

Pacific Basin HYCOM Modeling

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Alan J. Wallcraft and Luis Zamudio**

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Los Alamos, New Mexico
7-9 October 2002**

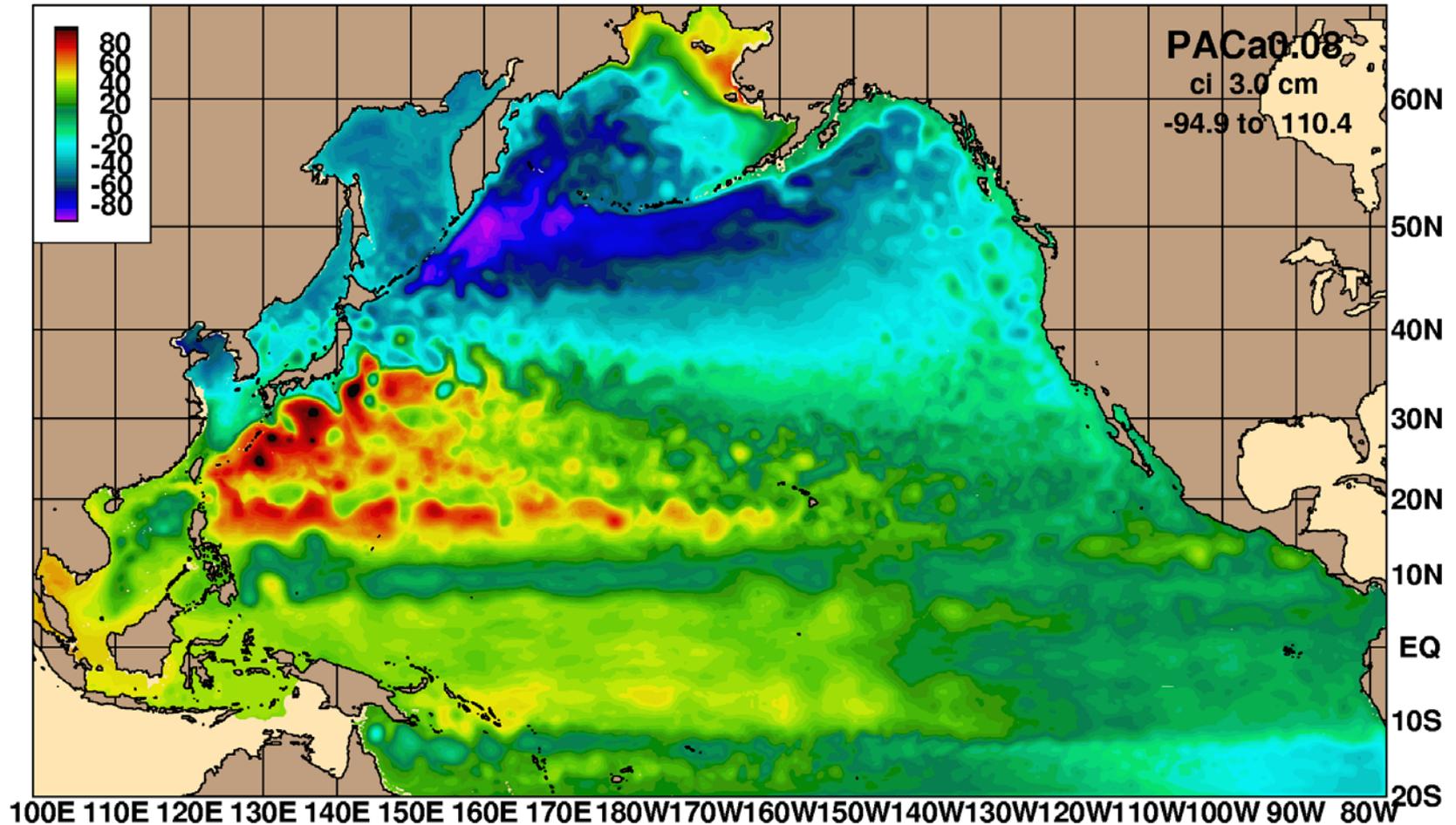
PACIFIC HYCOM MODEL CONFIGURATION

- **Horizontal grid: 1/12° equatorial resolution (2294 x 1362 grid points, 6.5 km spacing on average)**
- **20°S to 65.8°N**
- **20 vertical coordinates**
- **Bathymetry: Quality controlled ETOP05**
- **Surface forcing: (wind stress, wind speed, heat flux [using bulk formula], E-P + relaxation to climatological SSS)**
- **River runoff**
- **Buffer zone: ~3° band along southern and eastern boundary with relaxation to monthly climatological T and S**
- **Closed boundaries along 20°S, in the Indonesian throughflow region and in the Bering Strait**

Pacific HYCOM Modeling Progress

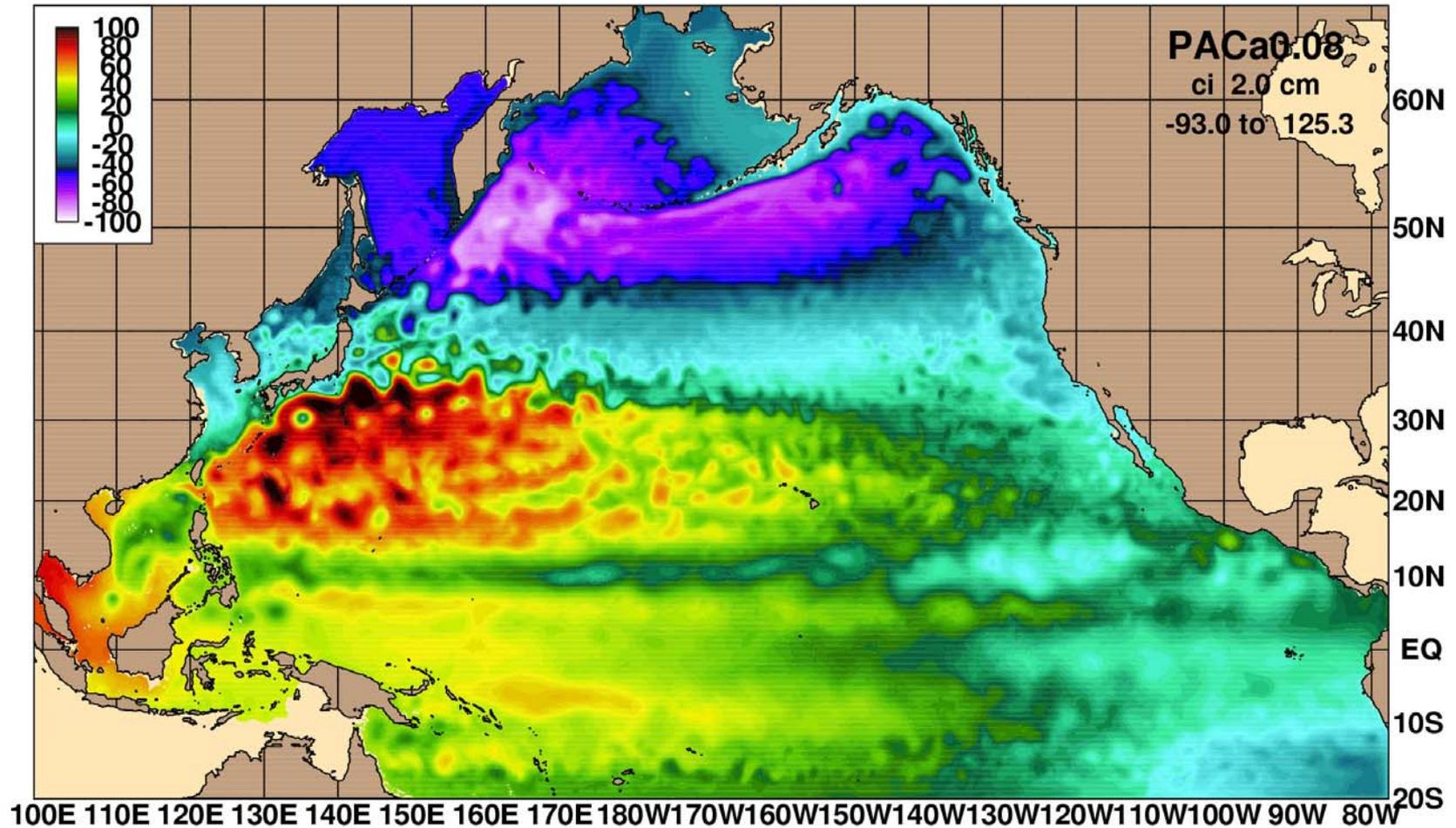
- **Seven 1/6° simulations testing**
 - **horizontal diffusion parameter space**
 - **sensitivity to atmospheric forcing (ECMWF and HR)**
- **Three 1/12° simulations**
 - **high frequency ECMWF climatological forced simulation (8.5 years)**
 - **high frequency HR climatological forced simulation (9.5 years – Challenge)**
 - **NOGAPS/HR interannual simulation January 2001 – May 2002, a period that spanned the life cycle of Hurricane Juliette**

1/12° Pacific HYCOM SSH Snapshot – 1 January



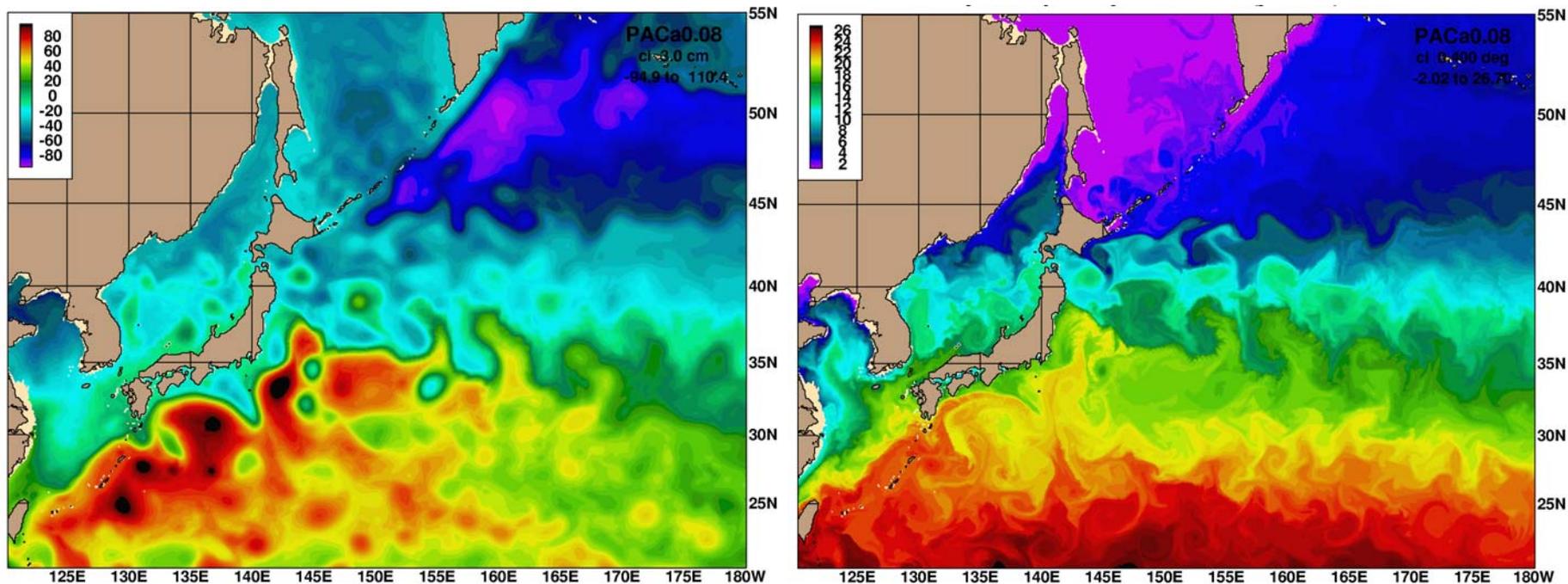
Forced with high frequency climatological **ECMWF** winds and thermal forcing

1/12° Pacific HYCOM SSH Snapshot – 17 December



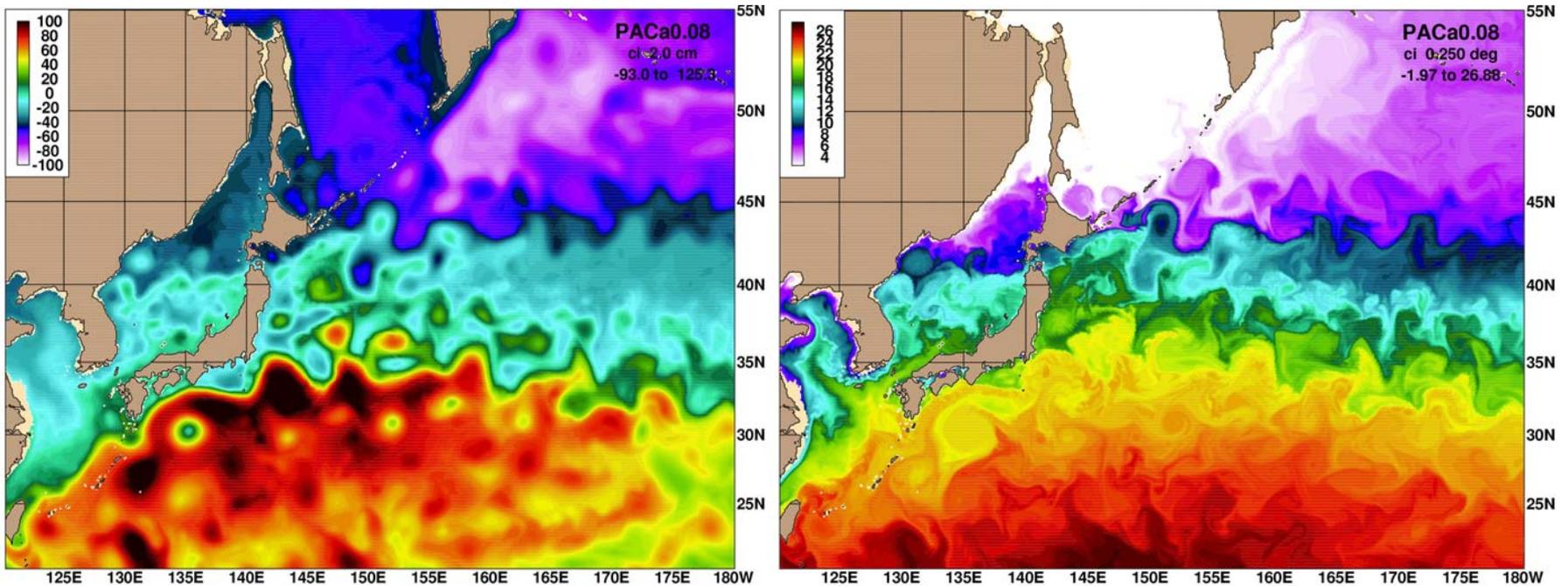
Forced with high frequency climatological **HR** winds and ECMWF thermal forcing

