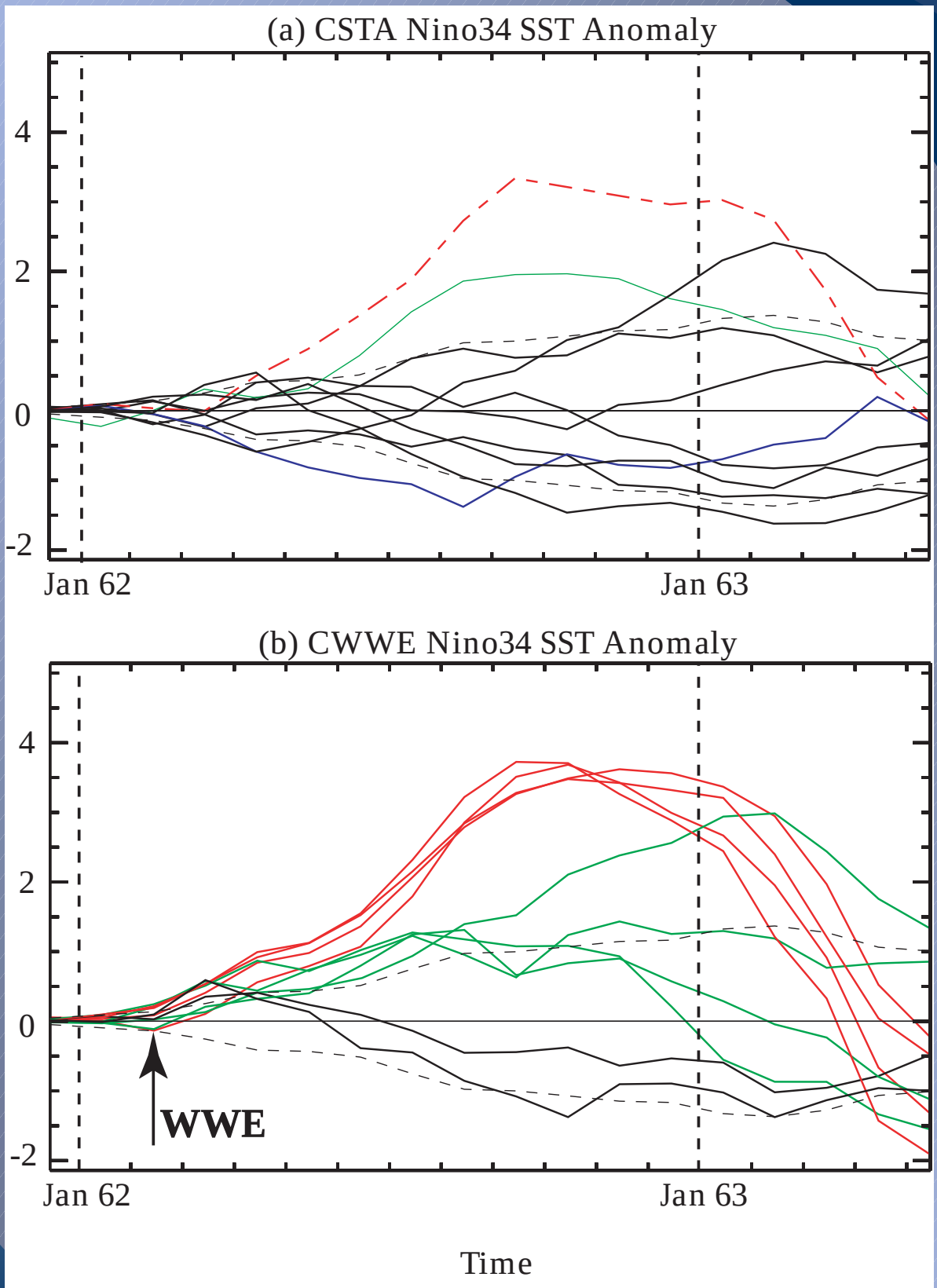


HadOPA coupled model experiments





Role of the March 1997 WWE in El Niño onset



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