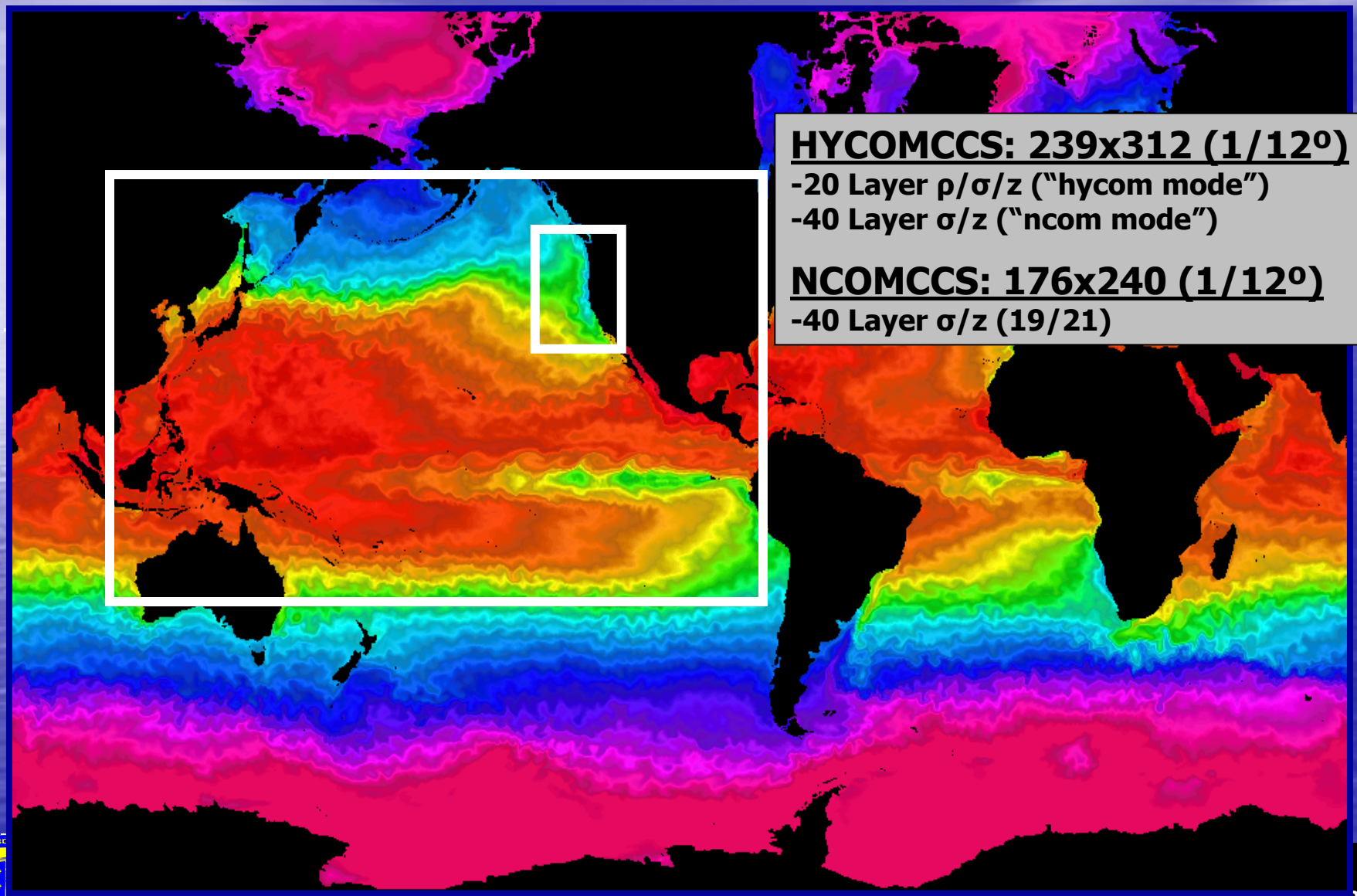
Running NCOM with HYCOM IC/BCs: Implementation and Influence

Sergio deRada

9th HYCOM Consortium Meeting
RSMAS, Miami, FL
Dec 7, 2005

Miami

SETTING THE STAGE



HYCOMCCS: 239x312 (1/12º)
-20 Layer ρ/σ/z ("hycom mode")
-40 Layer σ/z ("ncom mode")

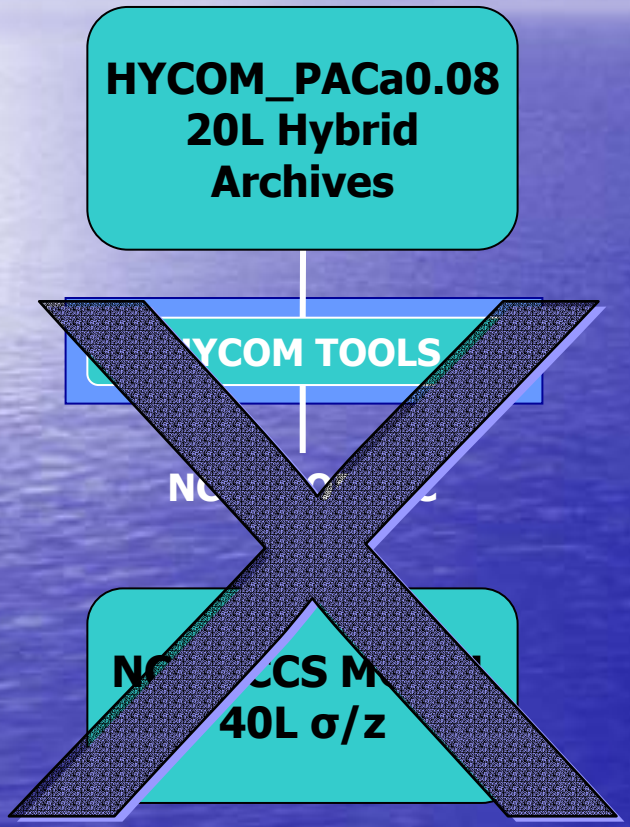
NCOMCCS: 176x240 (1/12º)
-40 Layer σ/z (19/21)

NESTING IMPLEMENTATION

- 1/12º HYCOM PACIFIC (ρ/σ/z) -> 1/12º NCOMCCS (σ/z)
  - PACa0.08 (Expt 03.4) Joe Metzger

NESTING IMPLEMENTATION

- 1/12º HYCOM PACIFIC (ρ/σ/z) -> 1/12º NCOMCCS (σ/z)



- Using HYCOM packaged tools to generate NCOM native OPNBC (OINIT) native boundary and initial condition files
  - Limited
- Problems seen in analysis and QC
- Successfully generated NCOM files
- Simulation will not run
- w/ MODAS
- Run with questionable results

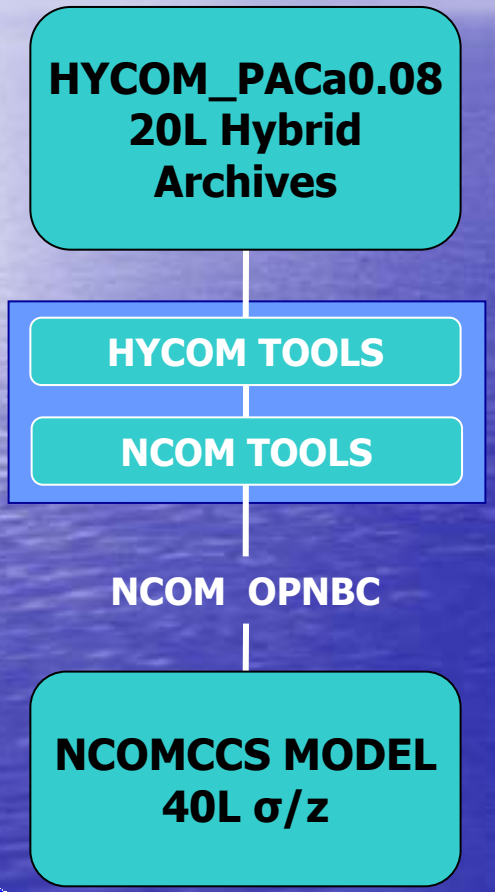
NESTING IMPLEMENTATION

- **1/12º HYCOM PACIFIC (ρ/σ/z) -> 1/12º NCOMCCS (σ/z)**

HYCOM_PACa0.08
20L Hybrid
Archives

NESTING IMPLEMENTATION

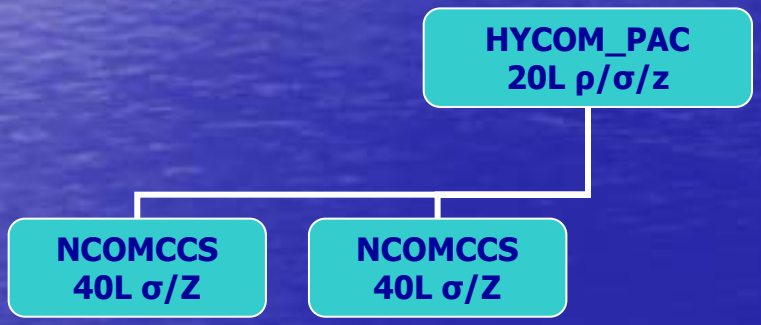
- **1/12º HYCOM PACIFIC (ρ/σ/z) -> 1/12º NCOMCCS (σ/z)**



- Using HYCOM packaged tools to generate intermediate Z grid (matches target grid)
  - HYCOM Archive to Z-Levels
- Use of NCOM tools to generate final σ/z grid
  - REGRID_GEN (same used in NCOM)
- Successfully generated NCOM files
  - OINIT and OPNBC
- Simulations run correctly
- With or Without MODAS assimilation

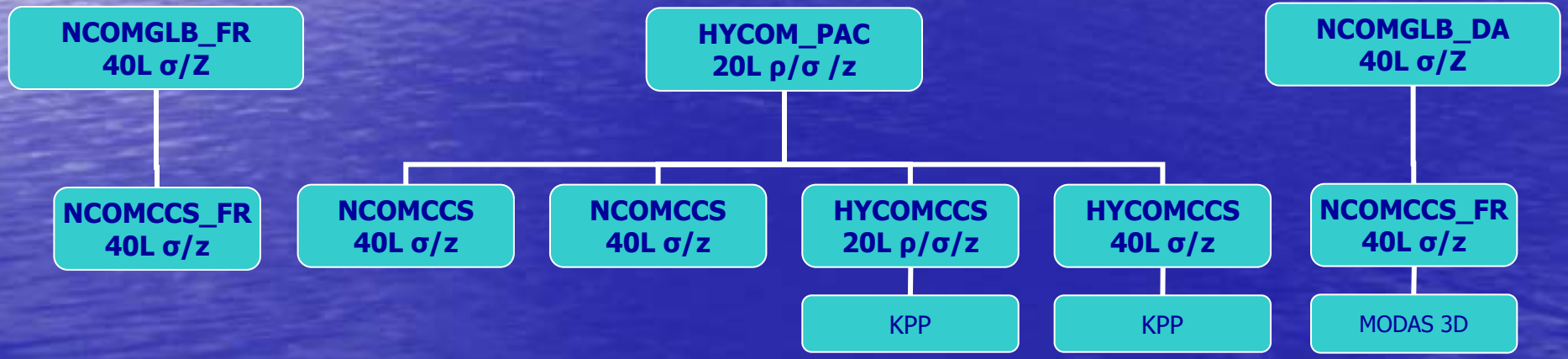
EXPERIMENTS

- **1/12º HYCOM PACIFIC -> 1/12º NCOMCCS**
  - -Regrid HYCOMPAC from 20 Layers directly to NCOMCCS
  - -Remap HYCOMPAC from 20 to 40 Layers, regrid to NCOMCCS