1/12° Pacific HYCOM SSH and SST Snapshot – 1 January



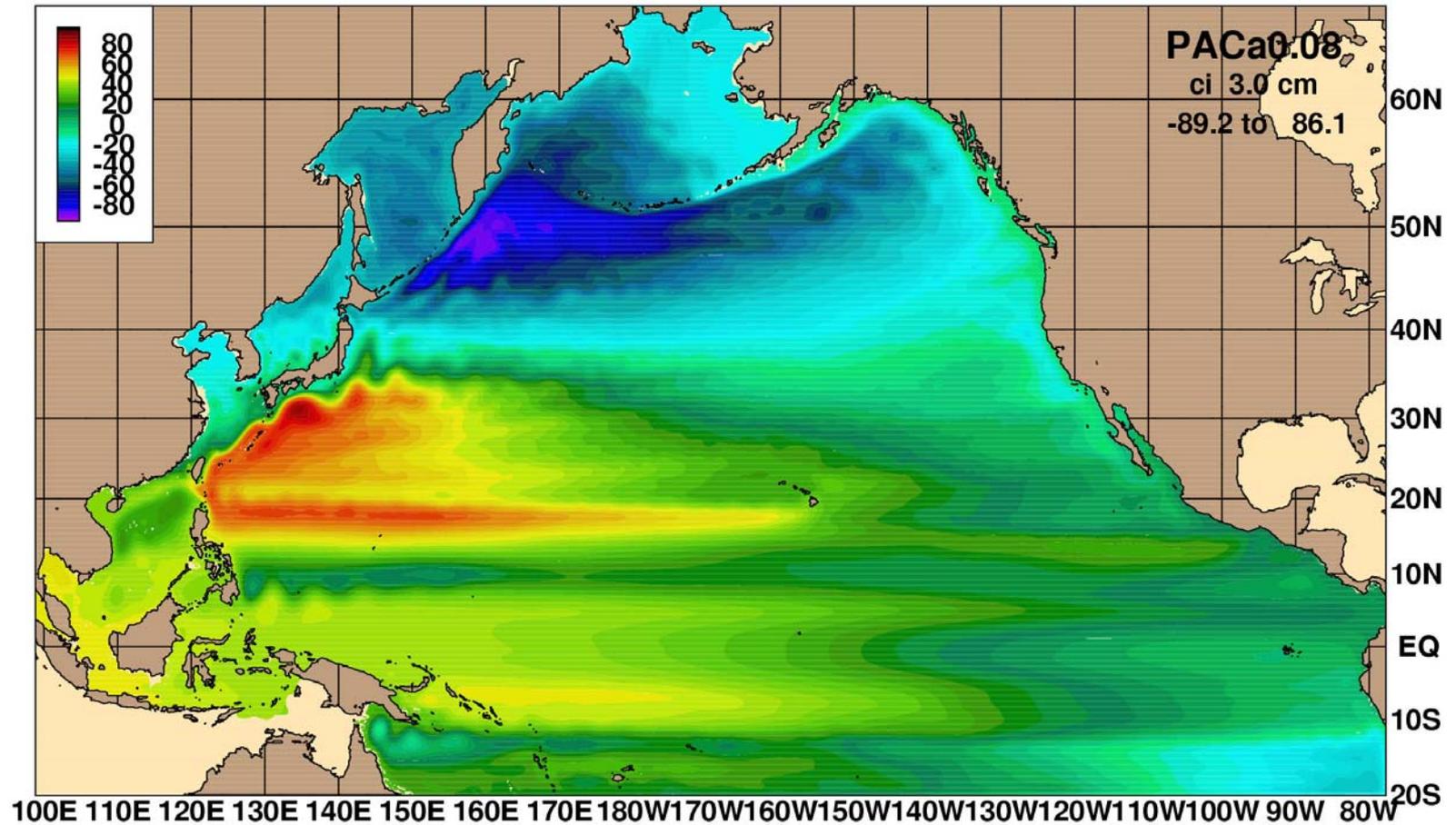
Forced with high frequency climatological **ECMWF** winds and thermal forcing

1/12° Pacific HYCOM SSH and SST Snapshot – 17 December



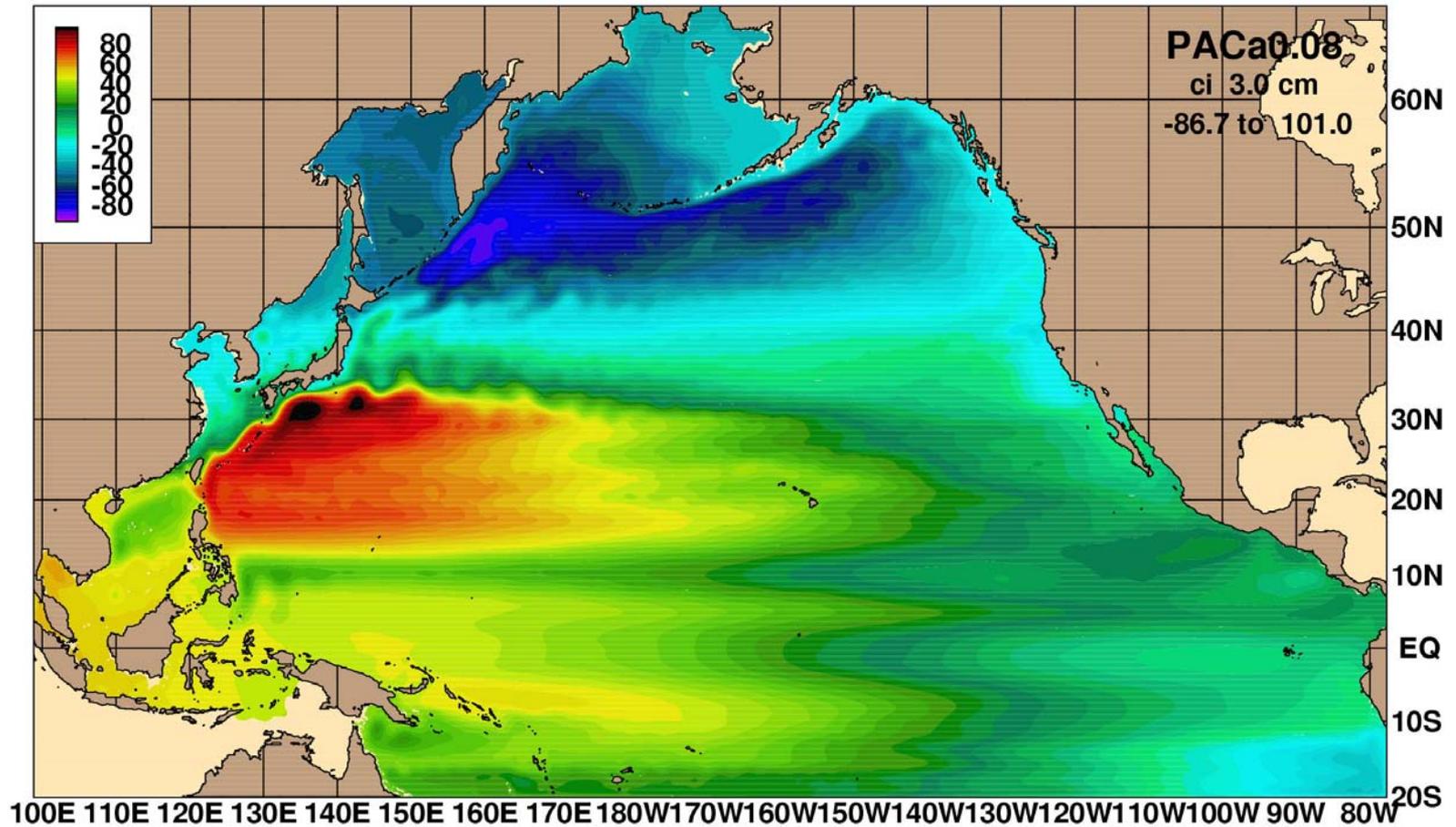
Forced with high frequency climatological **HR** winds and ECMWF thermal forcing

1/12° Pacific HYCOM 6 Year Mean SSH



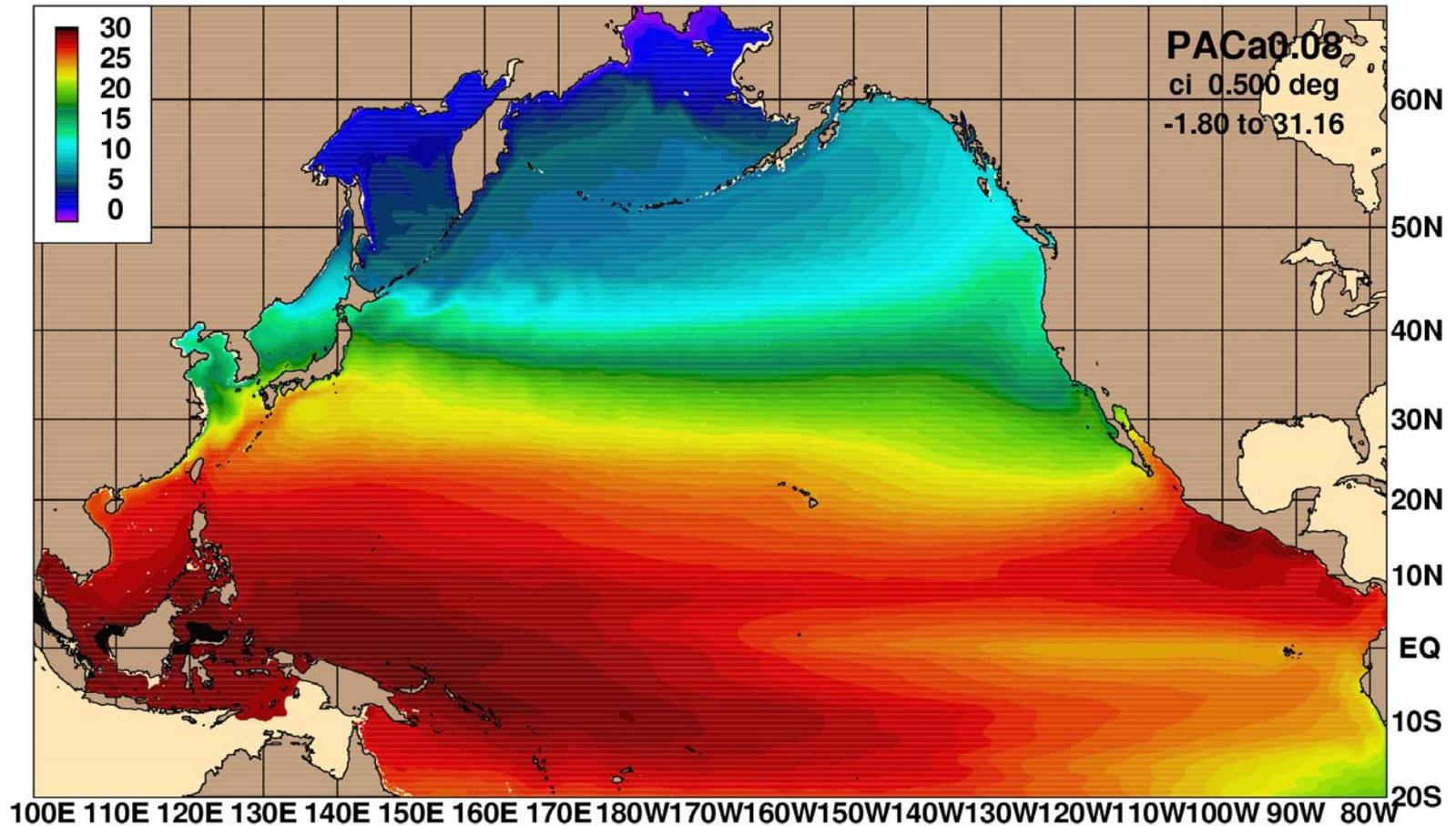
Forced with high frequency climatological **ECMWF** winds and thermal forcing

1/12° Pacific HYCOM 6 Year Mean SSH



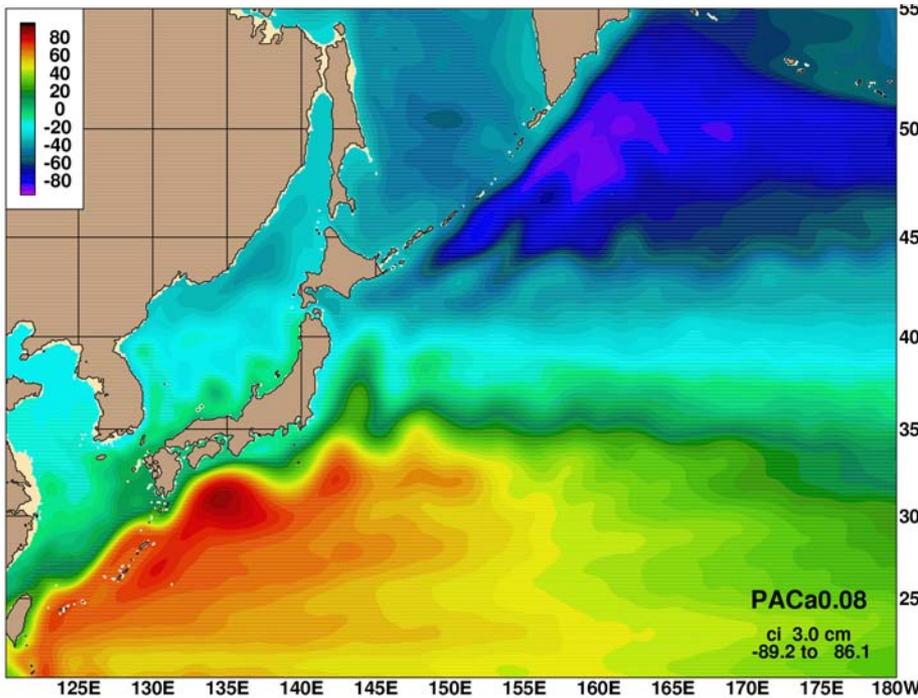
Forced with high frequency climatological **HR** winds and ECMWF thermal forcing