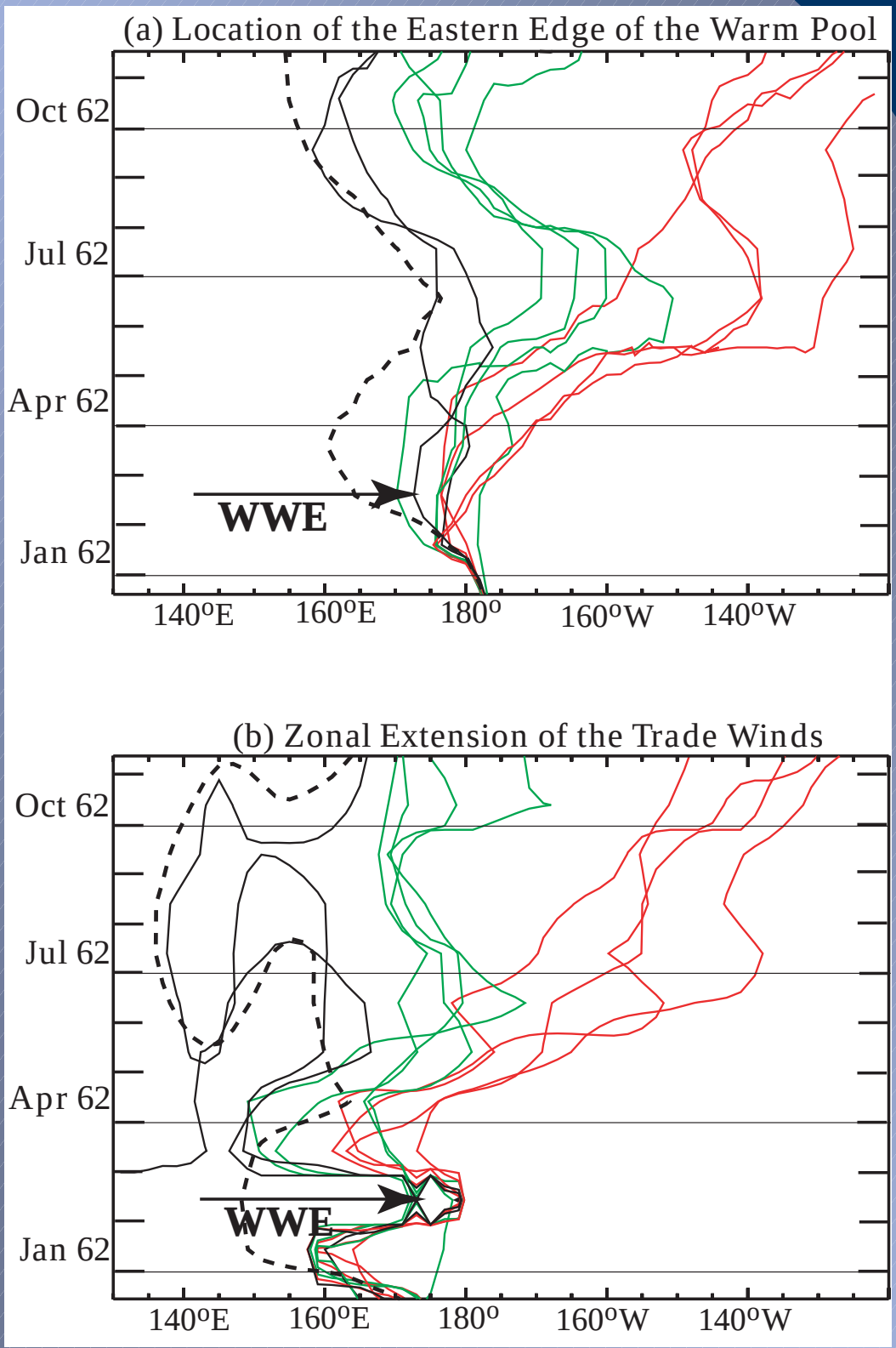

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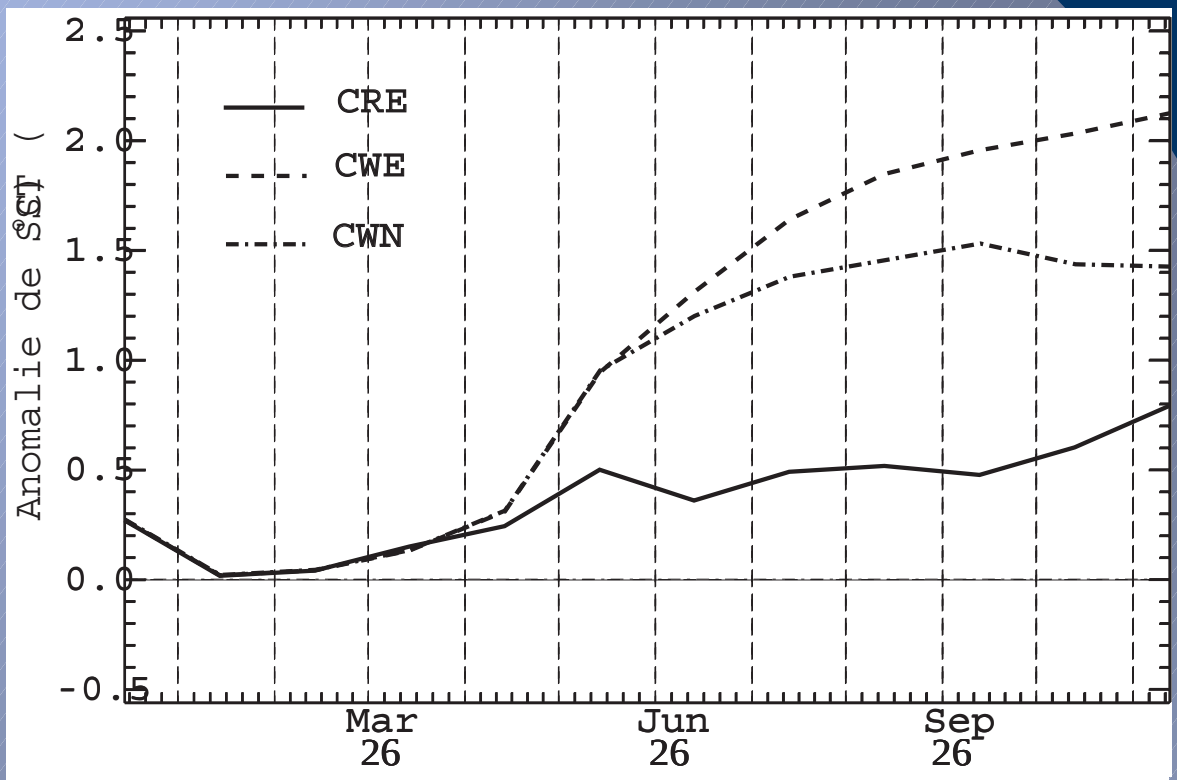