EXPERIMENTS

- **1/12º HYCOM PACIFIC -> 1/12º NCOMCCS**
  - -Regrid HYCOMPAC from 20 Layers directly to NCOMCCS
  - -Remap HYCOMPAC from 20 to 40 Layers, regrid to NCOMCCS
- **1/12º HYCOM PACIFIC -> 1/12º HYCOMCCS**
  - -Regrid HYCOMPAC to HYCOMCCS
  - -Remap HYCOMPAC from 20 to 40 Layers, regrid to HYCOMCCS ("ncom mode")
- **1/8º NCOM GLOBAL -> 1/12º NCOMCCS**
  - -Regrid NCOMGLB_FR to NCOMCCS_DA (both free running)
  - -Regrid NCOMGLB_DA to NCOMCCS_DA (free running)
  - -Regrid NCOMGLB_DA to NCOMCCS_DA (both w/ 3D MODAS DA)

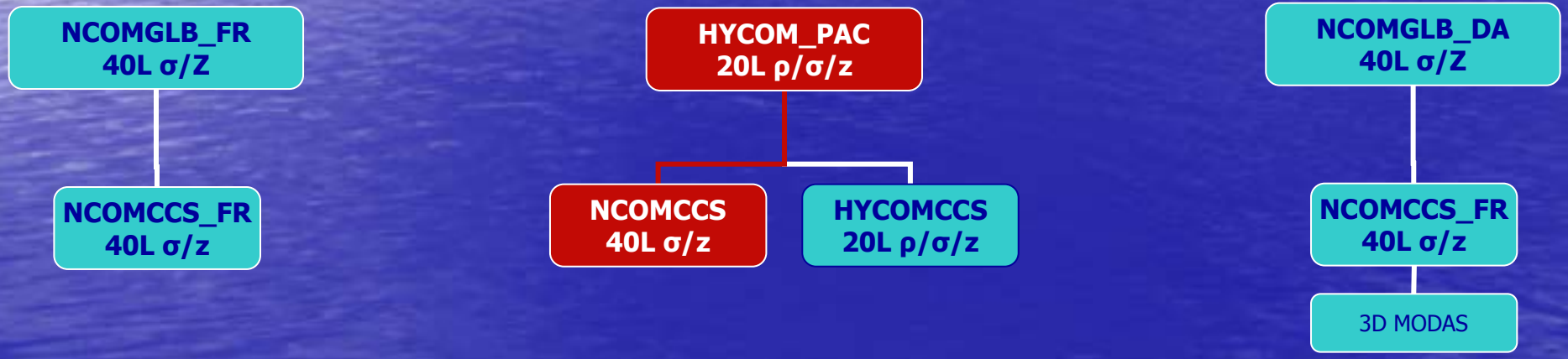


EXPERIMENTS

- **1/12º HYCOM PACIFIC -> 1/12º NCOMCCS**
  -Regrid HYCOMPAC from 20 Layers directly to NCOMCCS

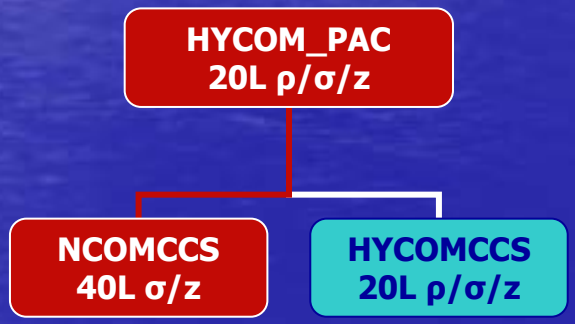
- **1/12º HYCOM PACIFIC -> 1/12º HYCOMCCS**
  -Regrid HYCOMPAC to HYCOMCCS

- **1/8º NCOM GLOBAL -> 1/12º NCOMCCS**
  -Regrid NCOMGLB_FR to NCOMCCS_DA (both free running)
  -Regrid NCOMGLB_DA to NCOMCCS_DA (free running)
  -Regrid NCOMGLB_DA to NCOMCCS_DA (both w/ 3D MODAS DA)



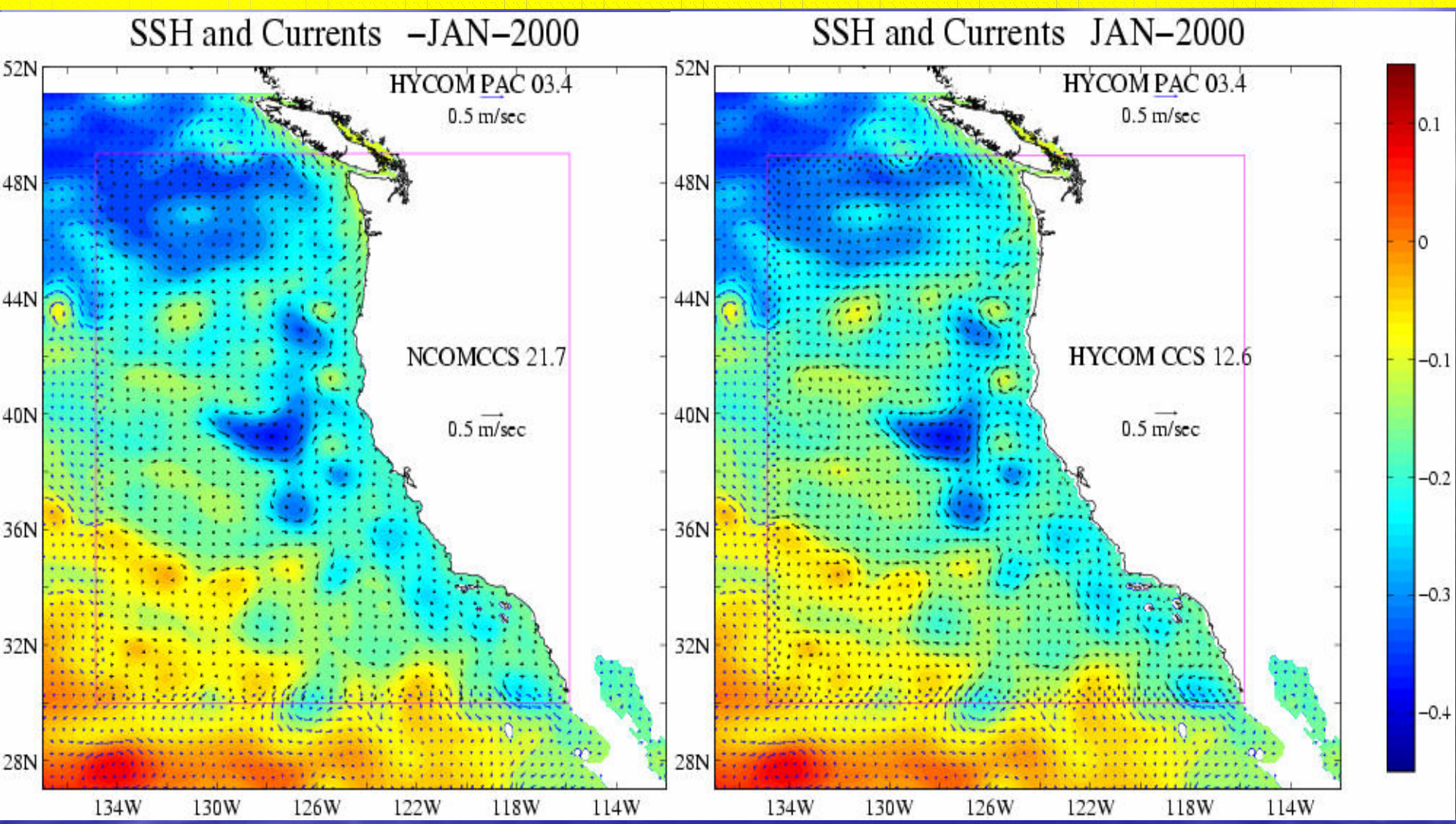
COMPARISONS

- Selected SSH (and currents) for qualitative measure of results
  - Temperature warmer in HYCOM to provide equitable comparison
  - SSH bias (.35) taken out for evaluation against NCOM
  - 2D plots of inner and outer nest
  - Monthly means from January to December (evolution)



PAC->NCOMCCS

PAC->HYCOMCCS (20L)



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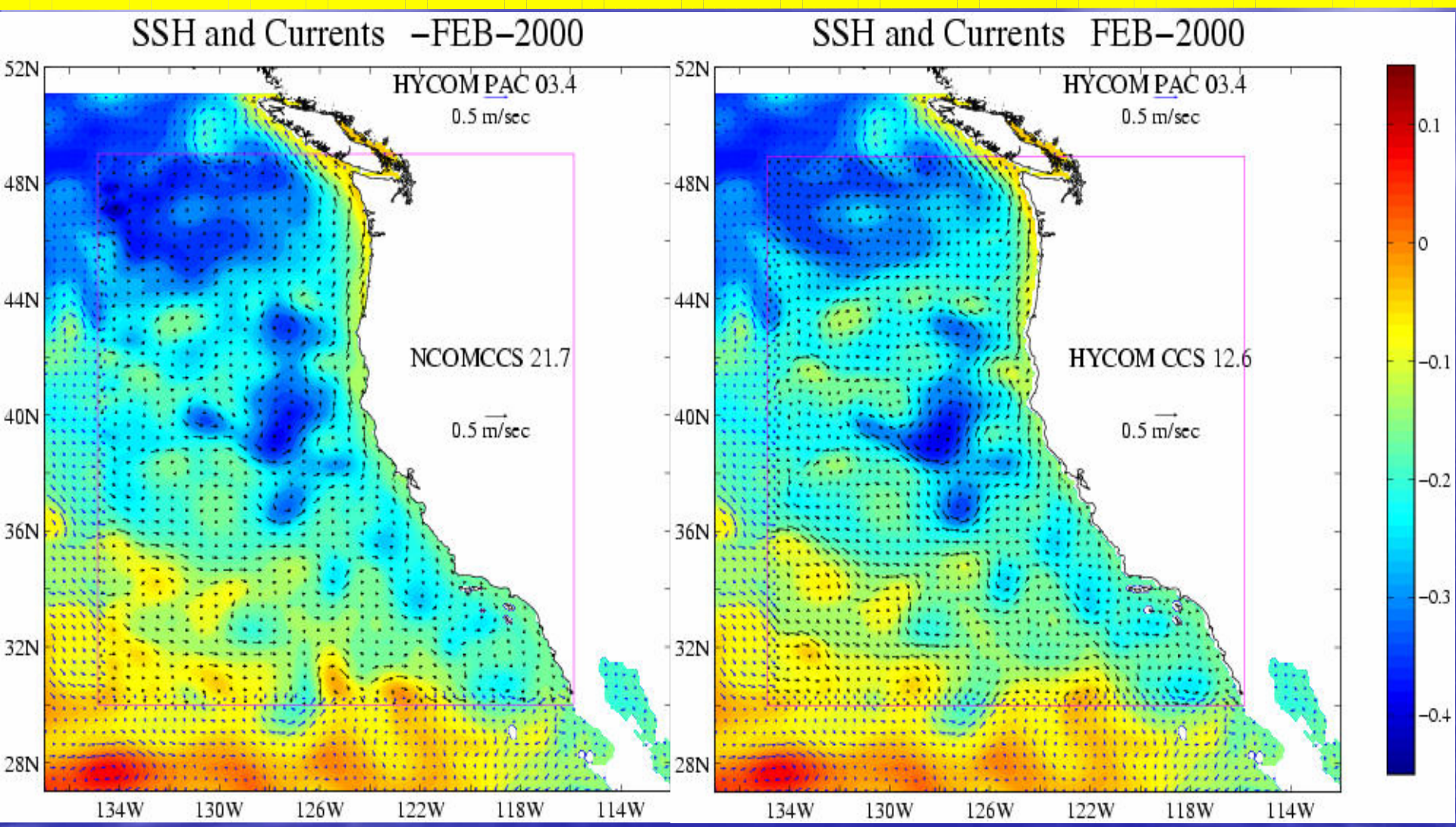