1/12° Pacific HYCOM 6 Year Mean SST

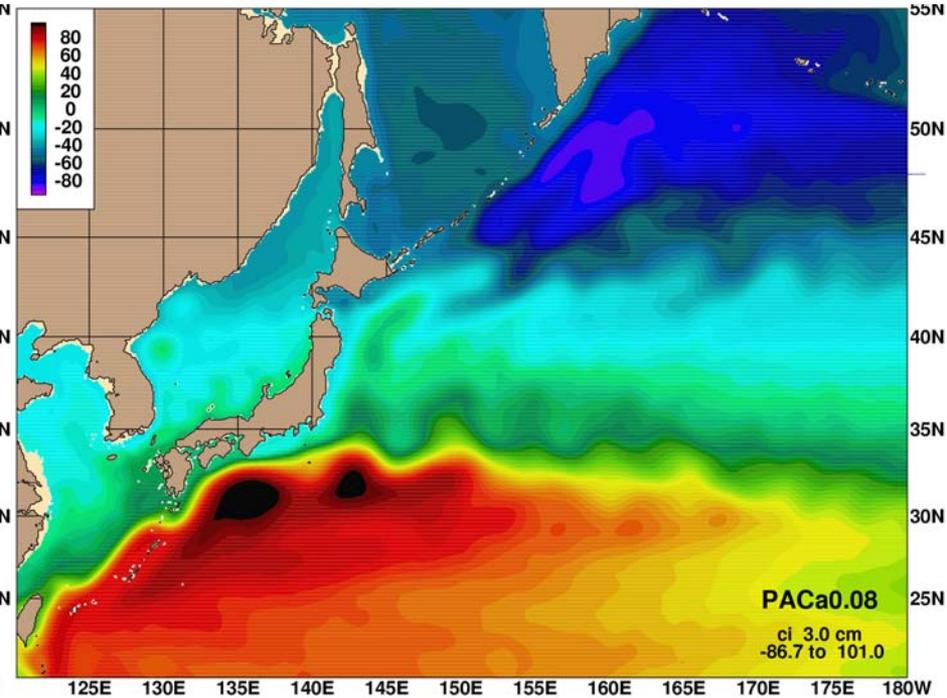


Forced with high frequency climatological **HR** winds and ECMWF thermal forcing

1/12° Pacific HYCOM 6 Year Mean SSH – Kuroshio subregion



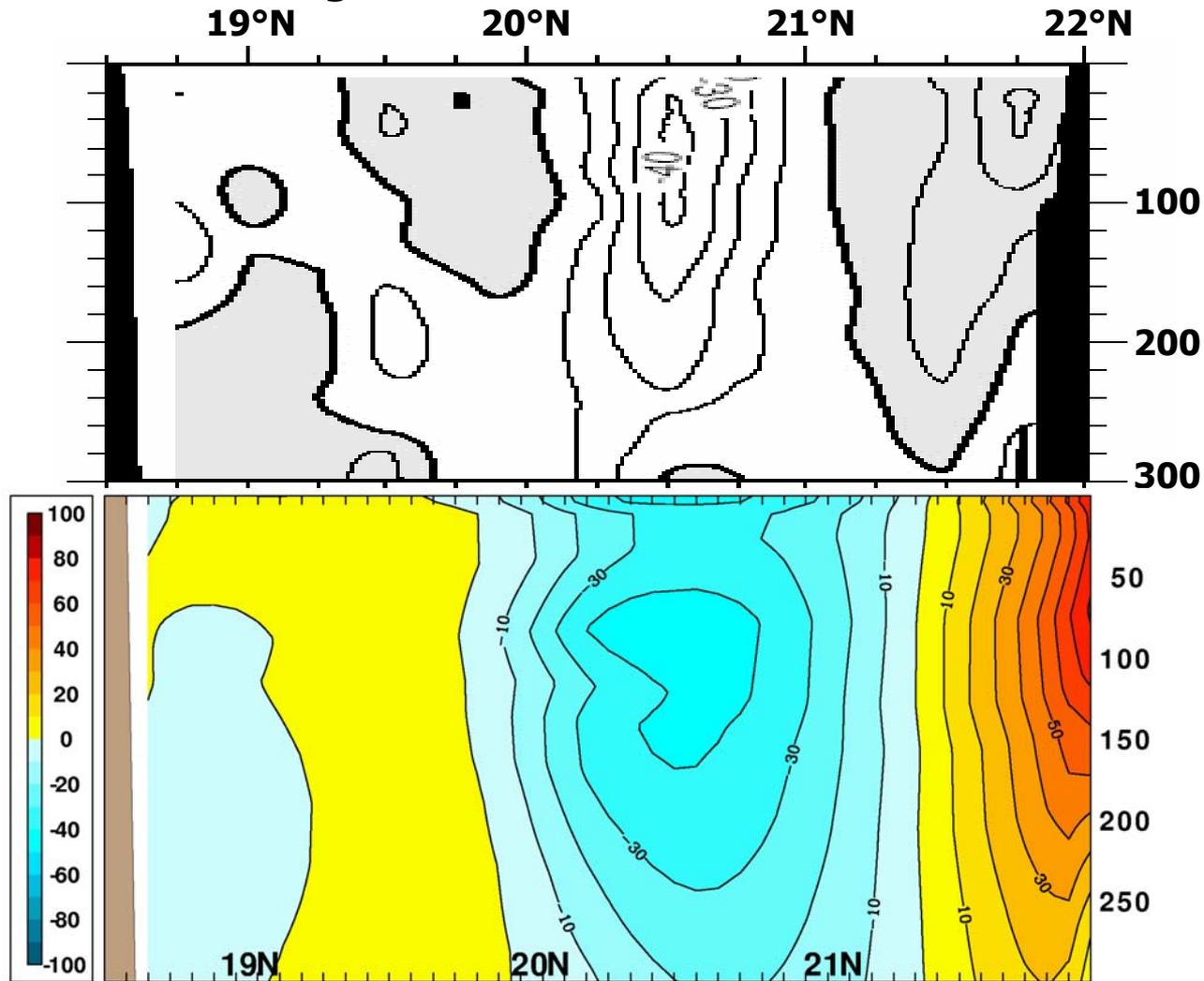
ECMWF forcing



HR forcing

Velocity Cross-section Across Luzon Strait

Sb-ADCP data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 300 m
Section along 120.75°E between Taiwan and Luzon

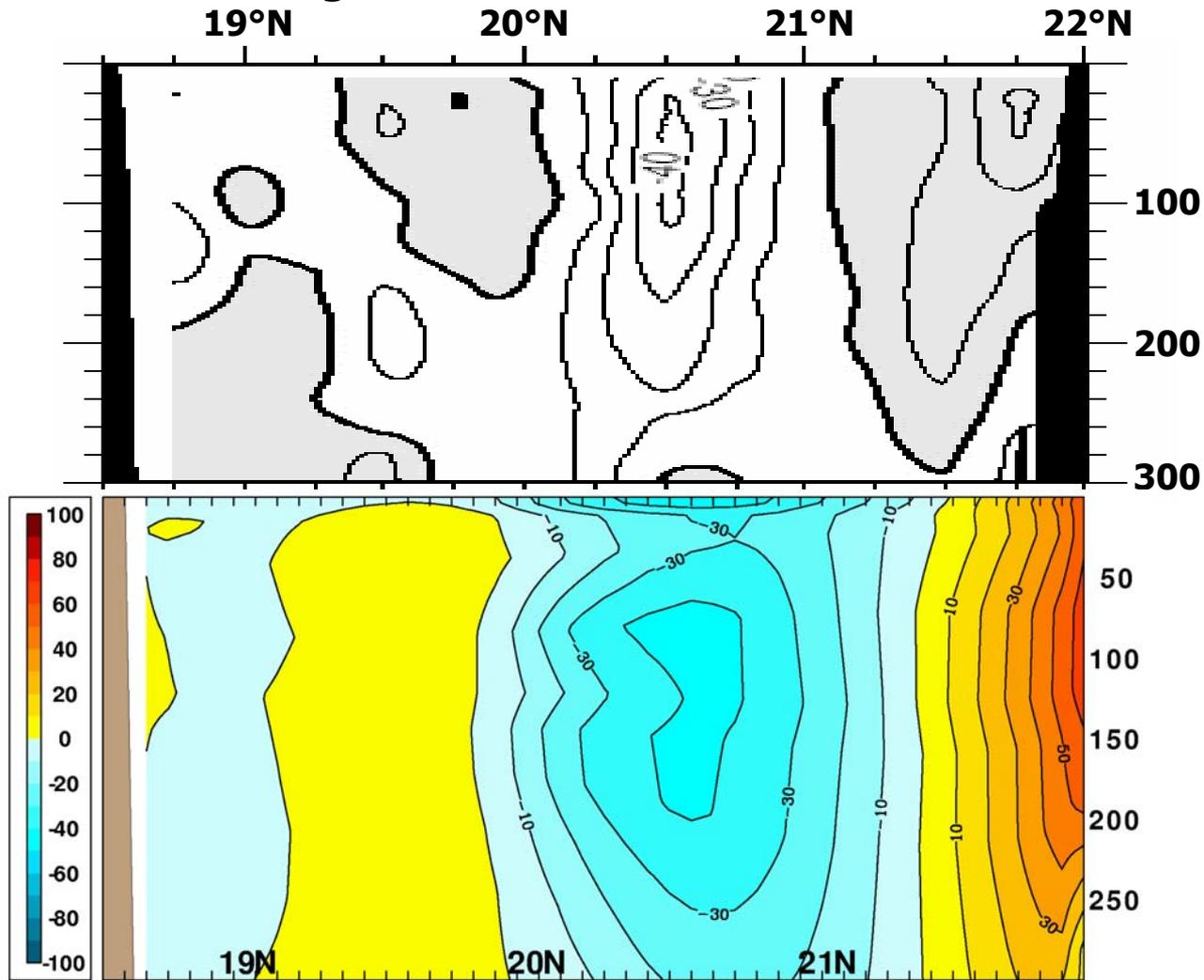


Sb-ADCP data from Liang et al. (DSR Pt. II, in press)

6 year mean from HYCOM forced with high-frequency **ECMWF** winds and thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across Luzon Strait

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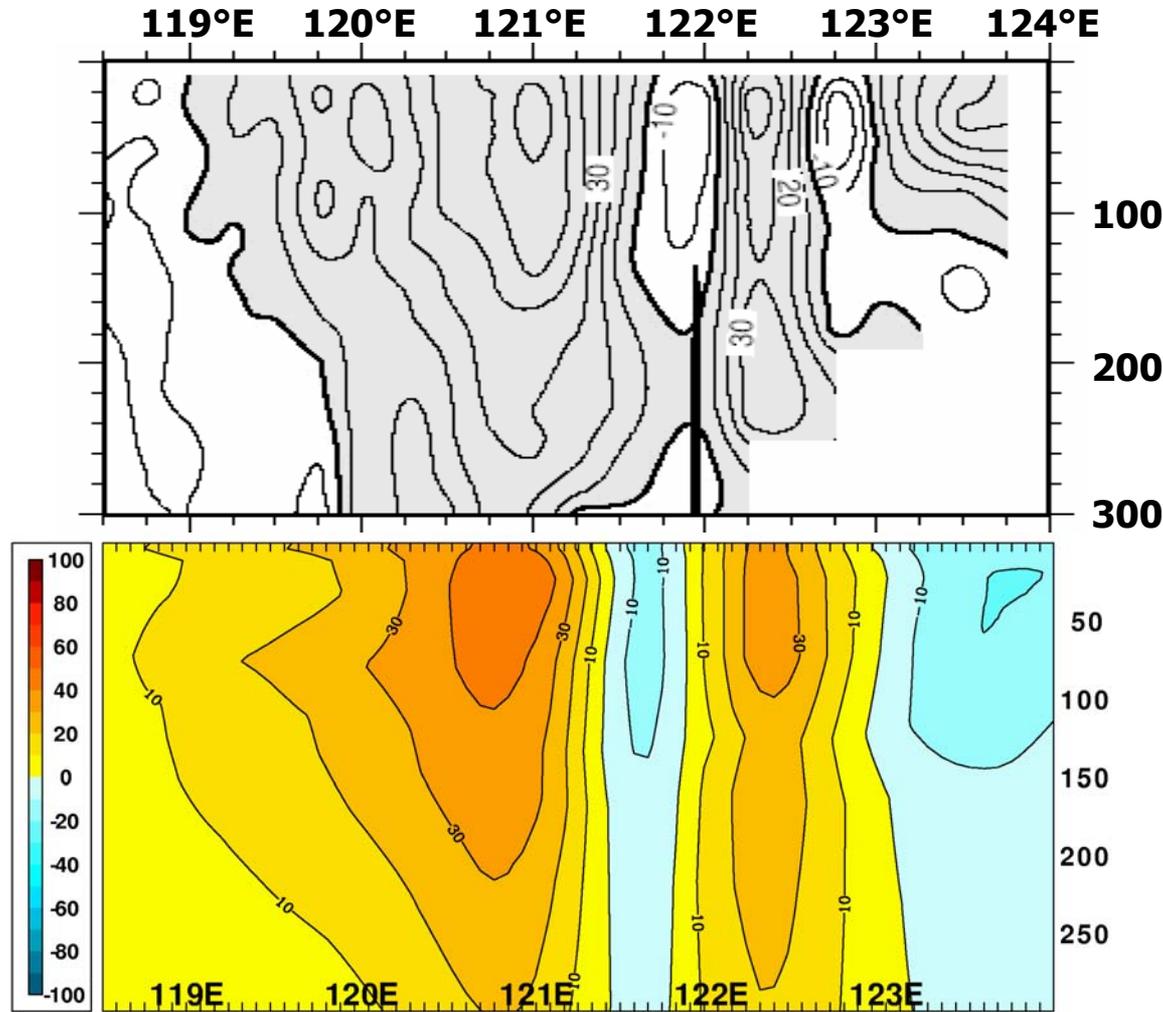


Sb-ADCP data from Liang et al. (DSR Pt. II, in press)

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Velocity Cross-section Along Luzon Strait

Sb-ADCP data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 300 m
Section along 21°N between 118.5°E and 124.0°E