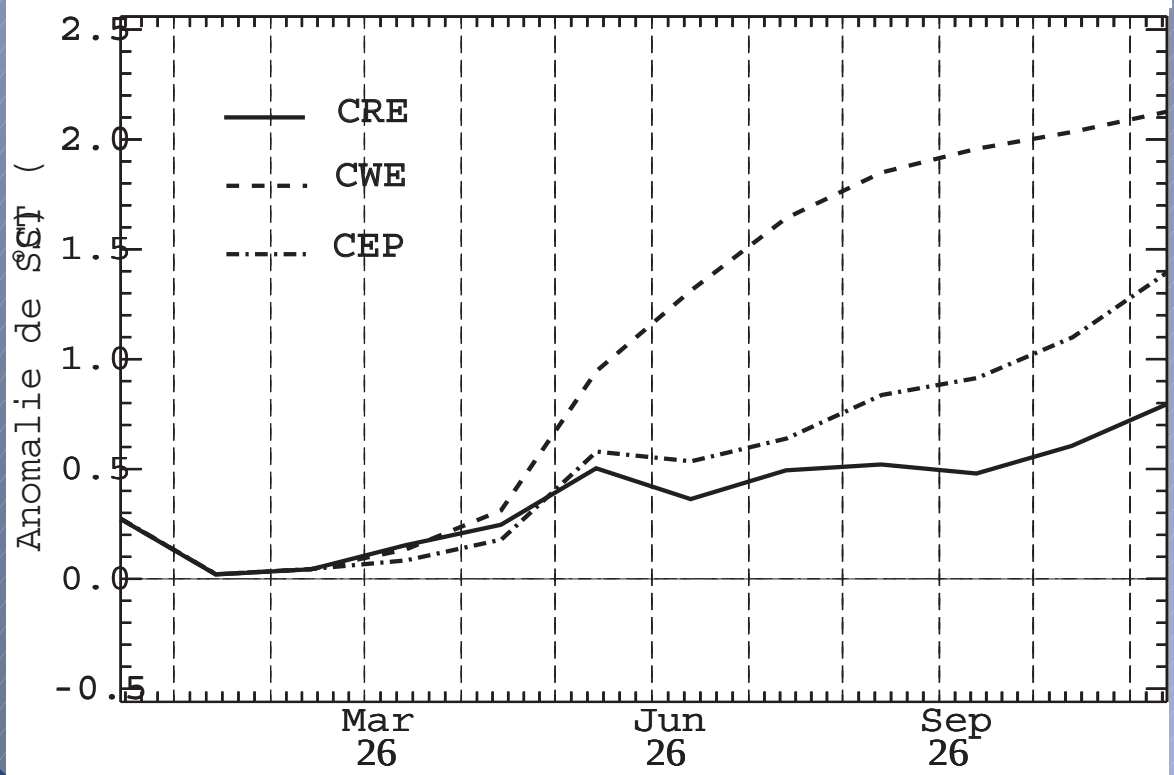

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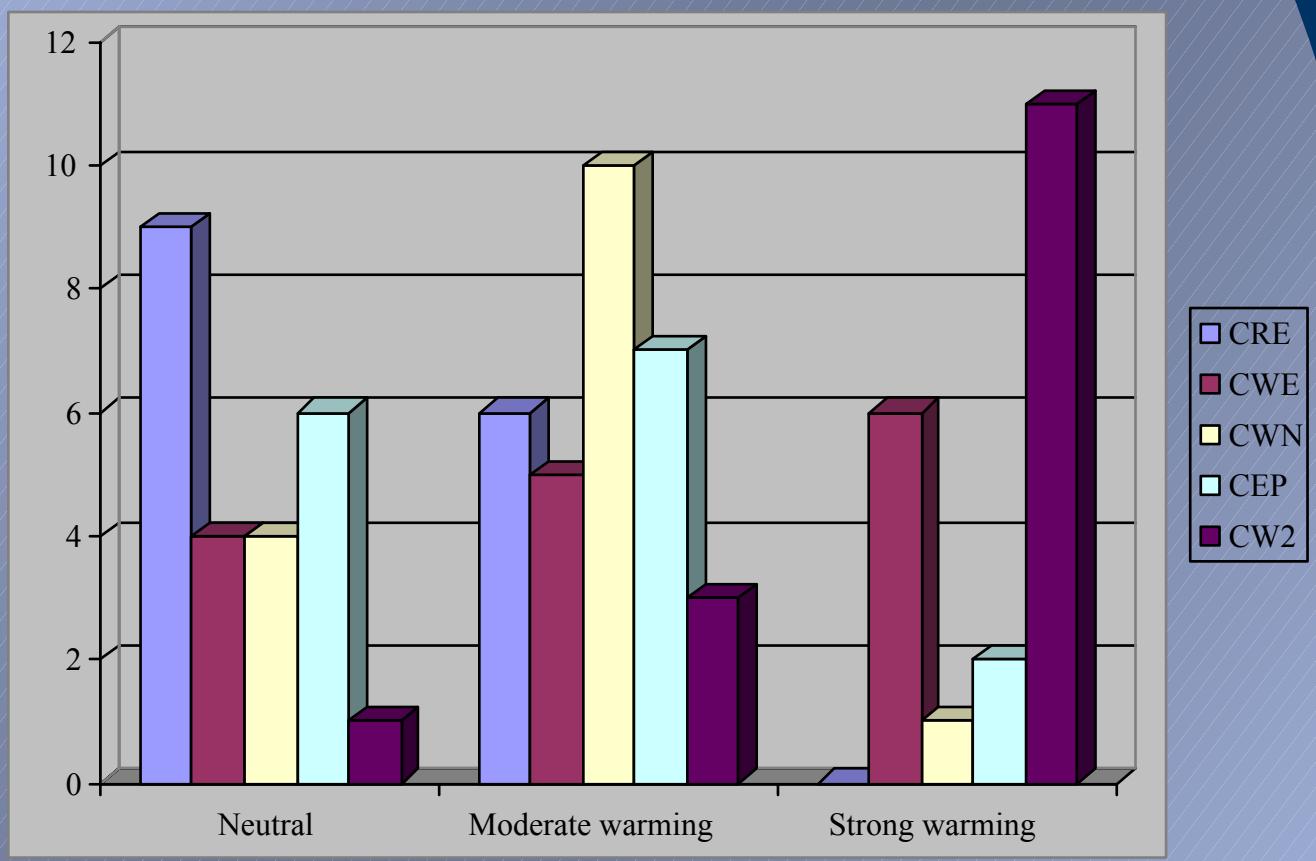