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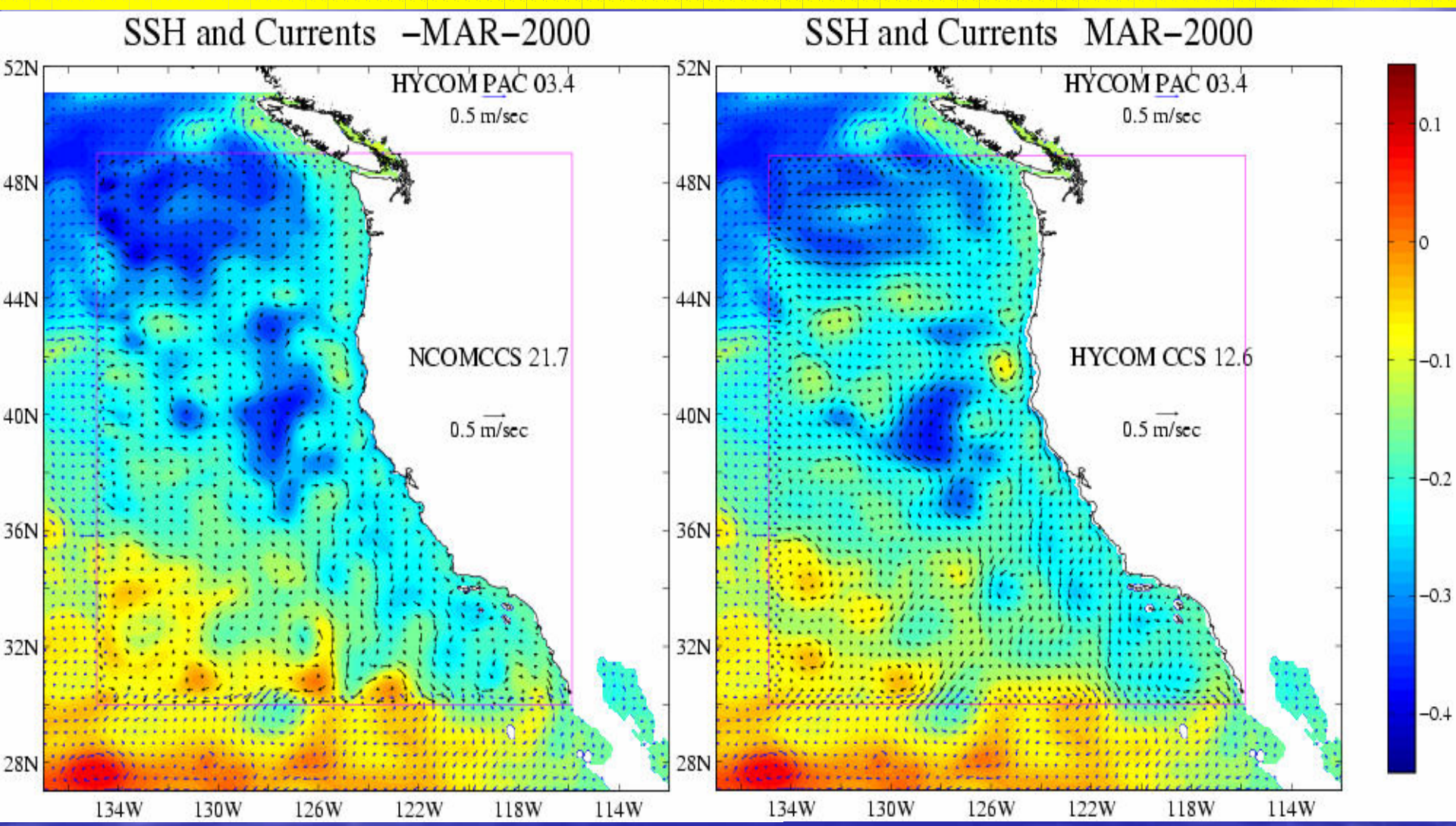
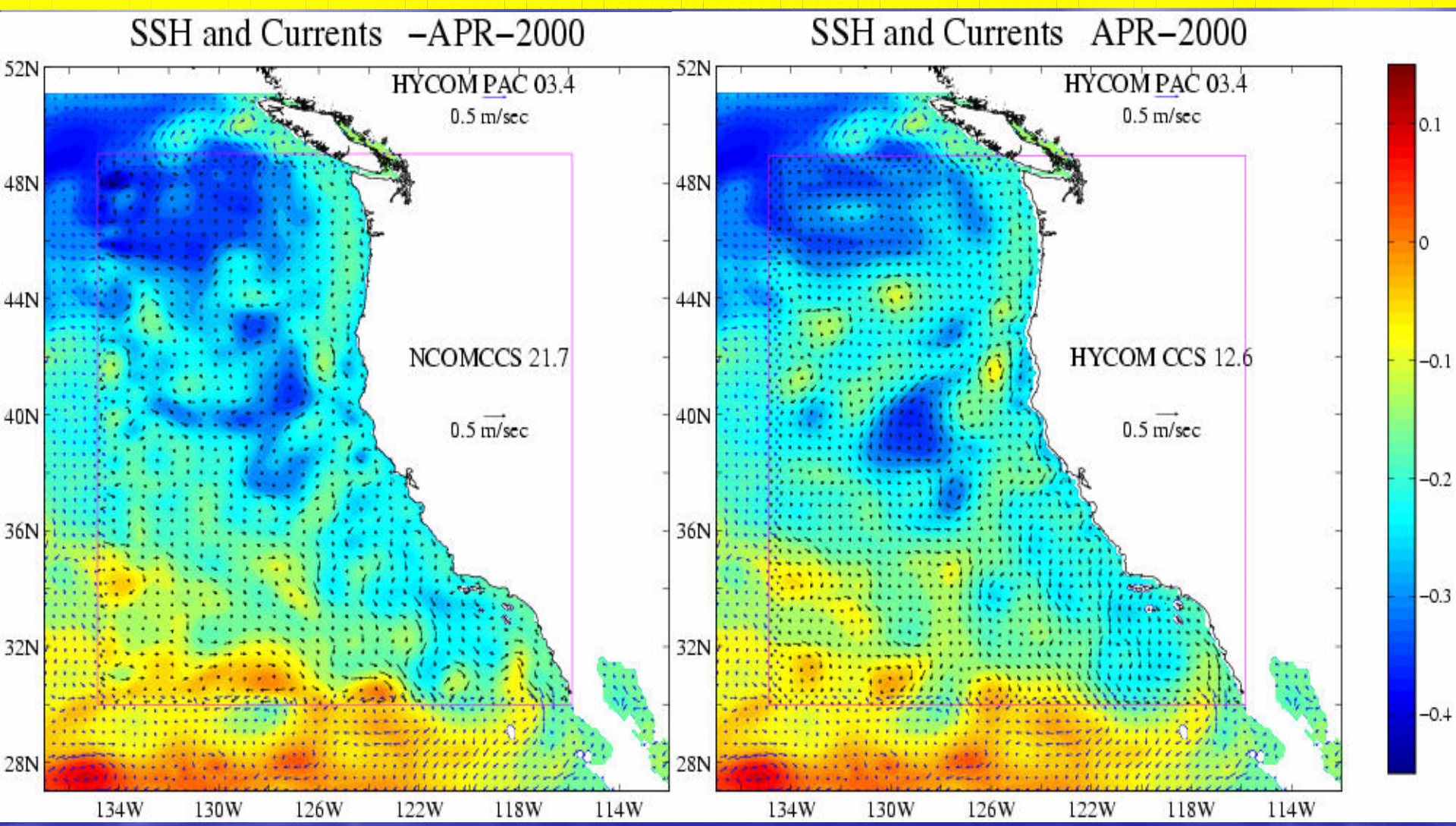
PAC->HYCOMCCS (20L)



PAC->NCOMCCS

PAC->HYCOMCCS (20L)