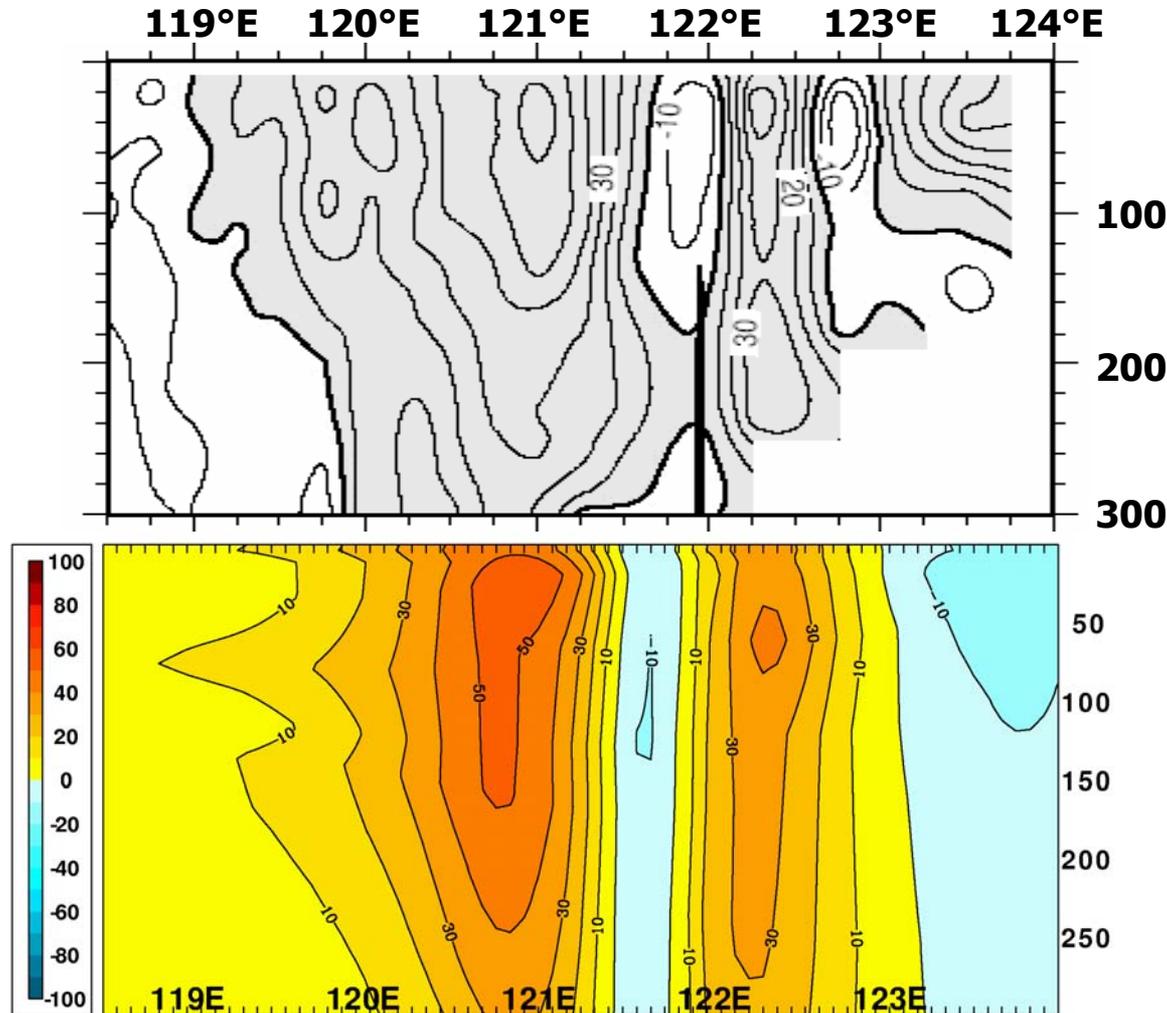


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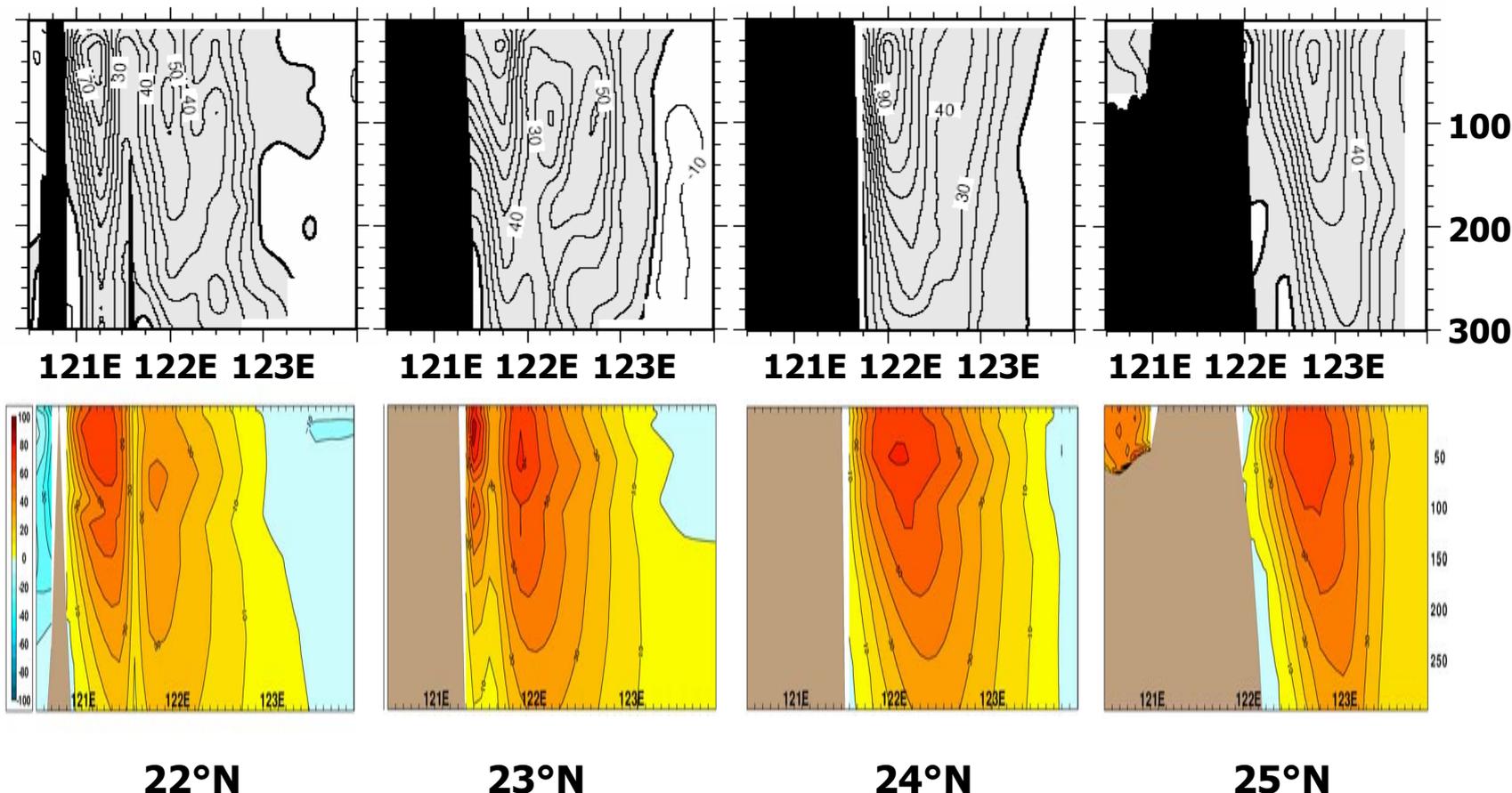


Sb-ADCP data from Liang et al. (DSR Pt. II, in press)

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Velocity Cross-section East of Taiwan

Sb-ADCP data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 300 m
Sections at 22°N, 23°N, 24°N and 25°N

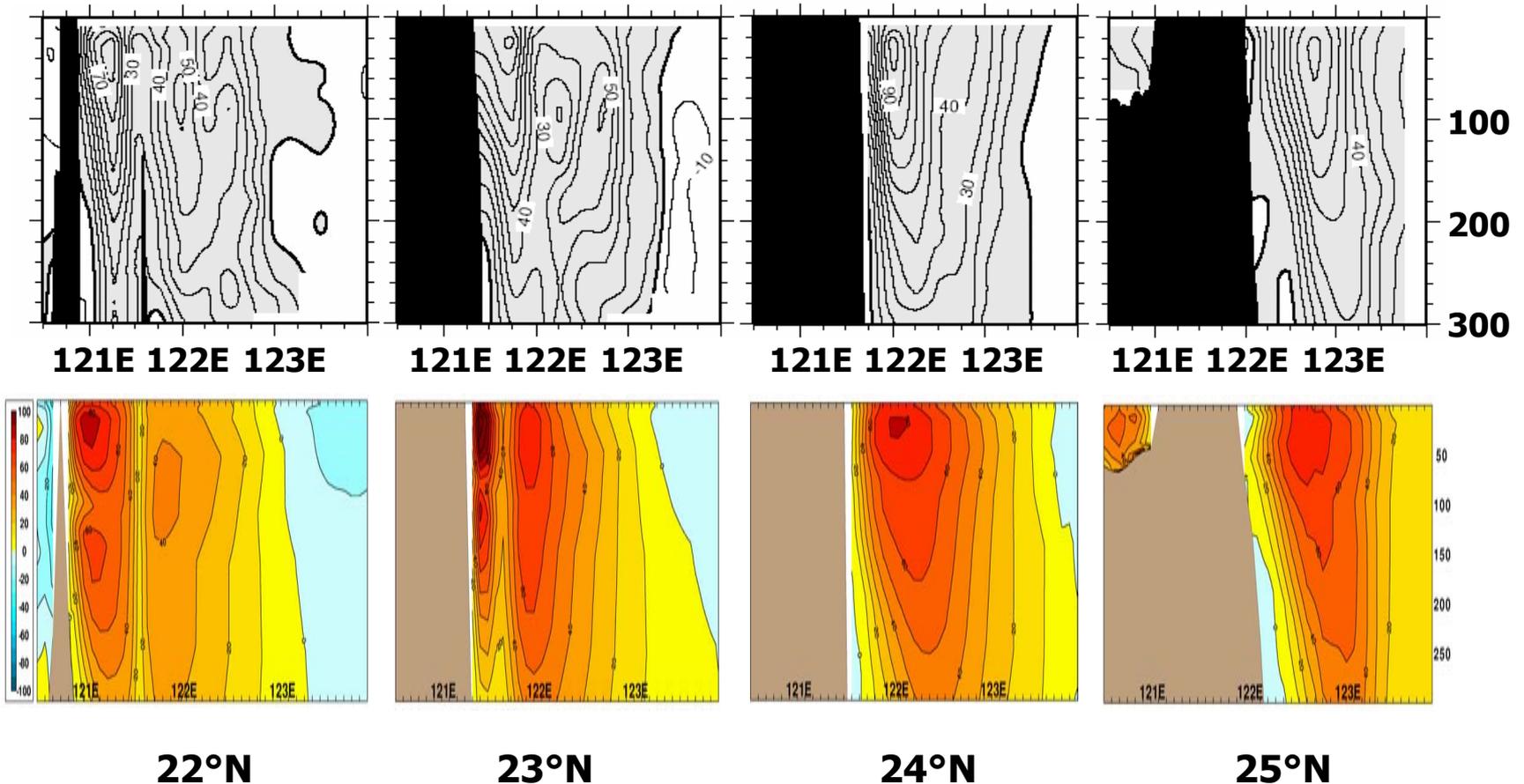


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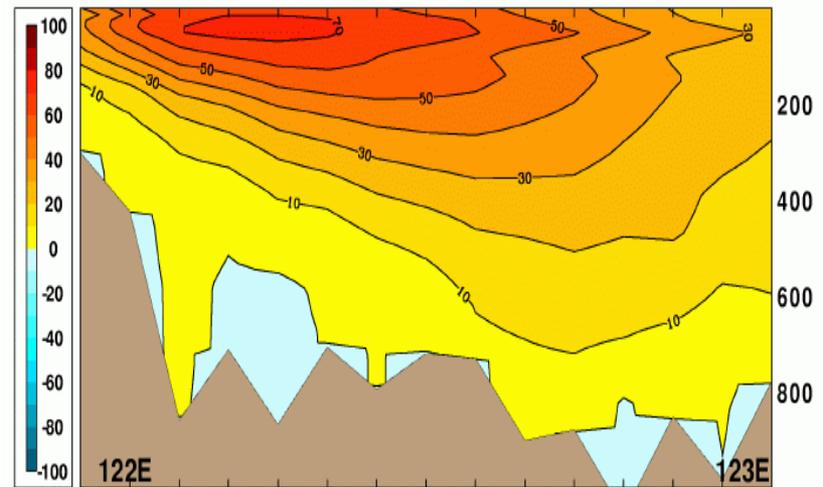
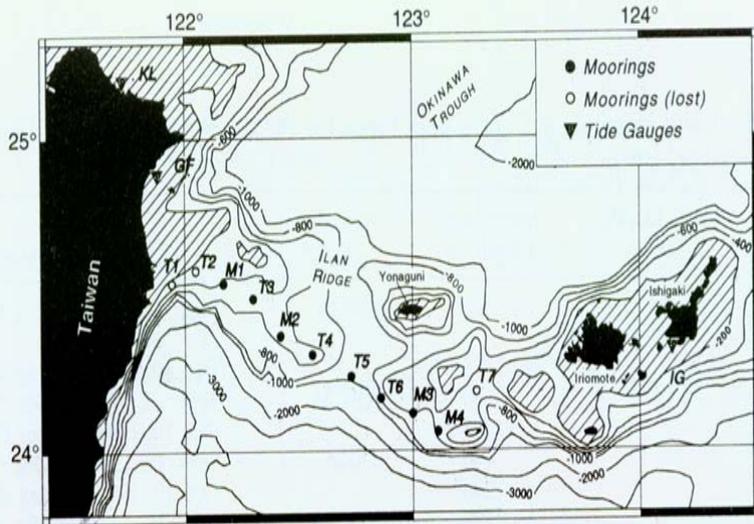
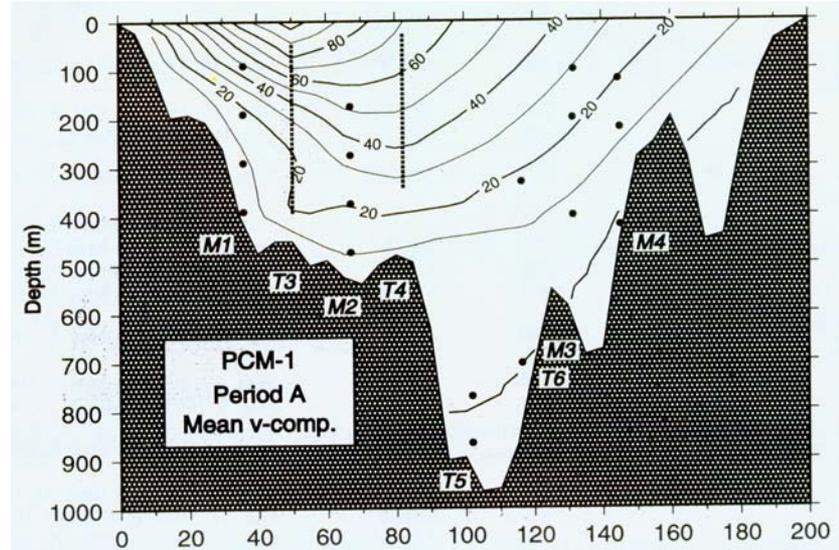


Sb-ADCP data from Liang et al. (DSR Pt. II, in press)
6 year mean from HYCOM forced with high-frequency **HR** winds and ECMWF thermal forcing
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Velocity Cross-section at WOCE PCM-1

Current meter data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 1000 m

PCM-1 data from
September 1995
to May 1996



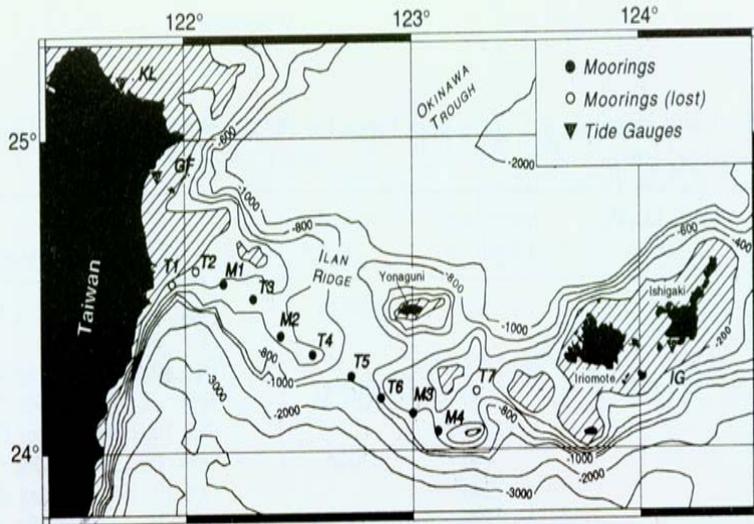
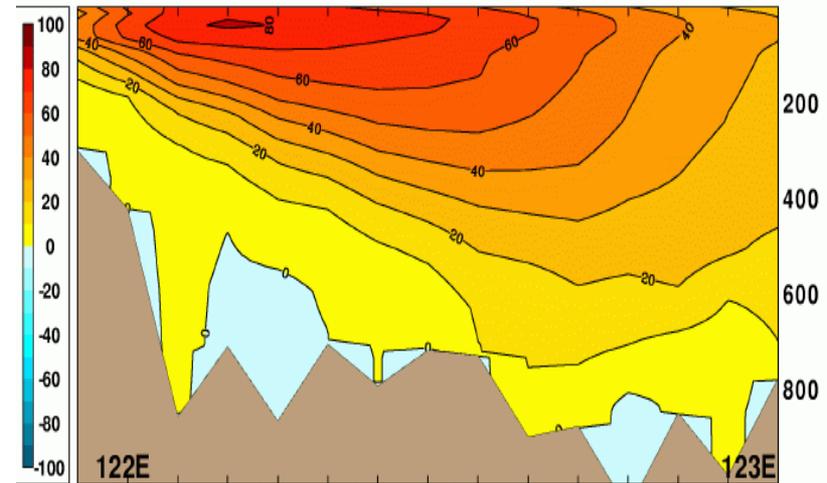
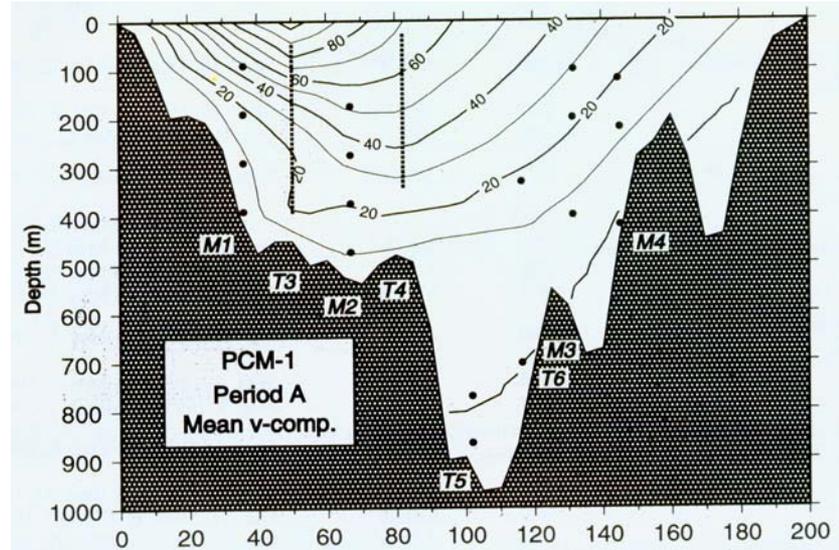
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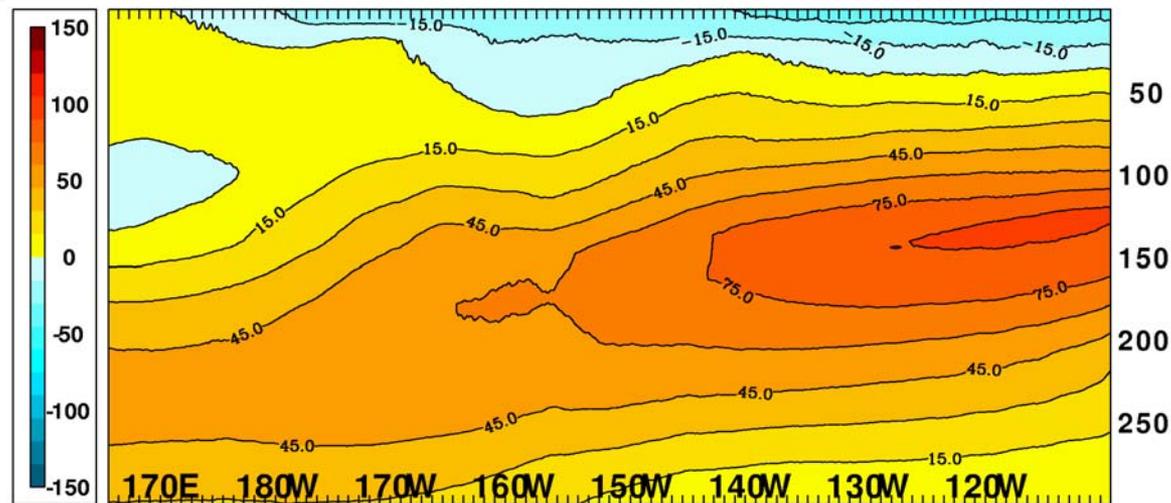
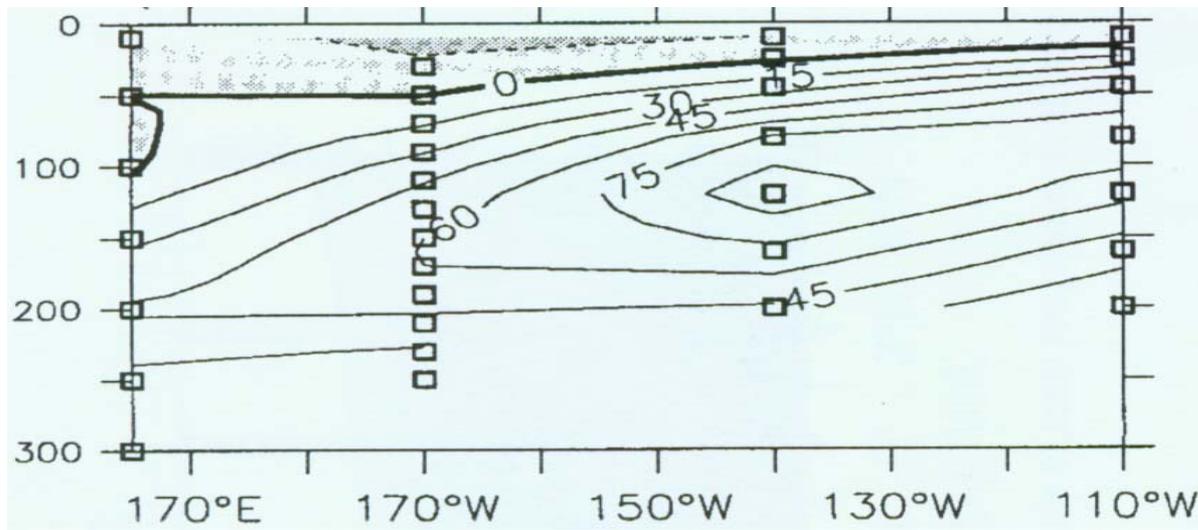