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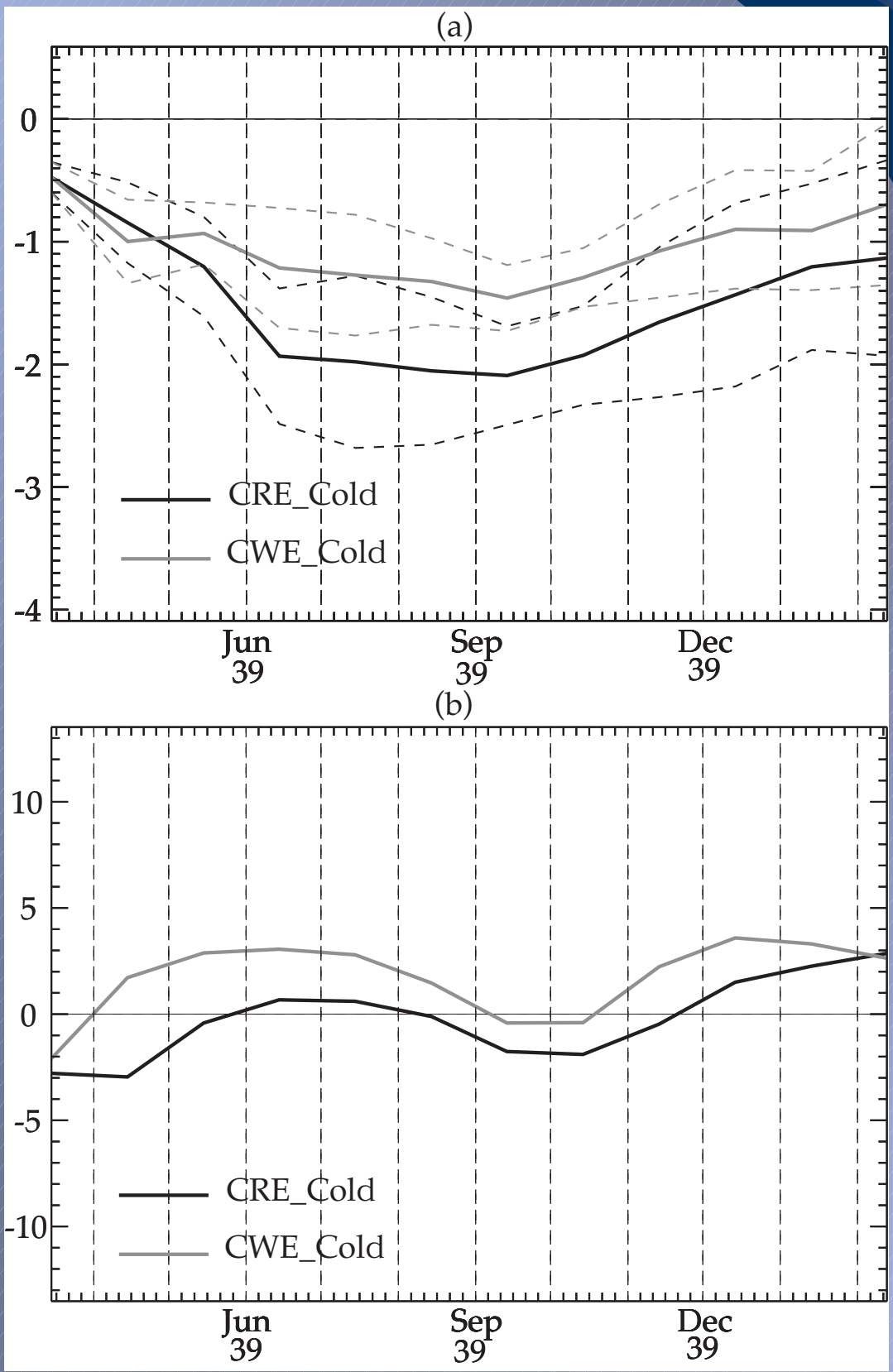