PAC->NCOMCCS

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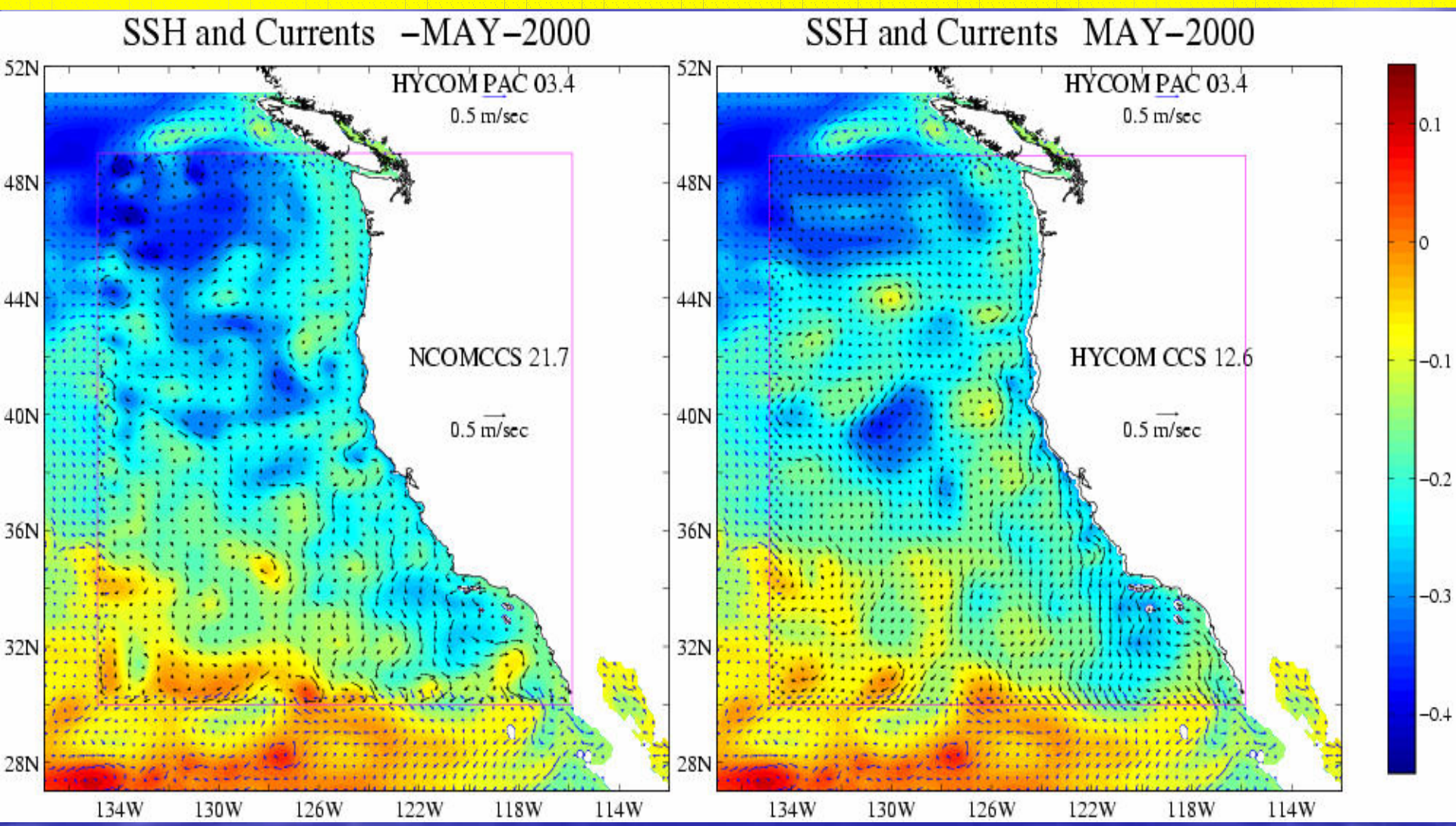
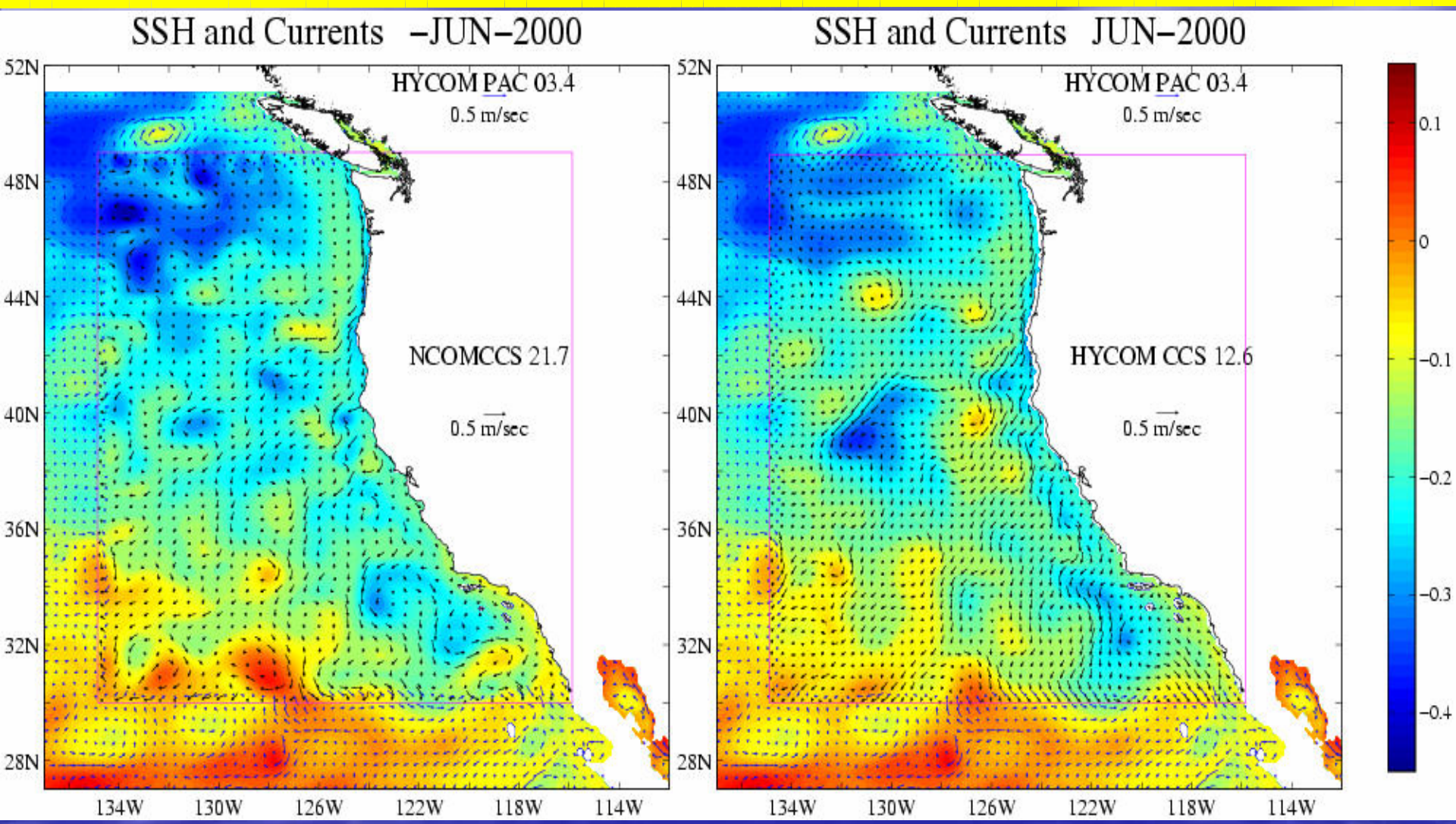


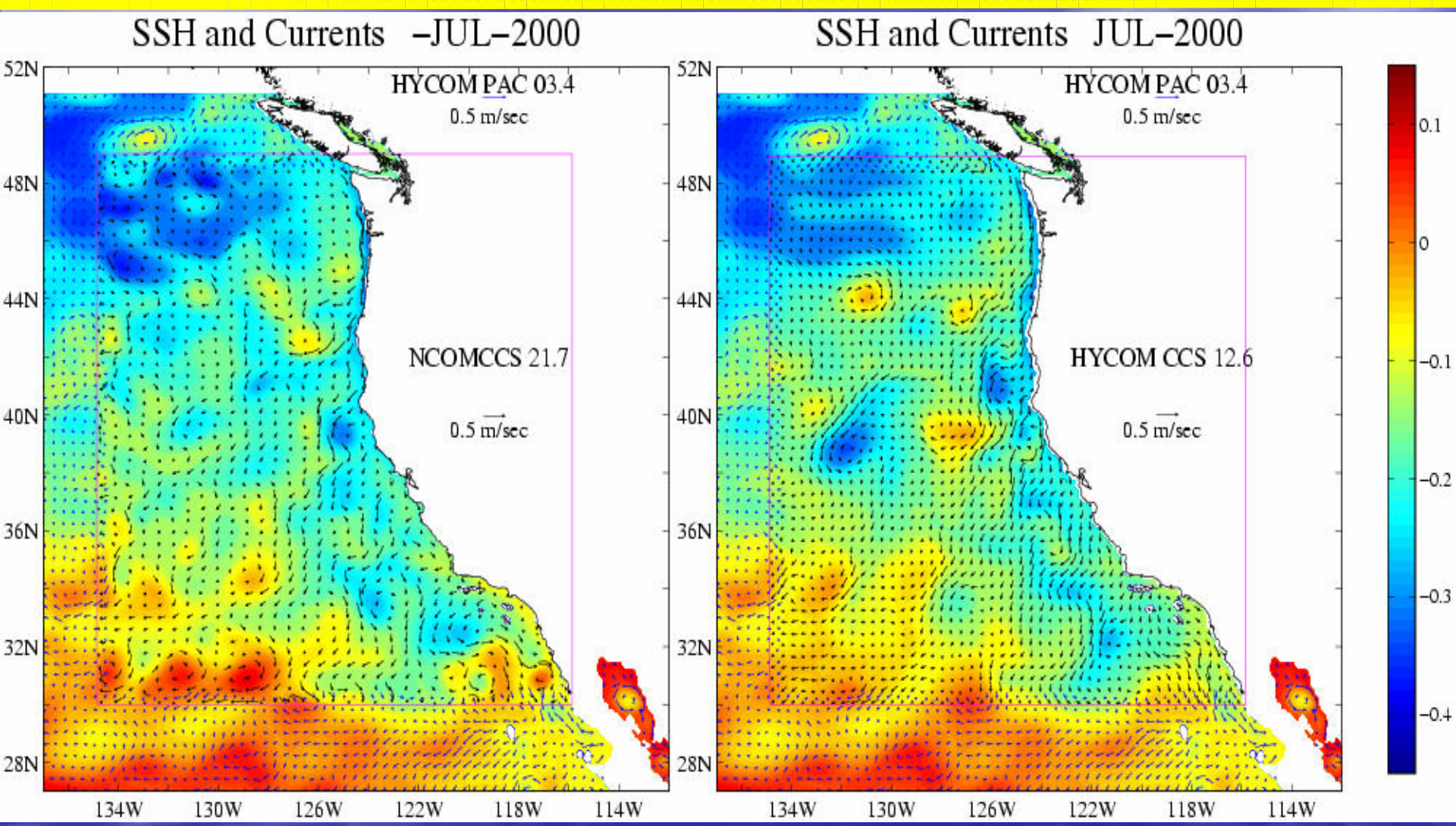
PAC->NCOMCCS

PAC->HYCOMCCS (20L)