Current meter data from Lee et al. (2001, JGR)

6 year mean from HYCOM forced with high-frequency HR winds and ECMWF thermal forcing
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Velocity Cross-section Along the Equator

TOGA TAO data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 300 m
Section between 165°E and 110°W

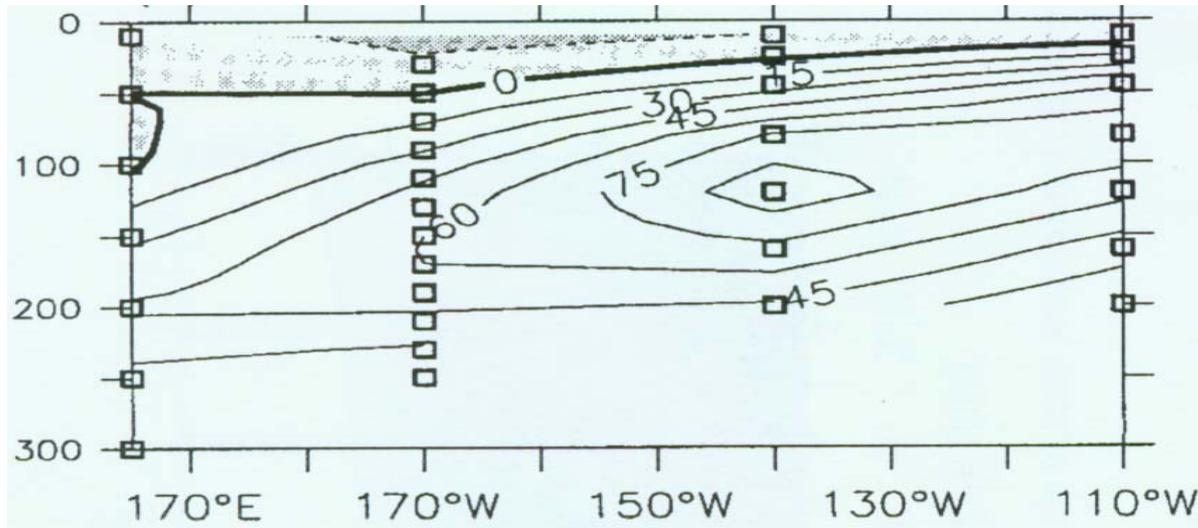


TOGA TAO buoy data from Yu and McPhaden (1999, JPO)

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No ocean data assimilation in HYCOM

Velocity Cross-section Along the Equator

TOGA TAO data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 300 m
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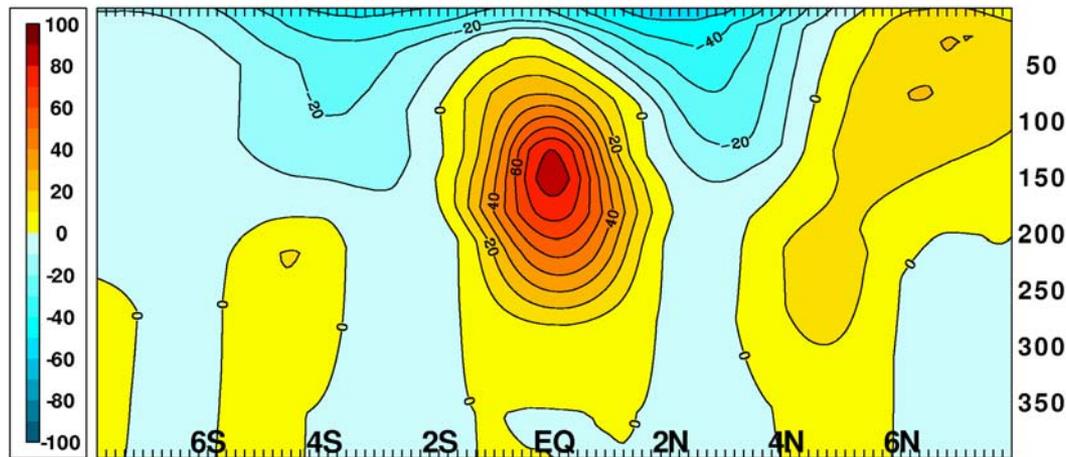
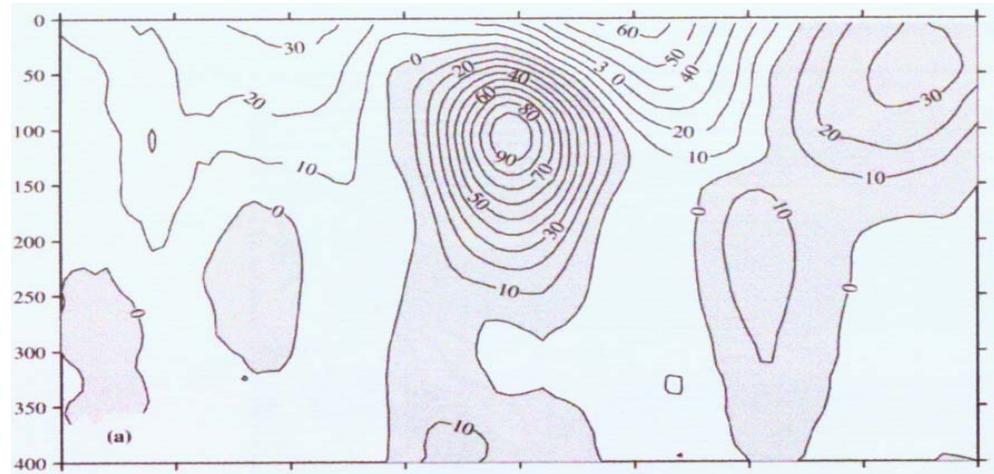


TOGA TAO buoy data from Yu and McPhaden (1999, JPO)

6 year mean from HYCOM forced with high-frequency HR winds and ECMWF thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across the Equator at 135°W

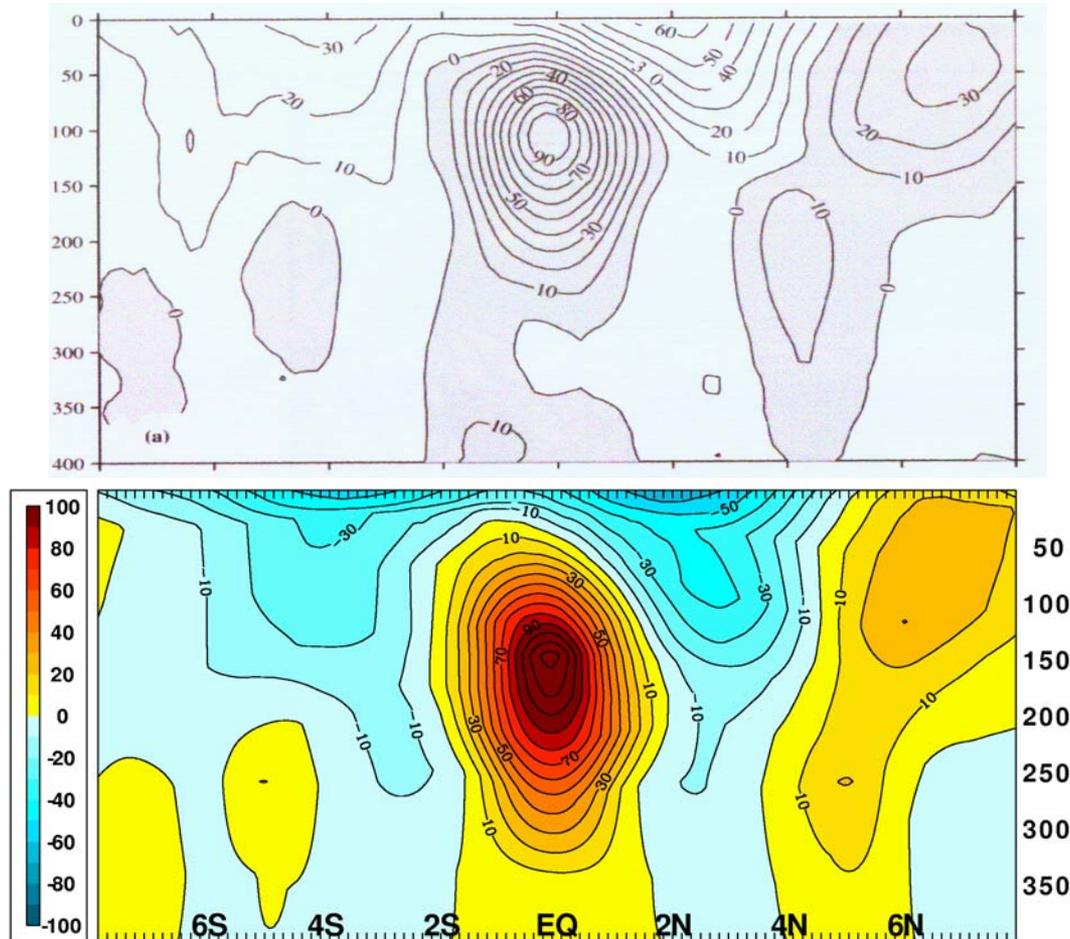
CTD/ADCP data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 400 m
Section between 8°S and 8°N



CTD/ADCP data from Johnson and McPhaden (2001, JPO)
6 year mean from HYCOM forced with high-frequency ECMWF winds and thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across the Equator at 135°W

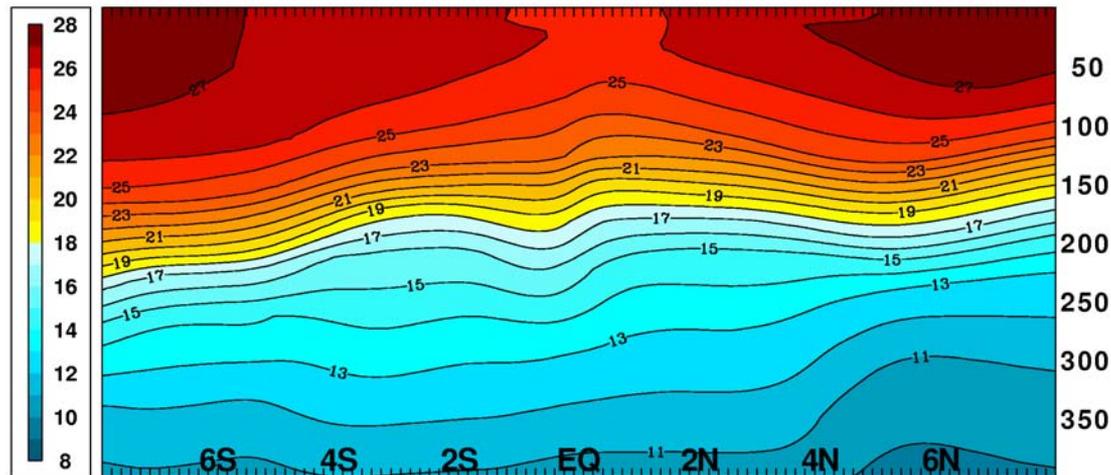
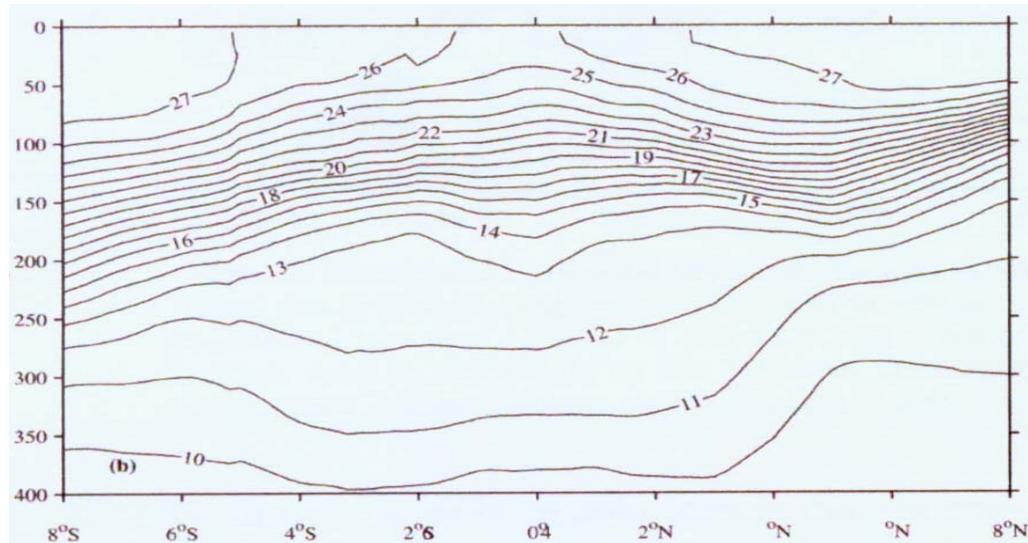
CTD/ADCP data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 400 m
Section between 8°S and 8°N