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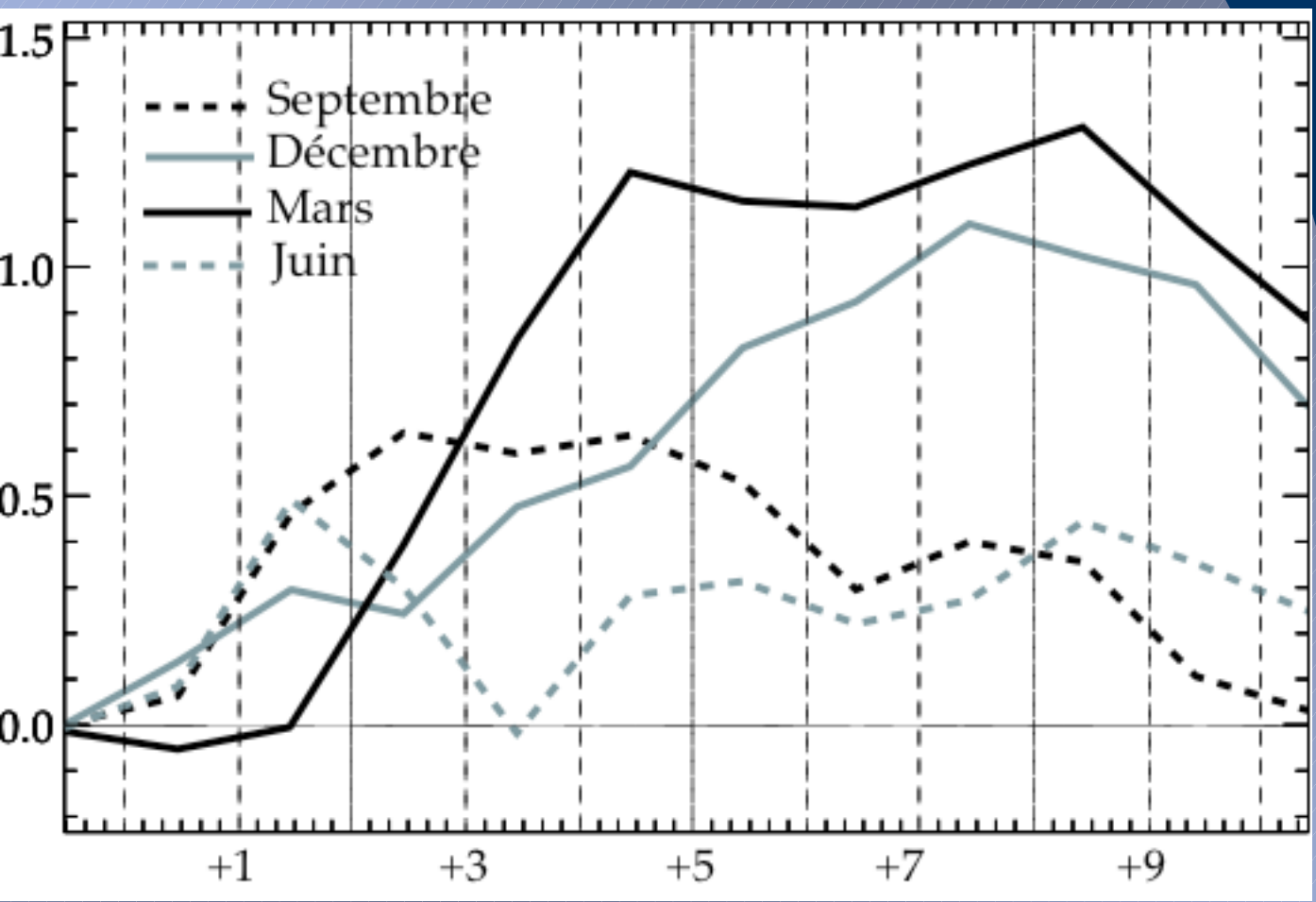
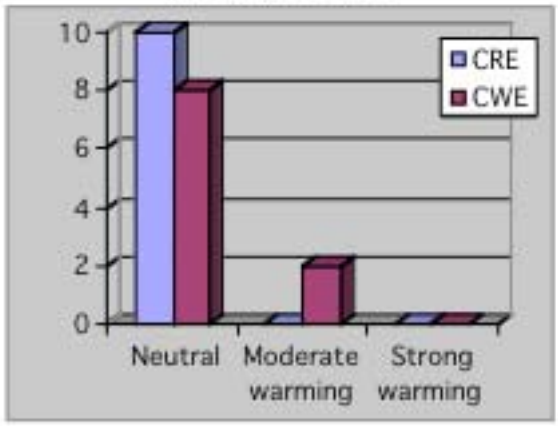
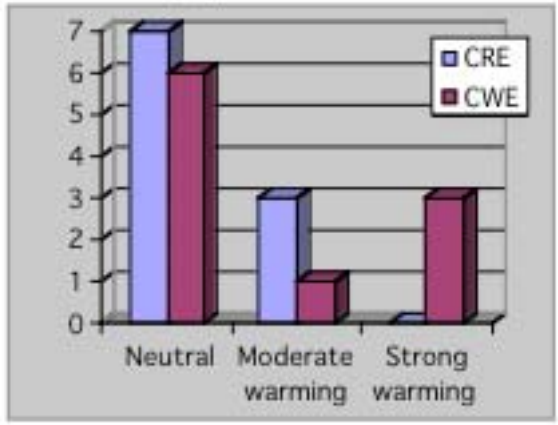