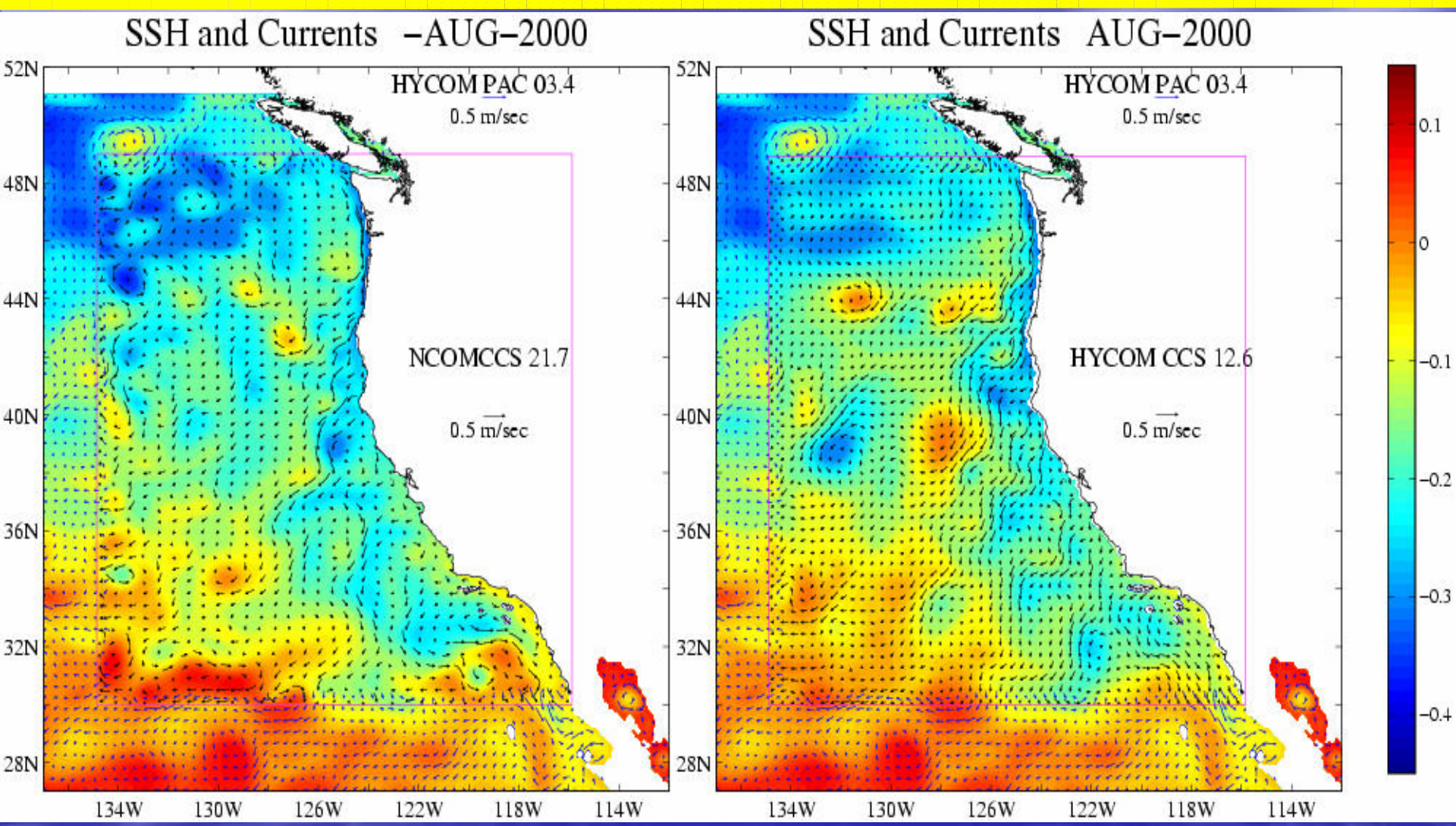
PAC->NCOMCCS

PAC->HYCOMCCS (20L)



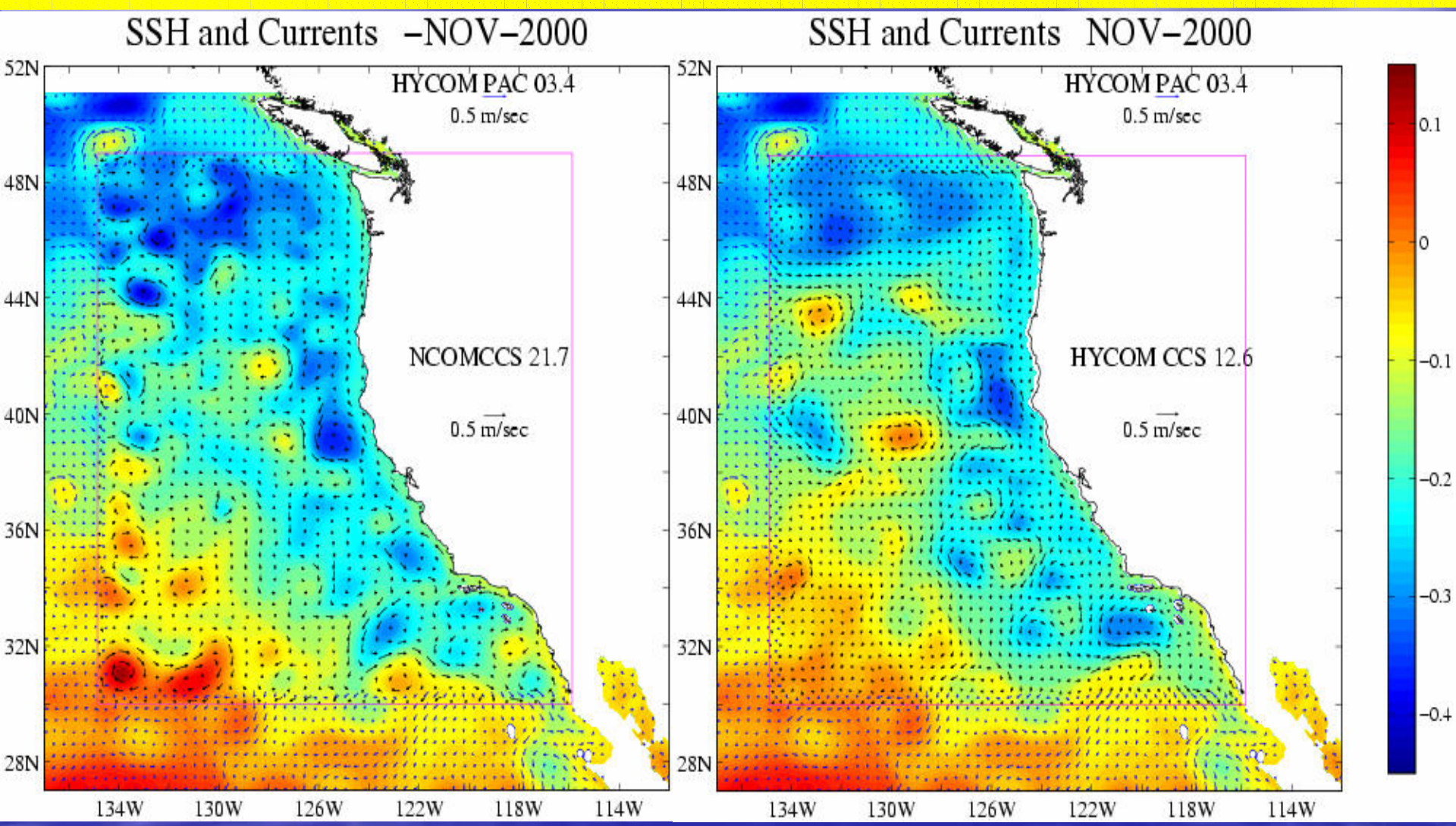
PAC->NCOMCCS

PAC->HYCOMCCS (20L)