CTD/ADCP data from Johnson and McPhaden (2001, JPO)
6 year mean from HYCOM forced with high-frequency **HR** winds and ECMWF thermal forcing
No ocean data assimilation in HYCOM

Temperature Cross-section Across the Equator at 135°W

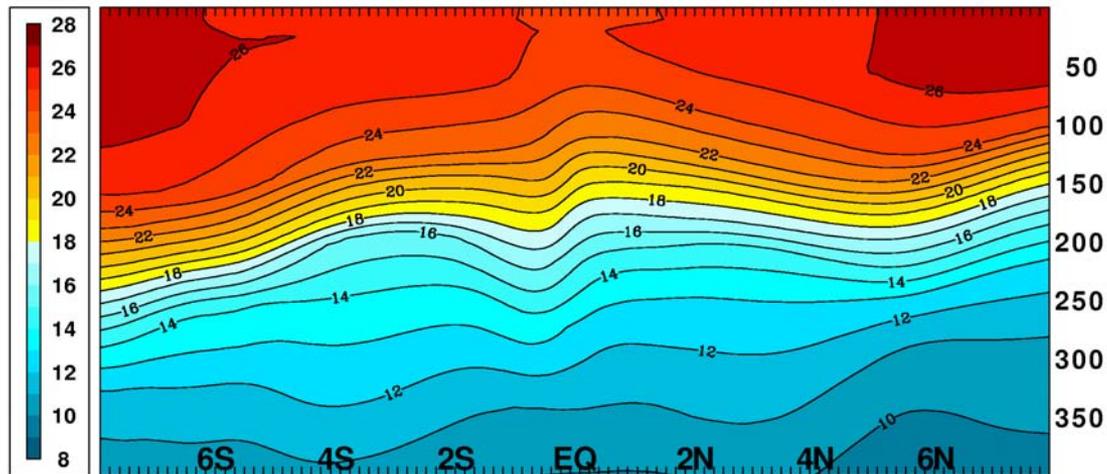
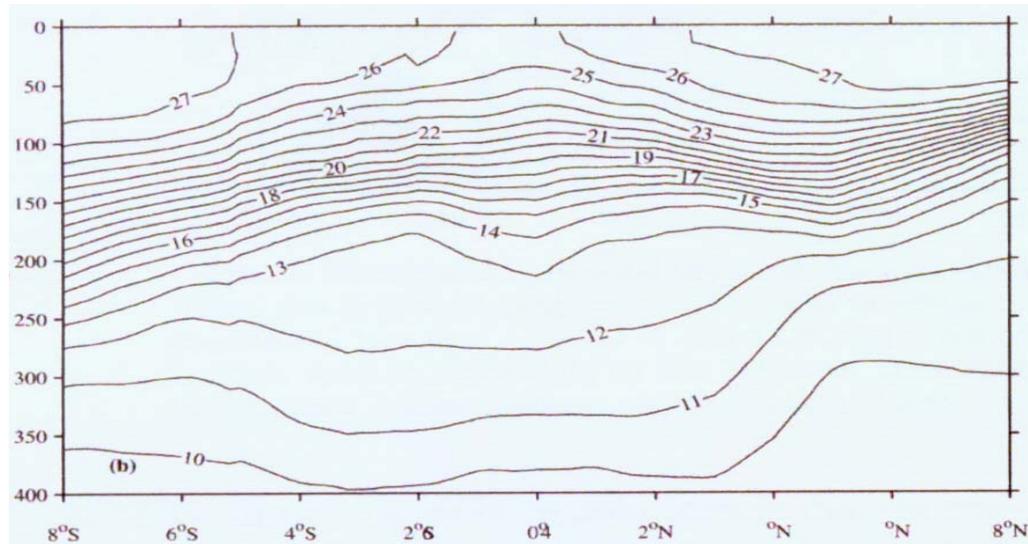
CTD/ADCP data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 400 m
Section between 8°S and 8°N



CTD/ADCP data from Johnson and McPhaden (2001, JPO)
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Temperature Cross-section Across the Equator at 135°W

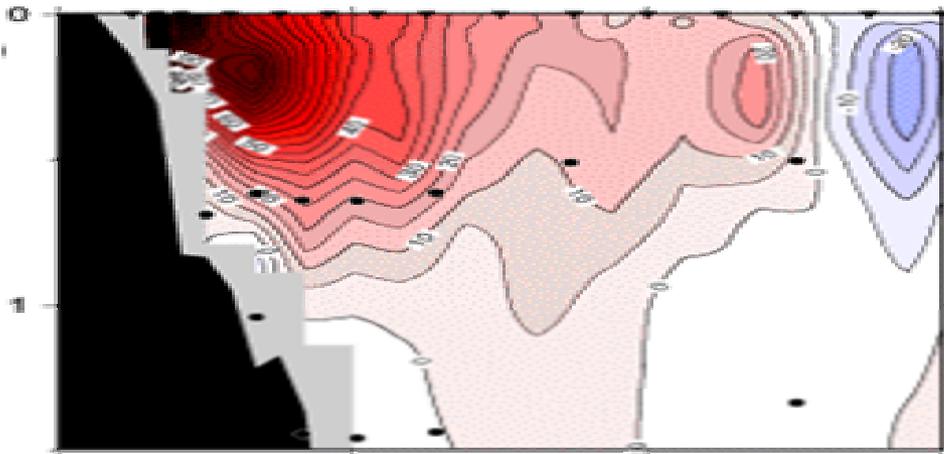
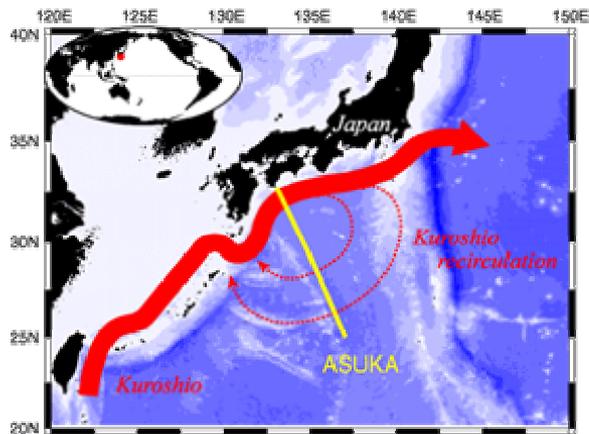
CTD/ADCP data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 400 m
Section between 8°S and 8°N



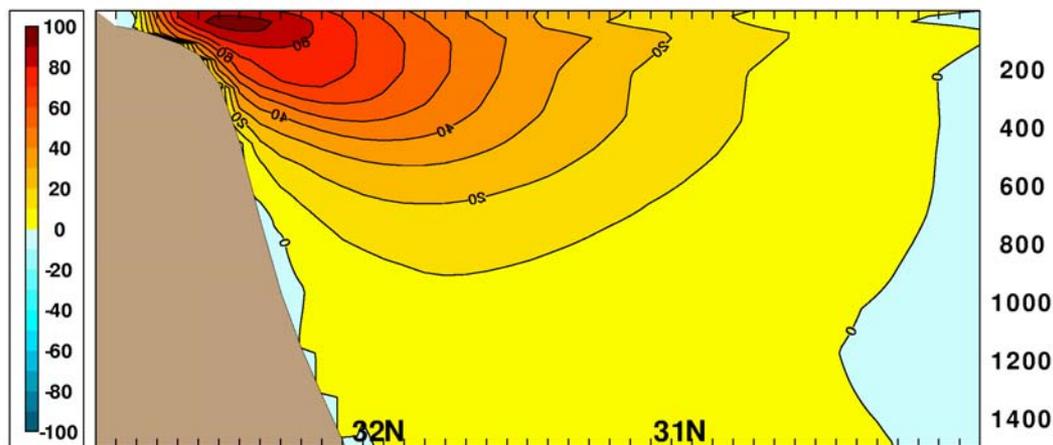
CTD/ADCP data from Johnson and McPhaden (2001, JPO)
6 year mean from HYCOM forced with high-frequency HR winds and ECMWF thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section South of Japan

Current meter data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 1500 m
Along the ASUKA line



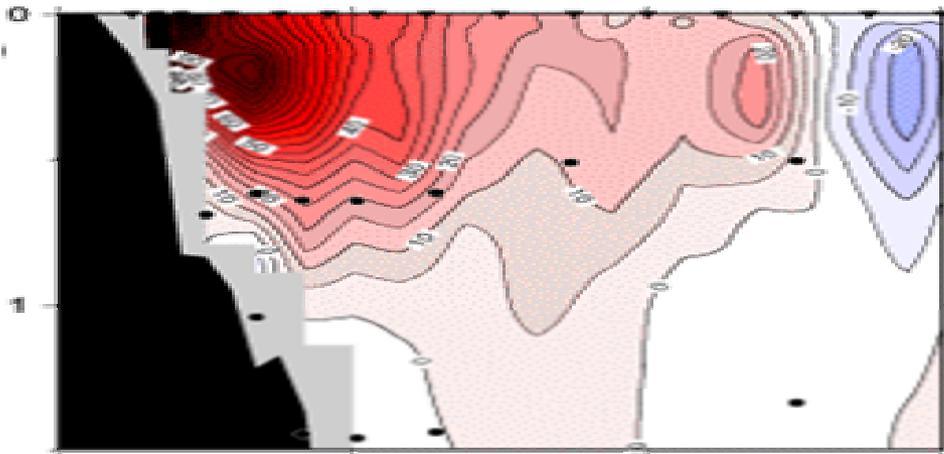
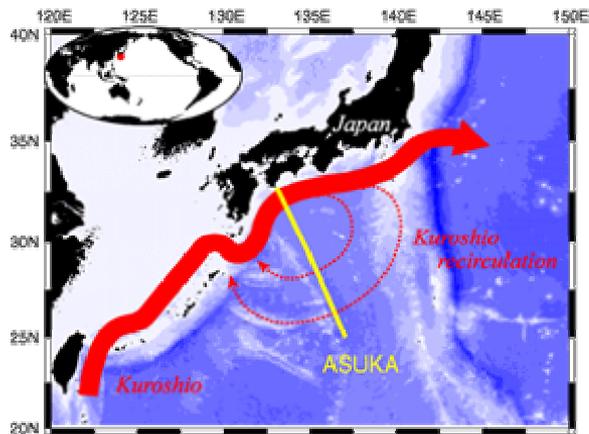
Note: The HYCOM section does not exactly follow the ASUKA line



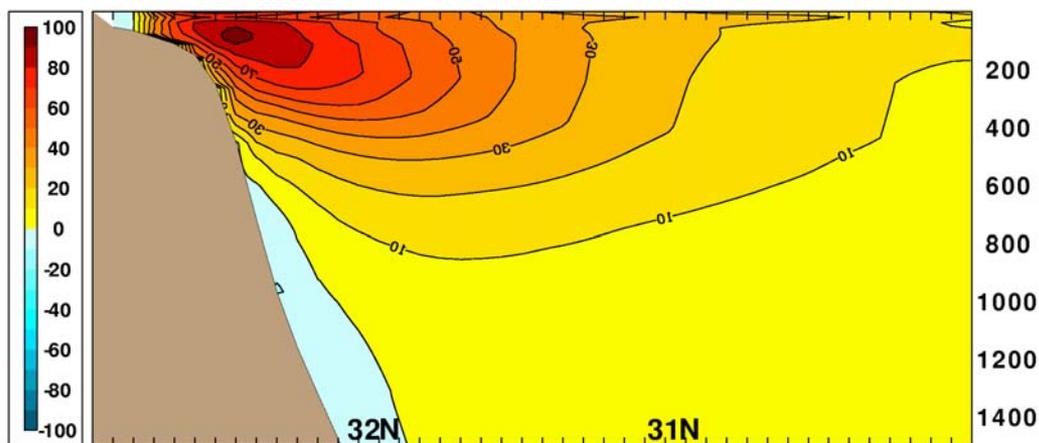
Current meter data from the ASUKA group
6 year mean from HYCOM forced with high-frequency ECMWF winds and thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section South of Japan

Current meter data (top) vs. 1/12° Pacific HYCOM (bottom) in the upper 1500 m
Along the ASUKA line



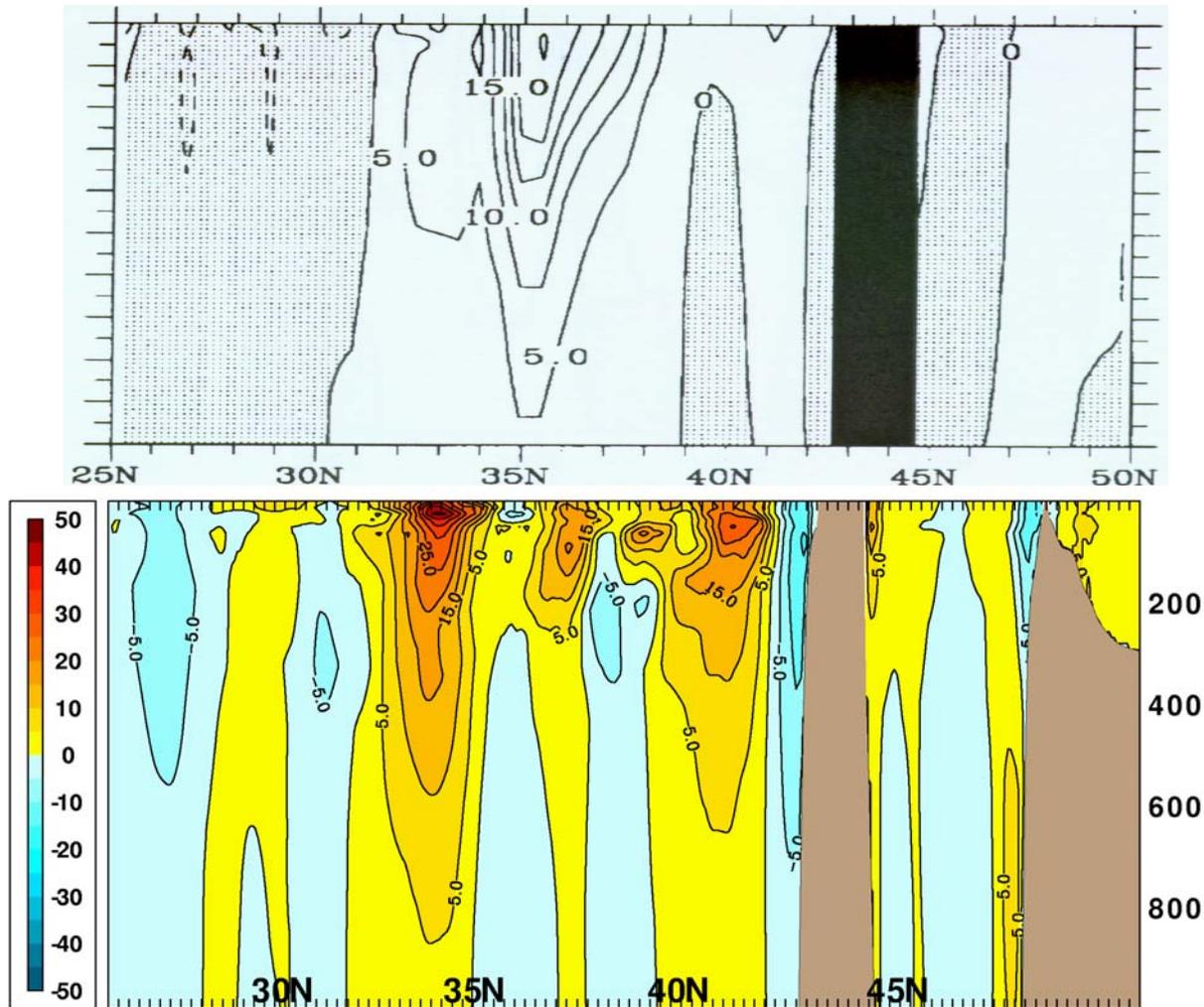
Note: The HYCOM section does not exactly follow the ASUKA line