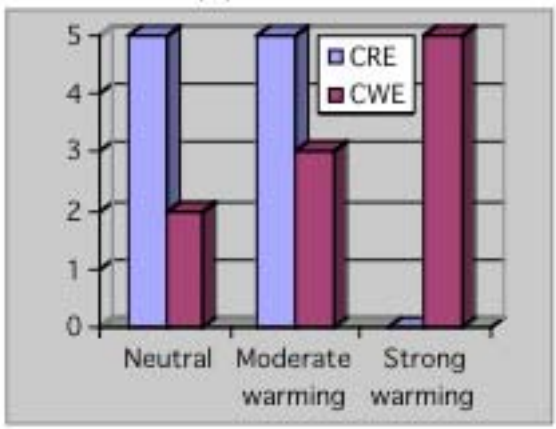
(a) Septembre



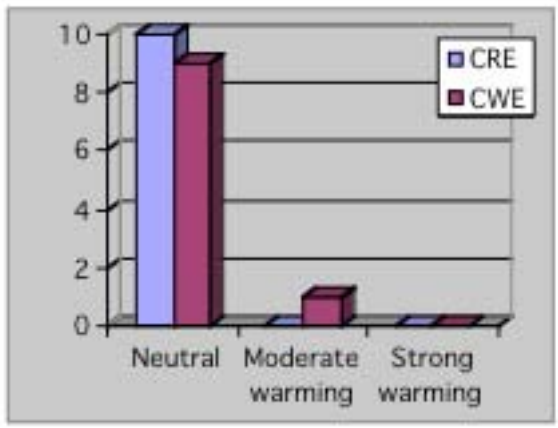
(b) Décembre



(c) Mars



(d) Juin



WWE activity and ENSO dynamics

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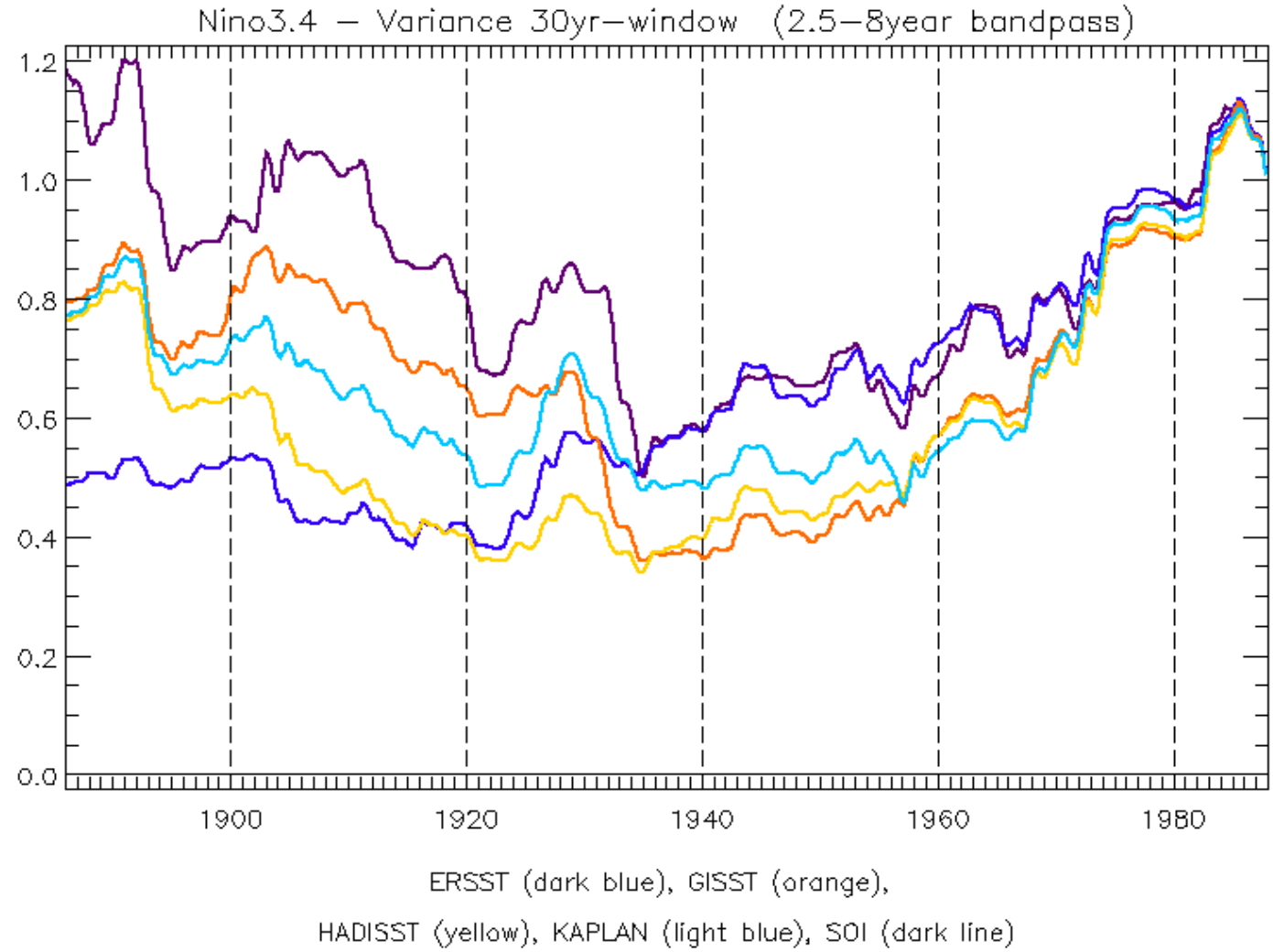
WWE activity and ENSO dynamics