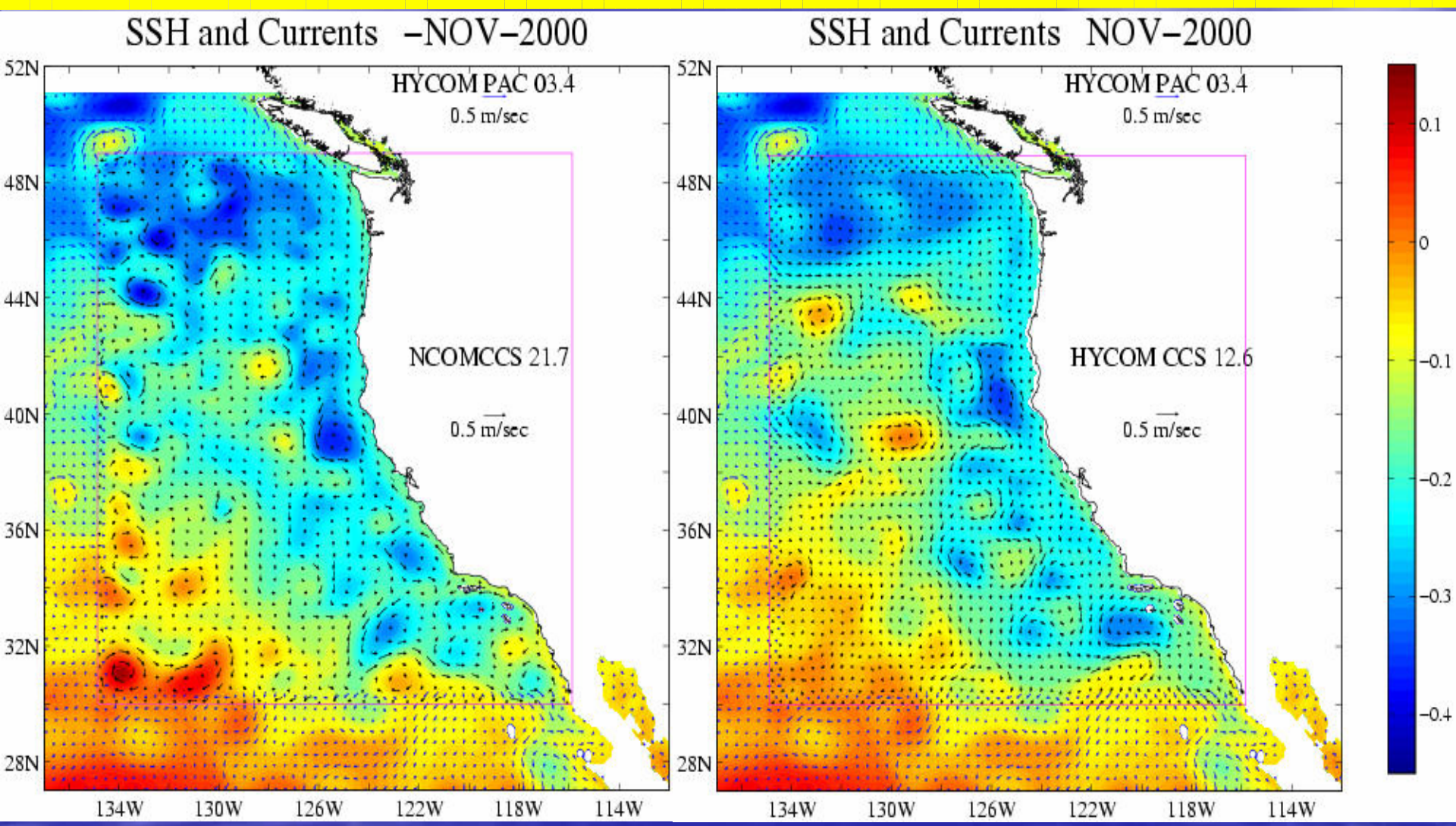


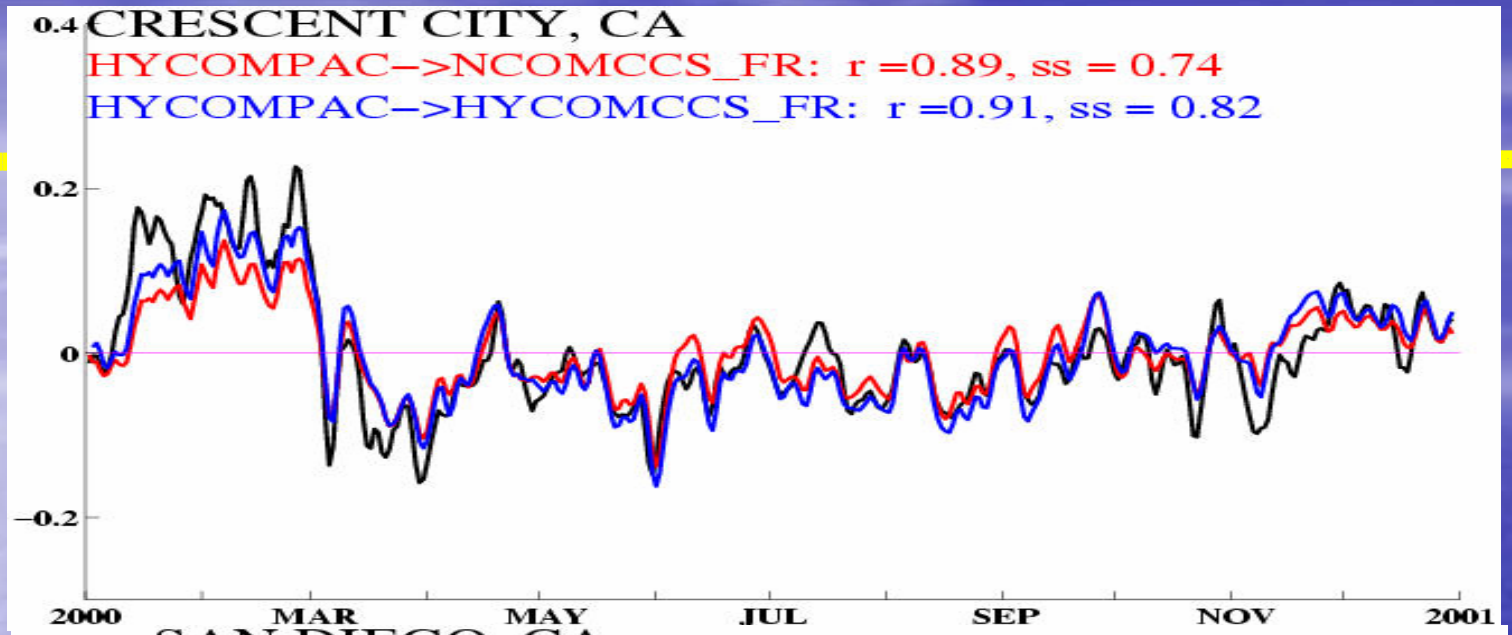
PAC->NCOMCCS

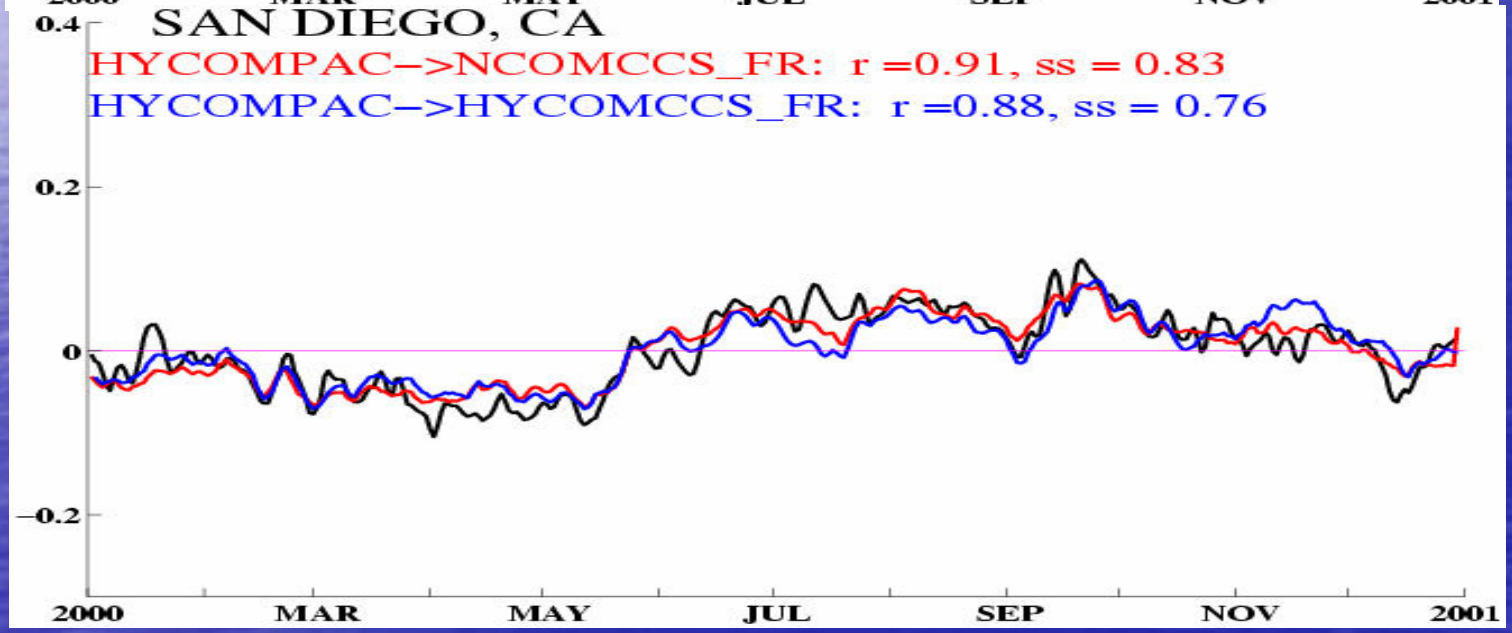
PAC->HYCOMCCS (20L)