Current meter data from the ASUKA group
6 year mean from HYCOM forced with high-frequency HR winds and ECMWF thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across the Kuroshio at 145°W

Hydrographic data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 1000 m
Section between 25°N and 50°N

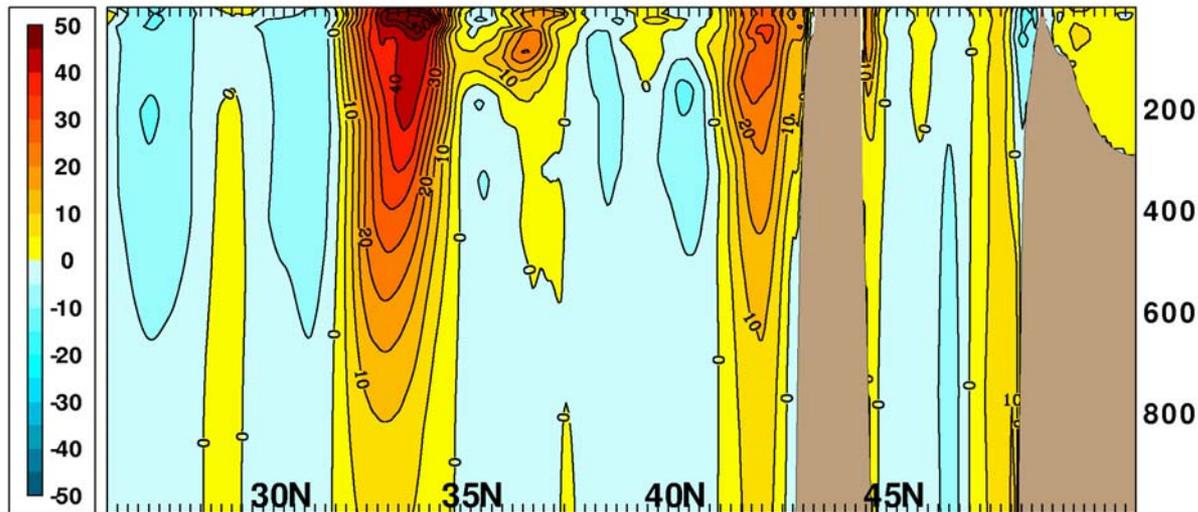
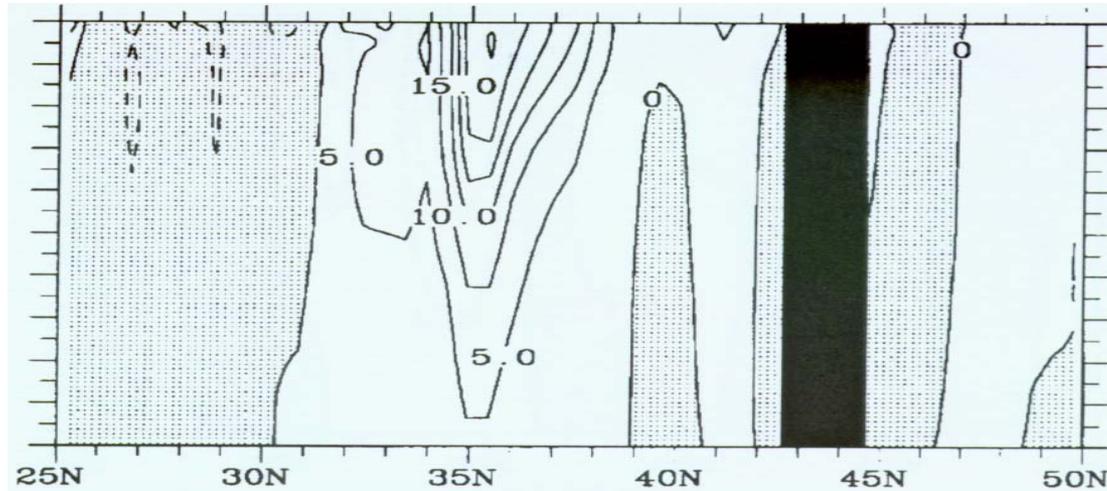


Hydrographic data from Qu et al. (2001, JPO)

6 year mean from HYCOM forced with high-frequency **ECMWF** winds and thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across the Kuroshio at 145°W

Hydrographic data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 1000 m
Section between 25°N and 50°N

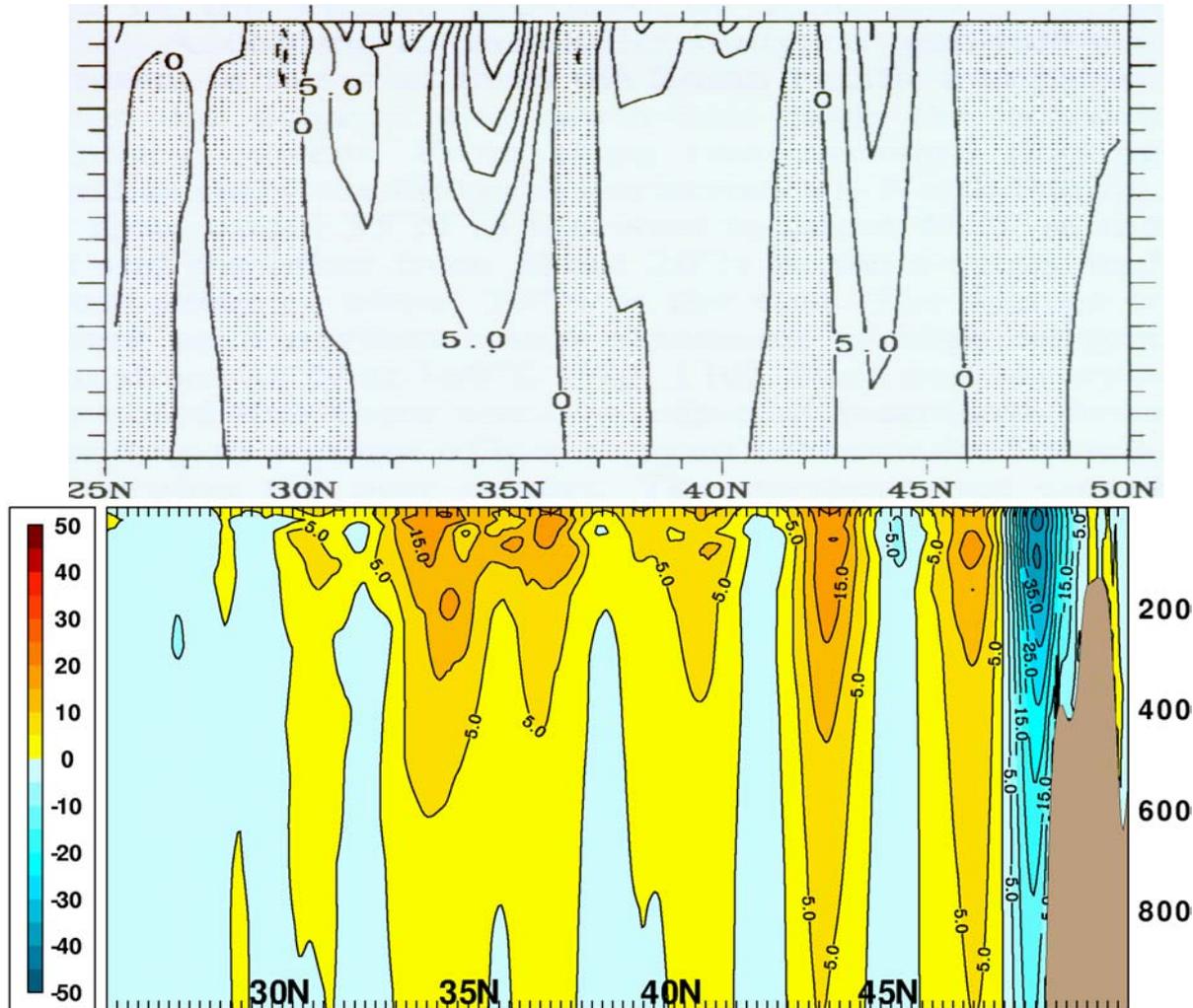


Hydrographic data from Qu et al. (2001, JPO)

6 year mean from HYCOM forced with high-frequency **HR** winds and ECMWF thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across the Kuroshio at 155°W

Hydrographic data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 1000 m
Section between 25°N and 50°N

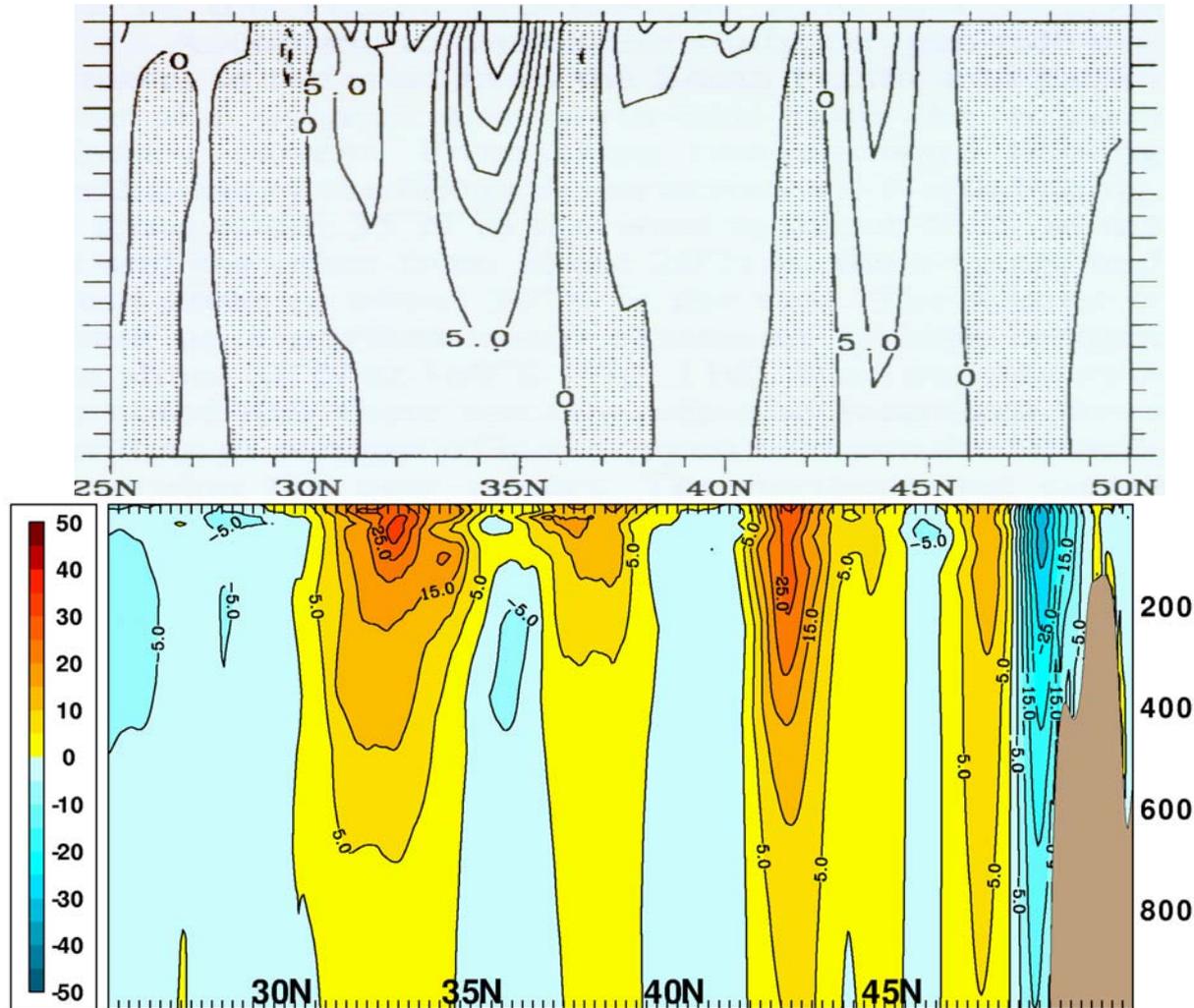


Hydrographic data from Qu et al. (2001, JPO)

6 year mean from HYCOM forced with high-frequency **ECMWF** winds and thermal forcing
No ocean data assimilation in HYCOM

Velocity Cross-section Across the Kuroshio at 155°W

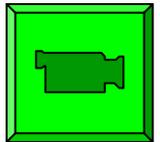
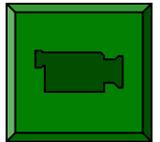
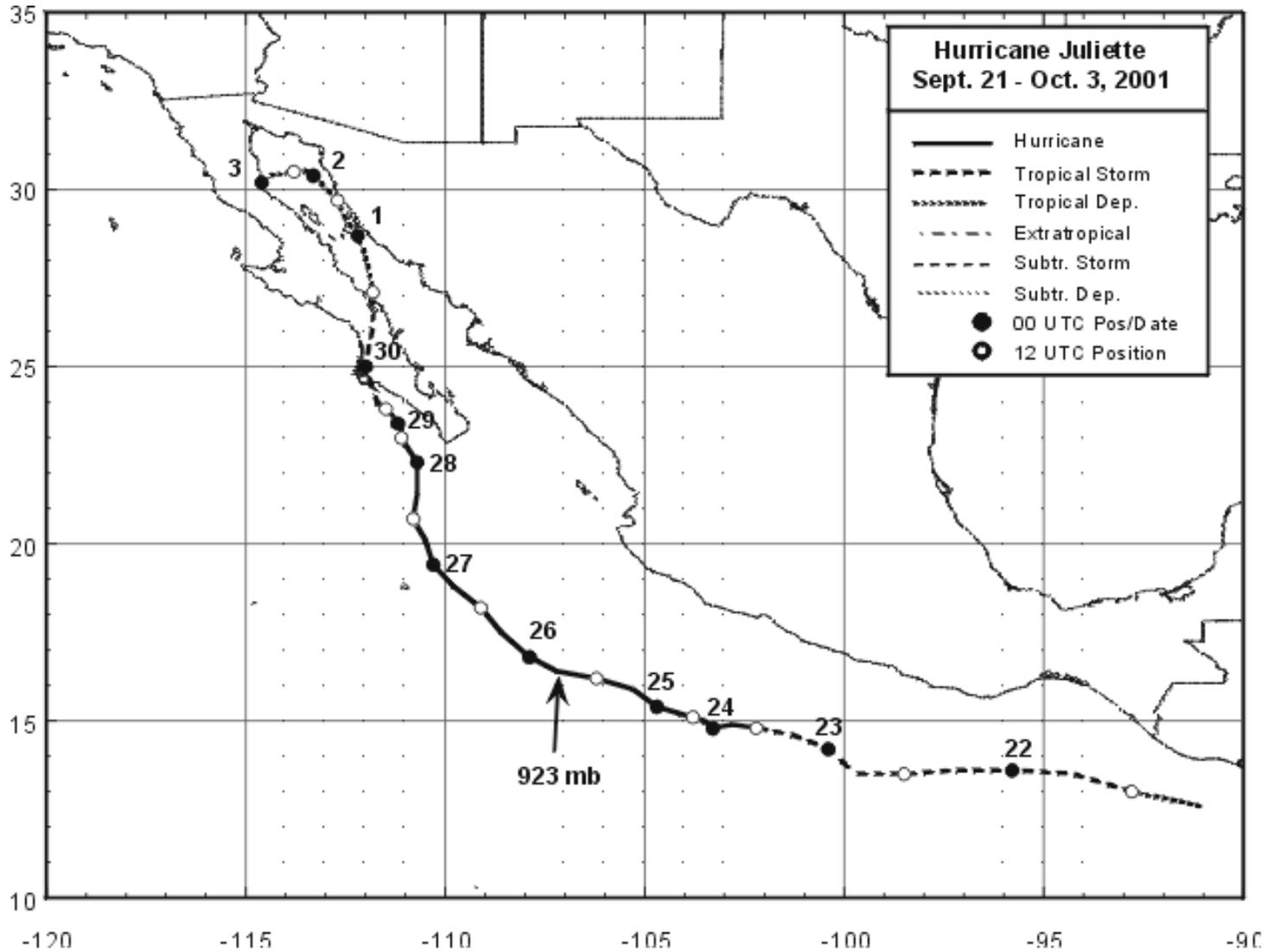
Hydrographic data (**top**) vs. 1/12° Pacific HYCOM (**bottom**) in the upper 1000 m
Section between 25°N and 50°N