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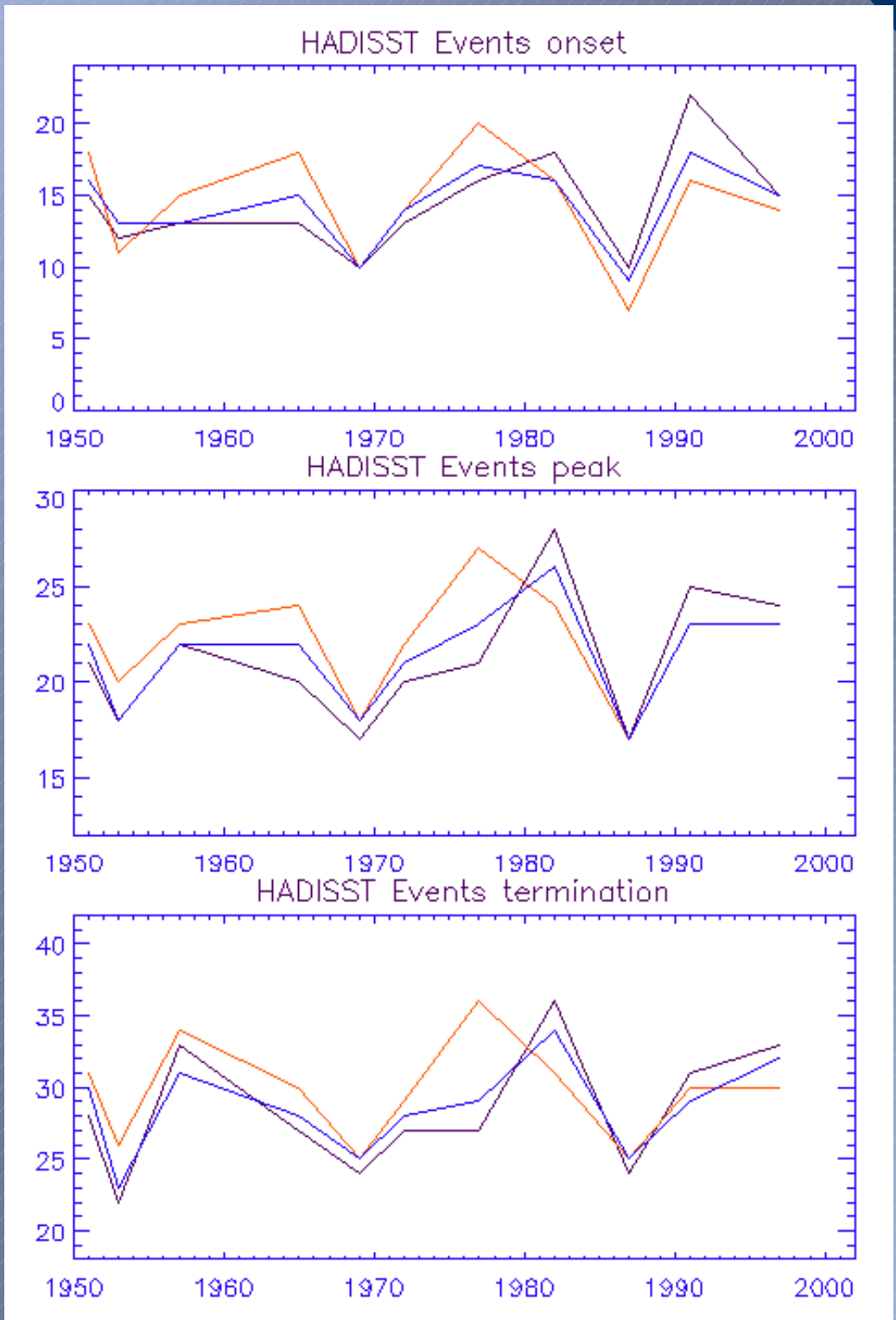
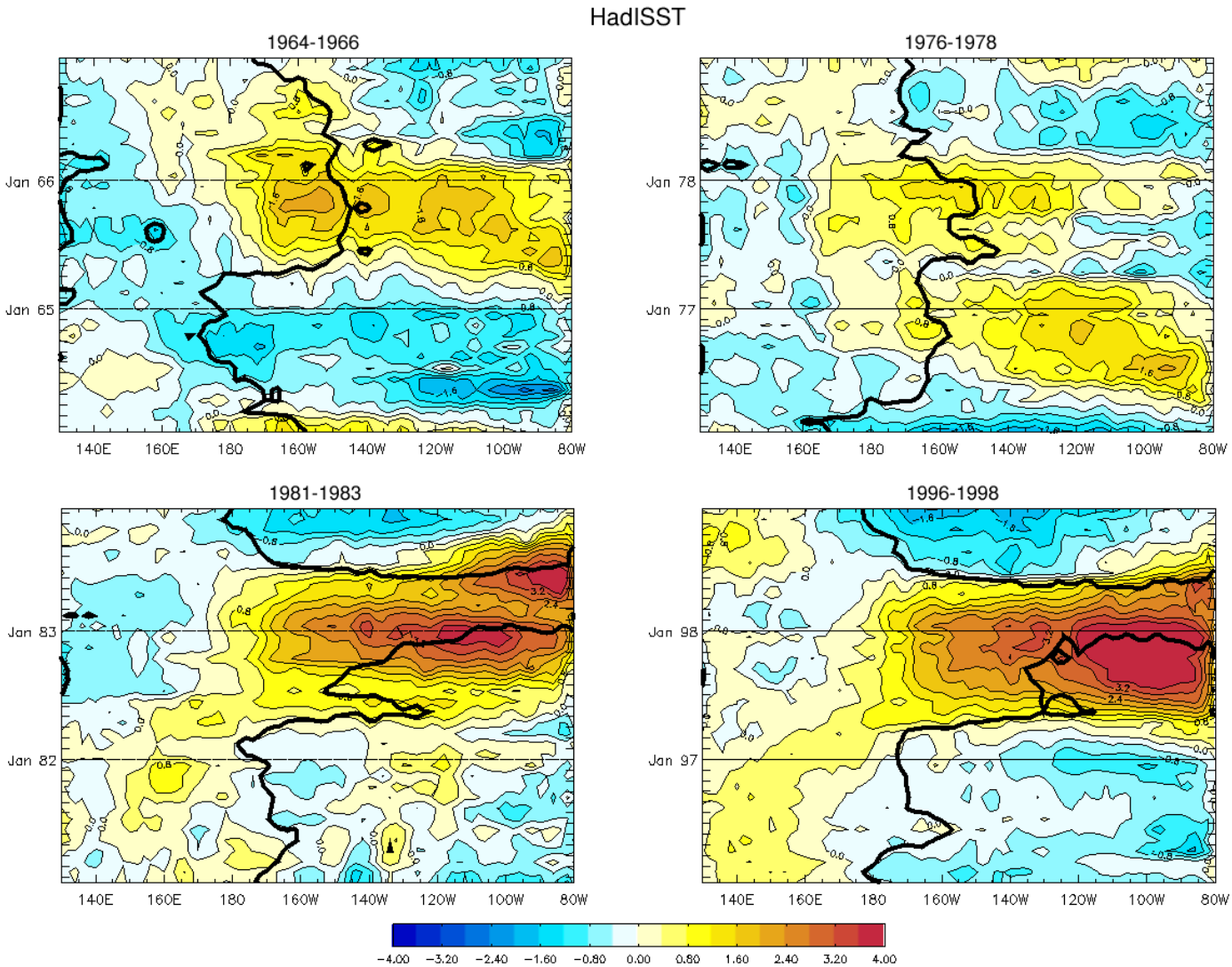


Recent changes in ENSO characteristics



Conclusions

1- Clear impact of an MJO in the termination of the 94-95 Dipole event in the IO.

Questions:
-what favors the occurrence of such an MJO in 94 and not in 97? Is it stochastic or are there any large scale conditions favoring such an occurrence?

Conclusions

2- Strong impact of the March 1997 wind event on El Niño

-Positive feedbacks (more WWE activity)

-Large dispersion (is it model dependent or does it reveal a « natural » sensitivity of the coupled system?)

-Can we define criteria associated to a risk of extreme El Niño occurrence?

-What is the exact role of the MJO? Is it a real contributor to ENSO or one of the mechanisms by which a strong WWE can occur? In such a case, as much efforts should be put in modelling the other mechanims (e.g. cold surges, cyclones, etc…) as in modelling MJO.

Conclusions

3- WWE and ENSO:
Is the change in dynamics observed with the 1982-1983 Event related to a different impact/sensitivity of IntraSeasonal Activity in the Pacific?