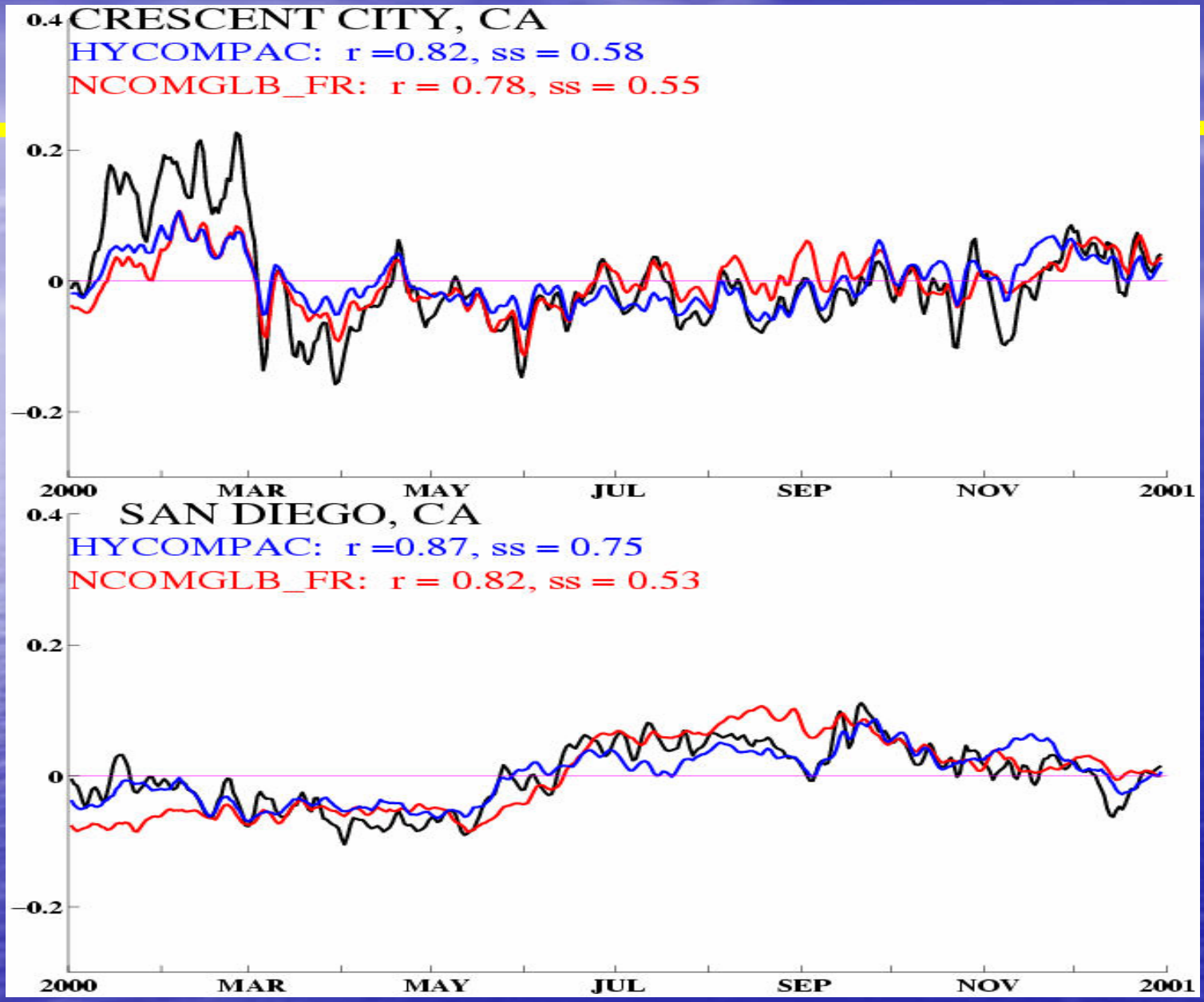


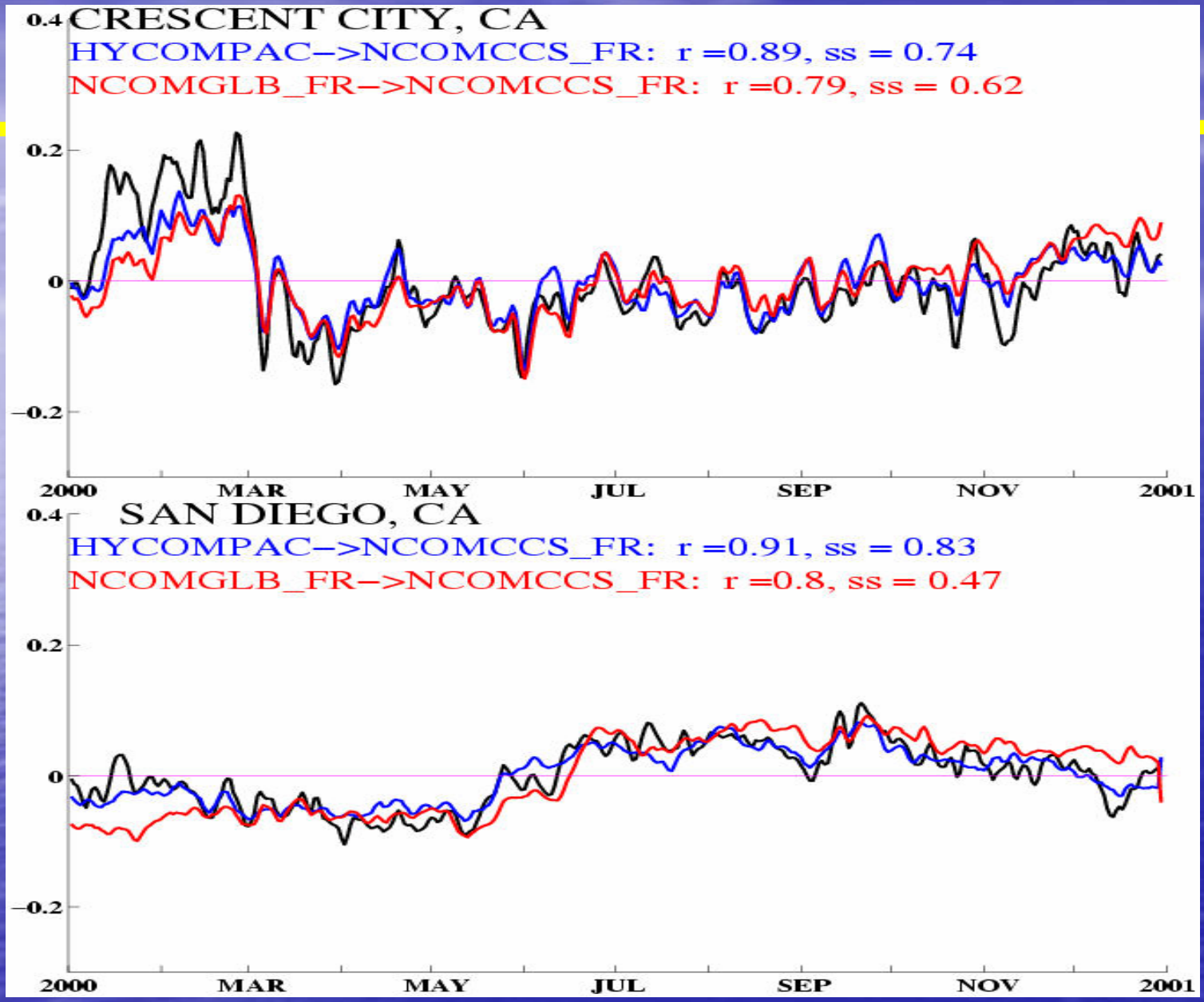
EVALUATION

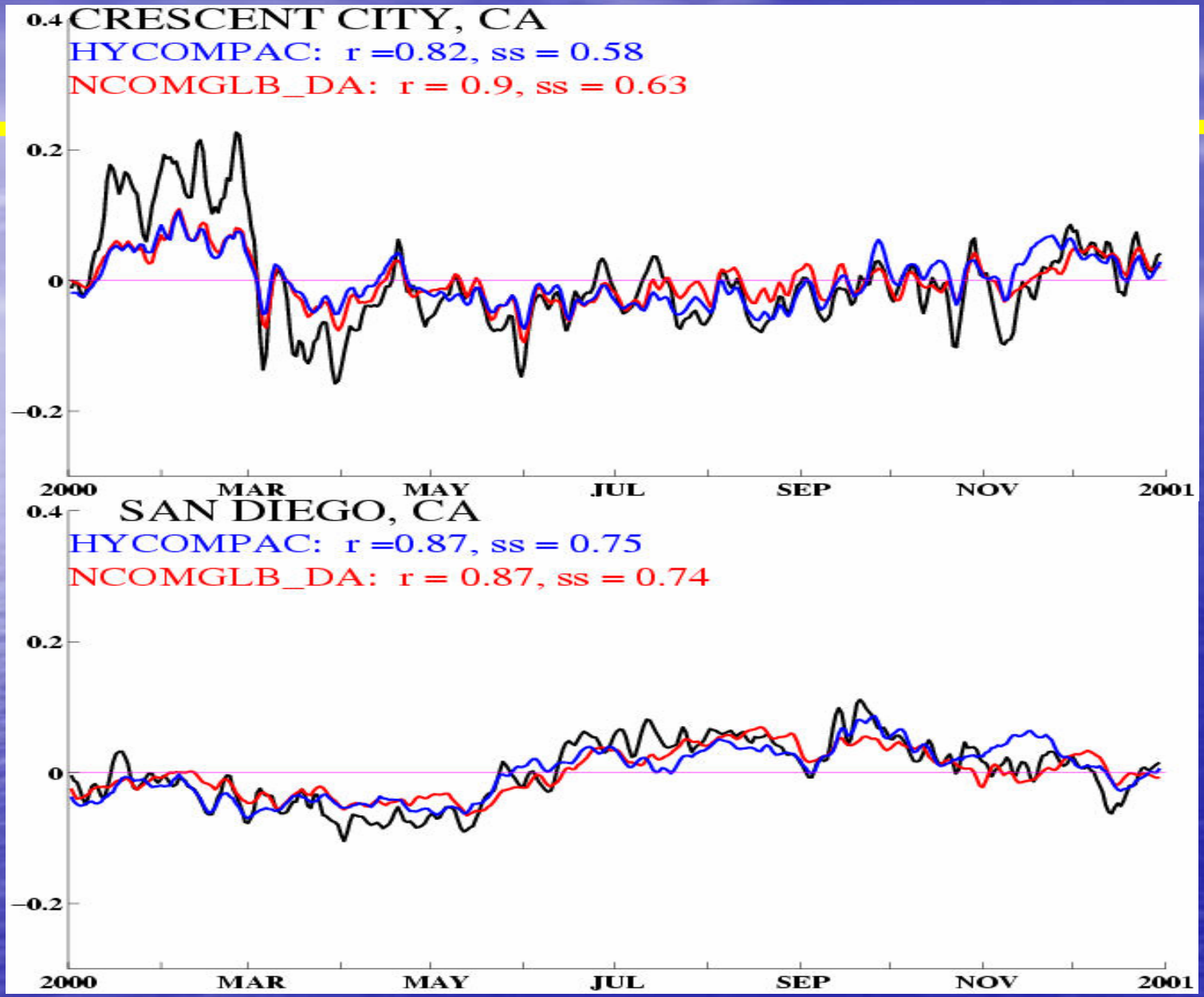

SSH and Currents –NOV–2000
HYCOM PAC 03.4
0.5 m/sec
NCOMCCS 21.7
0.5 m/sec
SSH and Currents NOV–2000
HYCOM PAC 03.4
0.5 m/sec
HYCOM CCS 12.6
0.5 m/sec
52N
48N
44N
40N
36N
32N
28N
134W
130W
126W
122W
118W
114W
0.1
0
−0.1
−0.2
−0.3
−0.4


CRESCENT CITY, CA
HYCOMPAC–>NCOMCCS_FR: r =0.89, ss = 0.74
HYCOMPAC–>HYCOMCCS_FR: r =0.91, ss = 0.82
0.4
0.2
0
–0.2
2000
MAR
MAY
JUL
SEP
NOV
2001


SAN DIEGO, CA
HYCOMPAC–>NCOMCCS_FR: r =0.91, ss = 0.83
HYCOMPAC–>HYCOMCCS_FR: r =0.88, ss = 0.76
0.4
0.2
0
–0.2
2000
MAR
MAY
JUL
SEP
NOV
2001


CRESCENT CITY, CA
HYCOMPAC: r =0.82, ss = 0.58
NCOMGLB_FR: r = 0.78, ss = 0.55
0.4
0.2
0
−0.2
2000
MAR
MAY
JUL
SEP
NOV
2001
SAN DIEGO, CA
HYCOMPAC: r =0.87, ss = 0.75
NCOMGLB_FR: r = 0.82, ss = 0.53
0.4
0.2
0
−0.2
2000
MAR
MAY
JUL
SEP
NOV
2001


CRESCENT CITY, CA
HYCOMPAC–>NCOMCCS_FR: r =0.89, ss = 0.74
NCOMGLB_FR–>NCOMCCS_FR: r =0.79, ss = 0.62
0.4
0.2
0
–0.2
2000
MAR
MAY
JUL
SEP
NOV
2001
SAN DIEGO, CA
HYCOMPAC–>NCOMCCS_FR: r =0.91, ss = 0.83
NCOMGLB_FR–>NCOMCCS_FR: r =0.8, ss = 0.47
0.4
0.2
0
–0.2
2000
MAR
MAY
JUL
SEP
NOV
2001


CRESCENT CITY, CA
HYCOMPAC: r =0.82, ss = 0.58
NCOMGLB_DA: r = 0.9, ss = 0.63
0.4
0.2
0
−0.2
2000
MAR
MAY
JUL
SEP
NOV
2001
SAN DIEGO, CA
HYCOMPAC: r =0.87, ss = 0.75
NCOMGLB_DA: r = 0.87, ss = 0.74
0.4
0.2
0
−0.2
2000
MAR
MAY
JUL
SEP
NOV
2001

VISUALIZATION

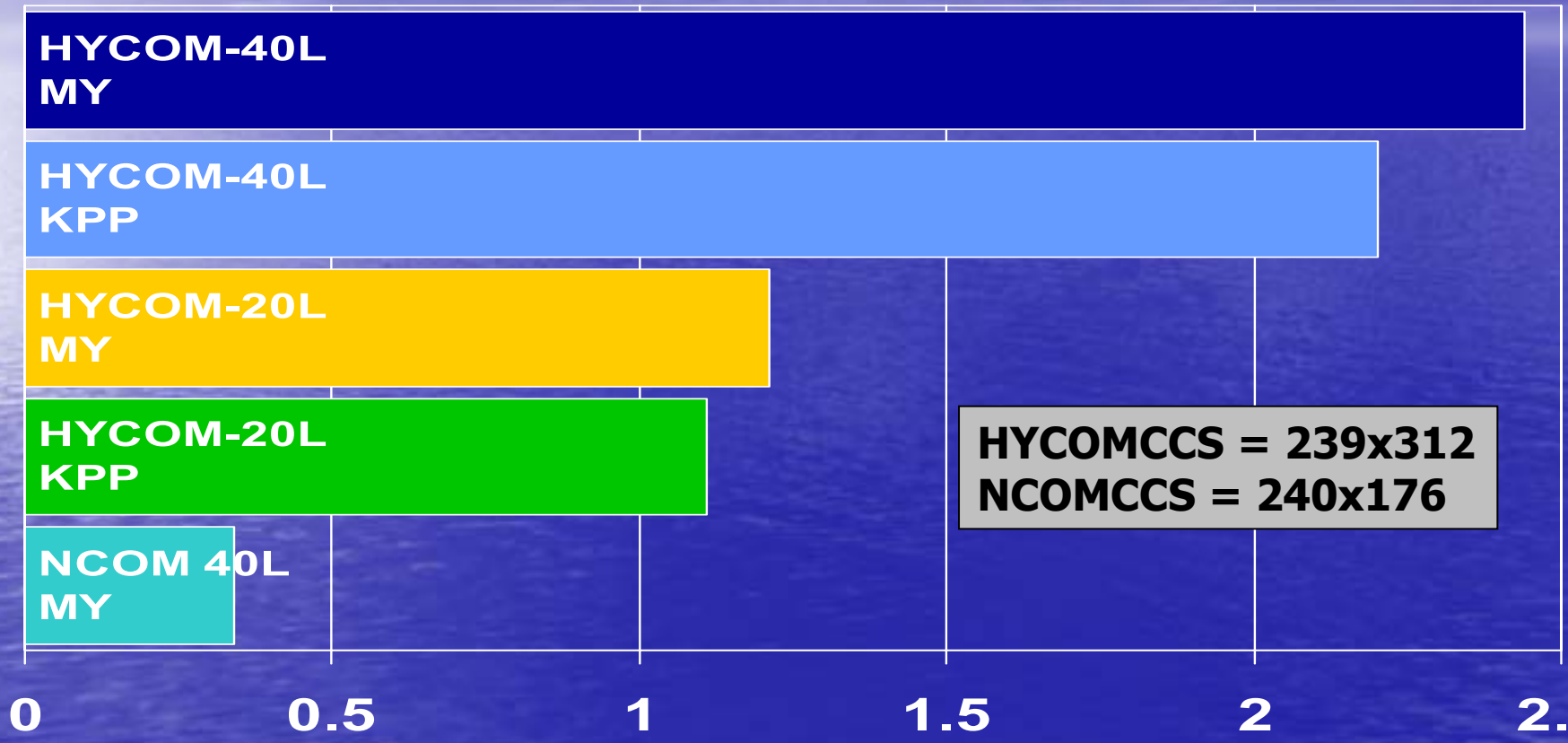
3D evolution from IC to ~July

Temperature (Color) and SSH (Contour)

finalhycom3.mov

BENCHMARKS

24-processor MPI, IBM SP4 (Romulus)
30 day segment wall clock hours (300s time-step)