Hydrographic data from Qu et al. (2001, JPO)

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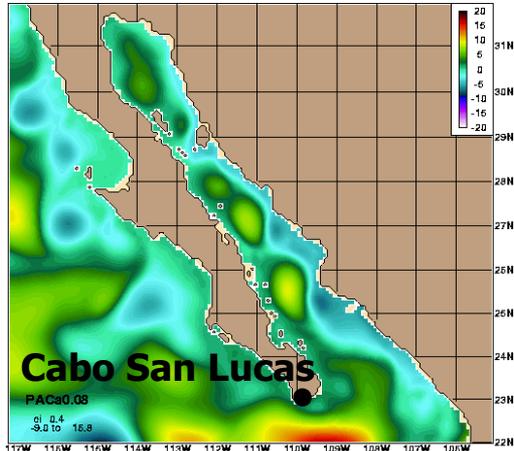
Track of Hurricane Juliette



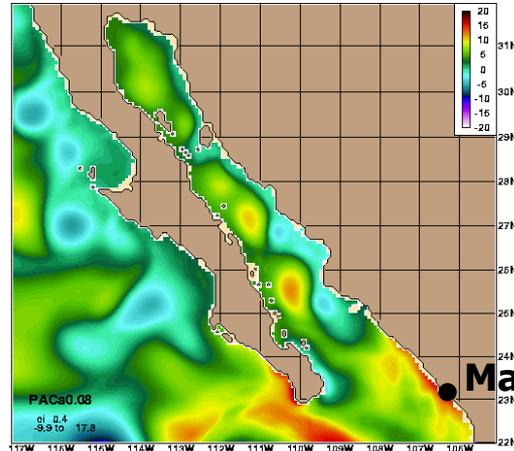
Source: National Hurricane Center

Evolution of the coastally trapped waves generated by Hurricane Juliette in 1/12° Pacific HYCOM

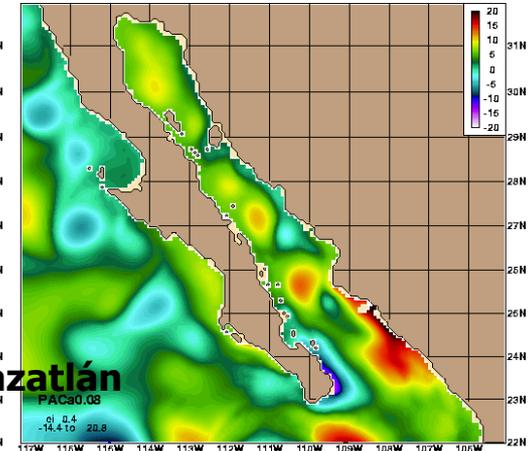
27 September 2001



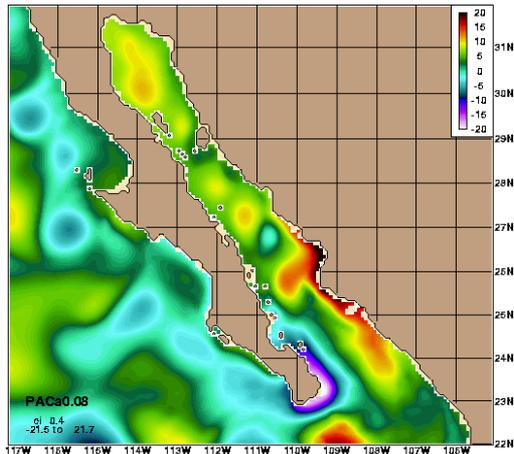
28 September 2001



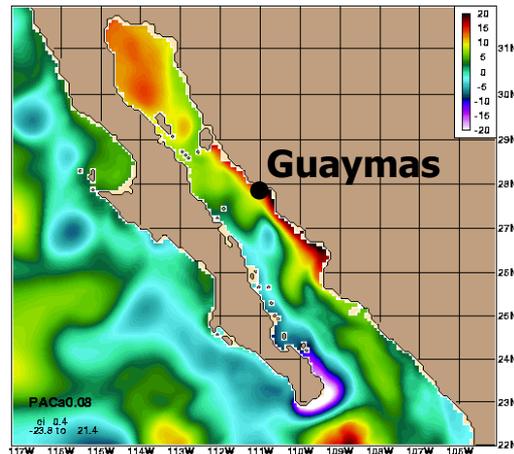
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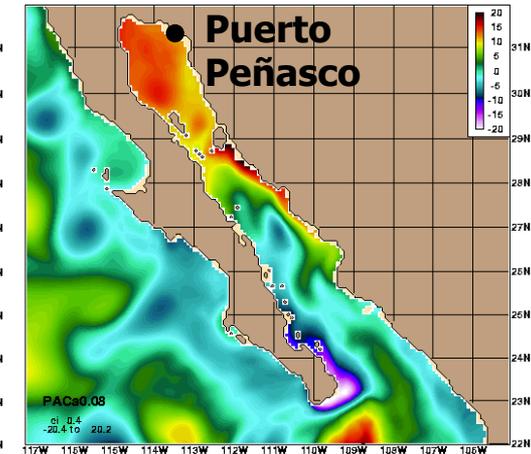
30 September 2001



1 October 2001



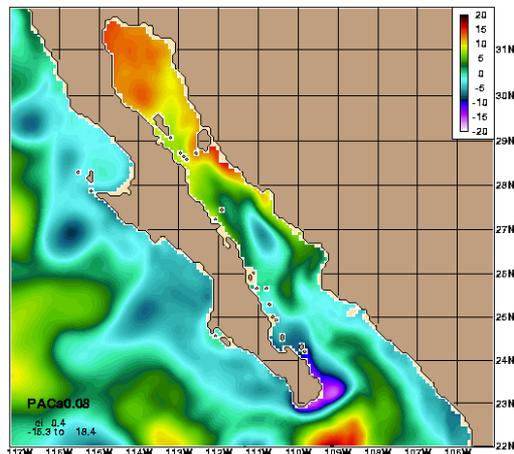
2 October 2001



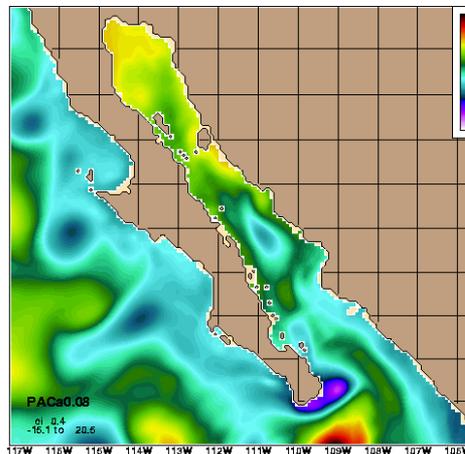
1/12° Pacific HYCOM forced with FNMOC NOGAPS/HR winds and FNMOC NOGAPS thermal forcing. No data have been assimilated into this model.

Evolution of the coastally trapped waves generated by Hurricane Juliette in 1/12° Pacific HYCOM

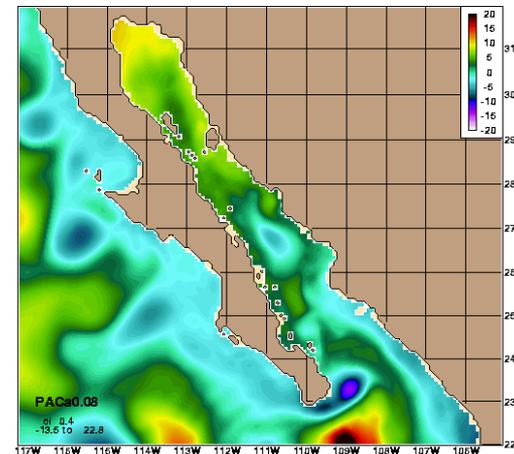
3 October 2001



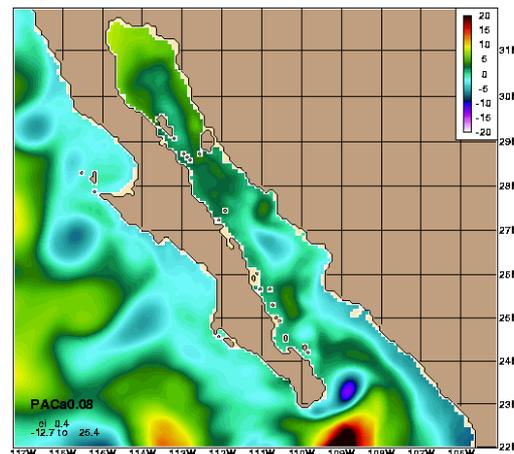
4 October 2001



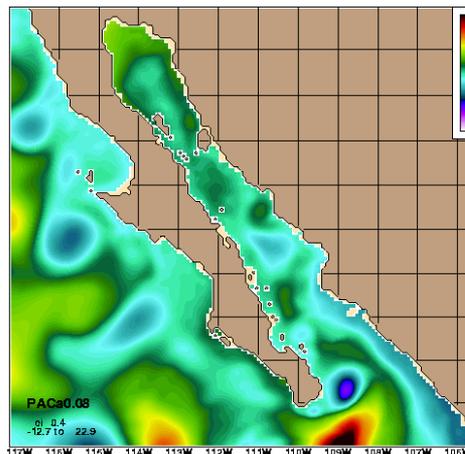
5 October 2001



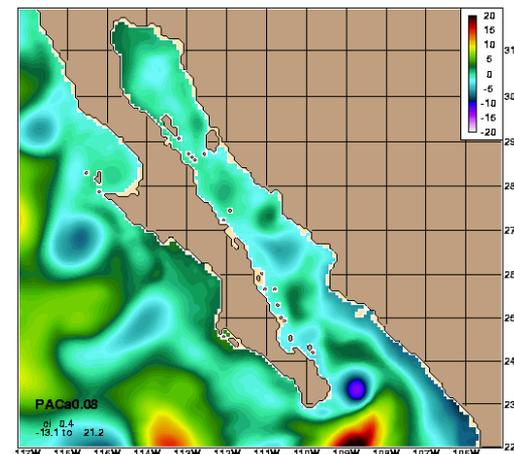
6 October 2001



7 October 2001

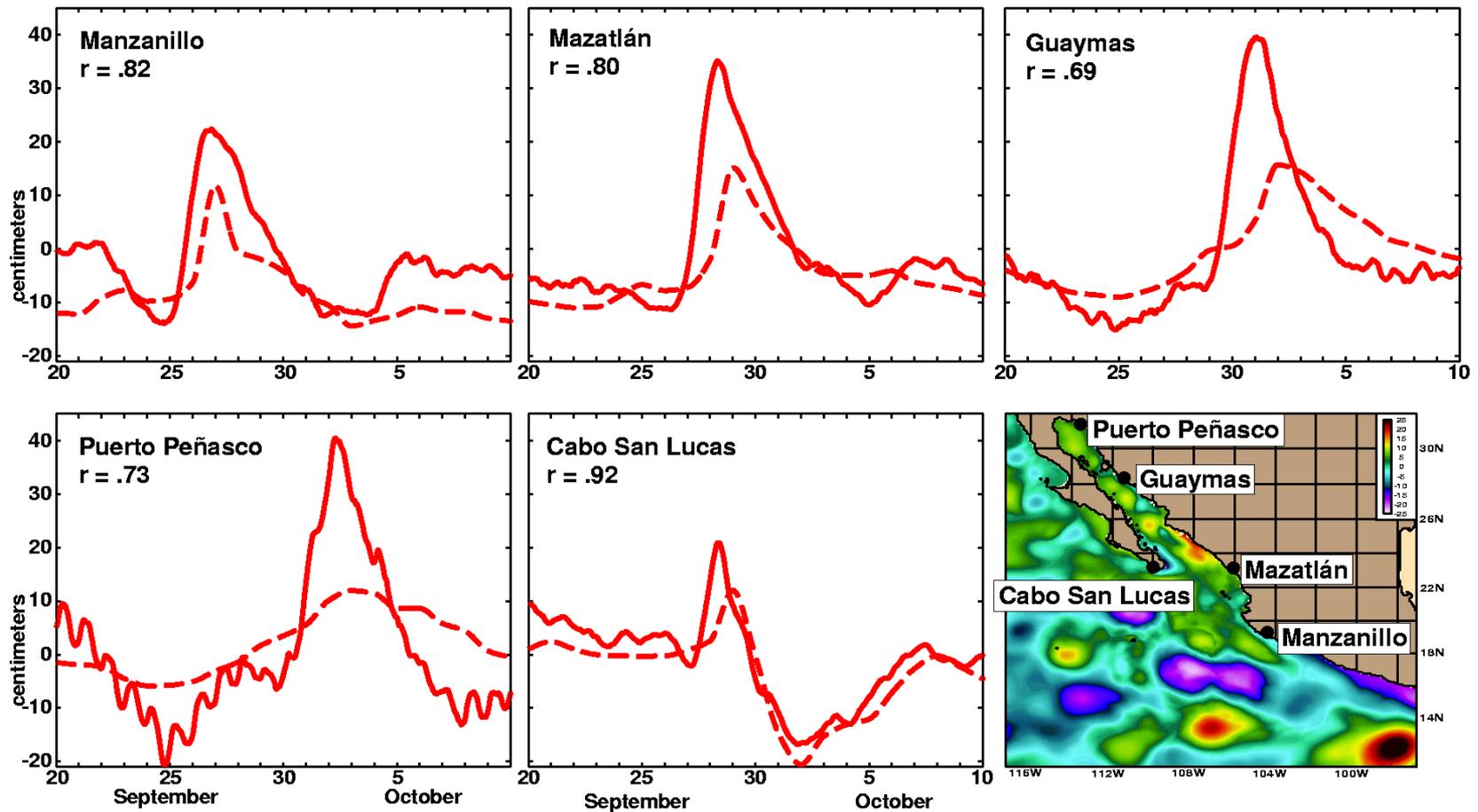


8 October 2001



1/12° Pacific HYCOM forced with FNMOC NOGAPS/HR winds and FNMOC NOGAPS thermal forcing. No data have been assimilated into this model.

Observed versus modeled sea level along the Mexican coast associated with the coastally trapped waves generated by Hurricane Juliette in 2001



1/12° Pacific HYCOM forced with FNMOC NOGAPS/HR winds and FNMOC NOGAPS thermal forcing. No data have been assimilated into this model. Sea level data provided by the University of Hawaii and the Secretaria de Marina de México.