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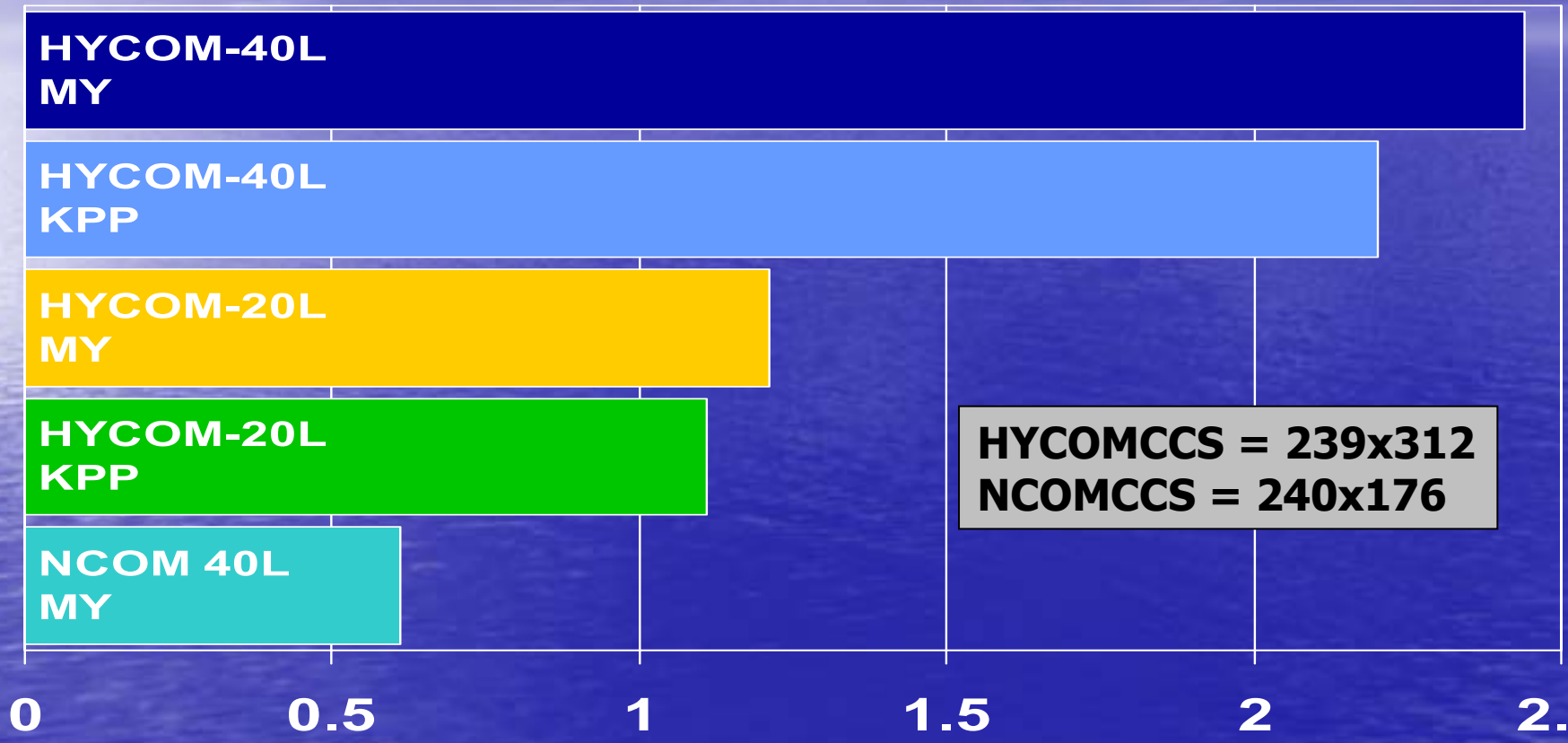
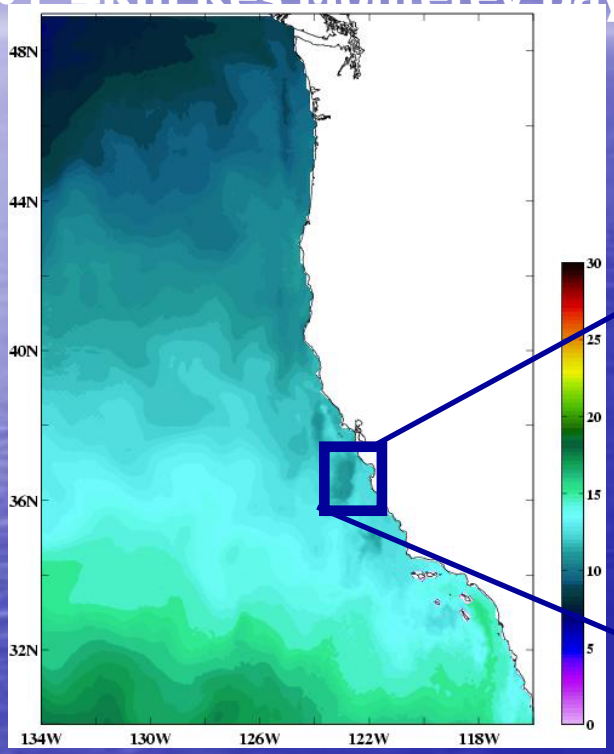
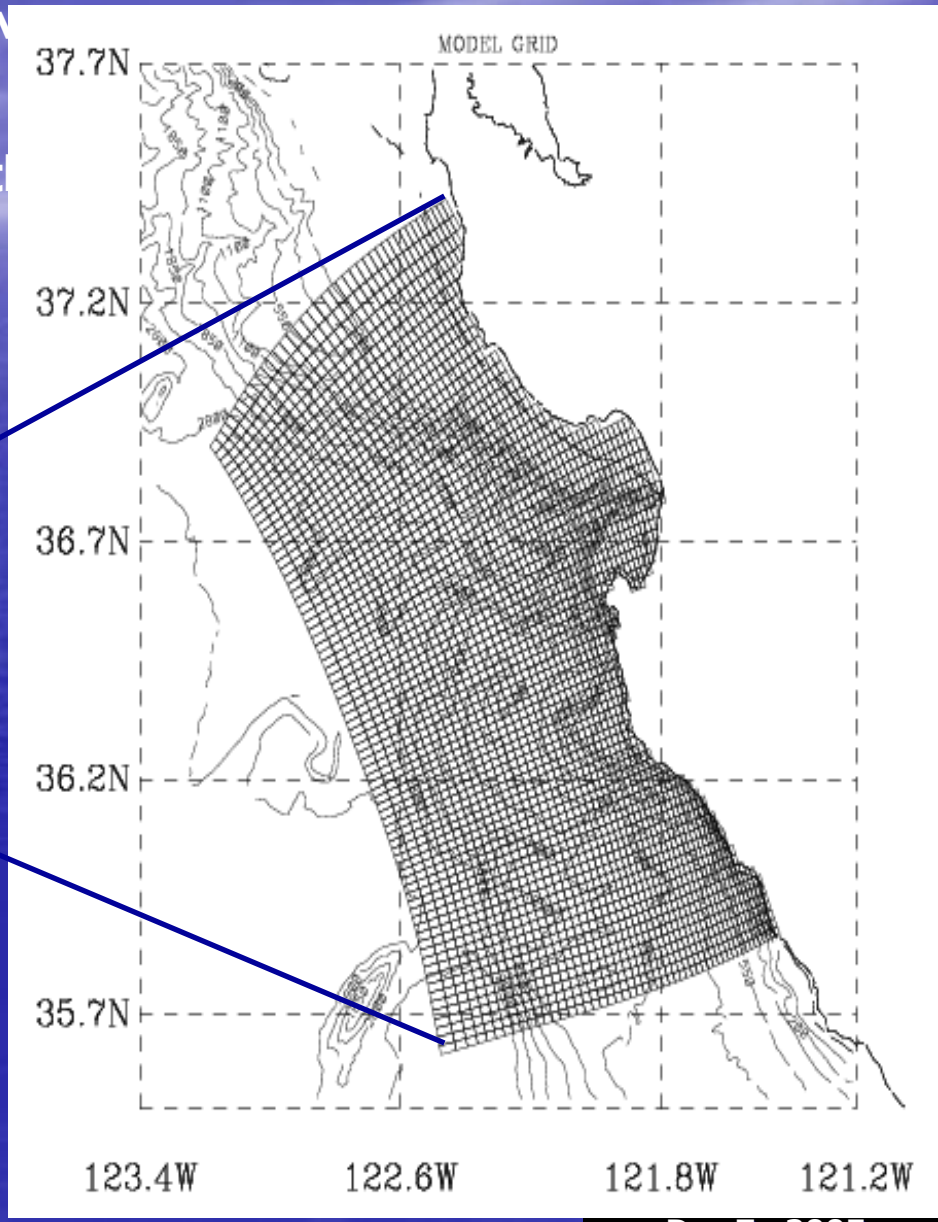


CURRENT & FUTURE WORK

- HYCOMPAC->HYCOMCCS->NCOMM
  HYCOMPAC->NCOMMB
  - ~1-4Km Res Monterey Bay Orth





CURRENT & FUTURE WORK

- HYCOMPAC->HYCOMCCS->NCOMMB (biology)
  HYCOMPAC-> NCOMMB (biology)
  - ~1-4Km Res Monterey Bay Orthogonal Curvilinear grid
- Mapping to sigma-only grids (NCOMCCS and/or NCOMMB)

  (will show above results at OS2006)

CURRENT & FUTURE WORK

- HYCOMPAC->HYCOMCCS->NCOMMB (biology)
  HYCOMPAC-> NCOMMB (biology)
  - ~1-4Km Monterey Bay Orthogonal Curvilinear grid
- Mapping to sigma-only grids (NCOMCCS and/or NCOMMB)

  (will show above results at OS2006)
- NCOMGLB->HYCOMCCS->NCOMMB
- Collaborating with J. Allen and R. Samuelson to provide BCs for ROMS
- Implementation of NCOMCCS 4.5Km and HYCOMCCS 4.5Km
- Implementation of HYCOMMB (OCG)

- Further studies and more science
  -Mass/Momentum conservation
  -Baroclinic assessment
  -Sensitivity analysis

CONCLUSIONS

- HYCOM viable as an IC/BC provider for NCOM
  - Mapping techniques carefully chosen
  - Robust established mapping process (generalized)
  - "Better" in NCOMCCS than from GLOBAL NCOM
    - Improved due to outer nest resolution
    - Subtle difference due to vertical resolution
      - 40L "NCOM-mode" slighly improves the results at twice the expense, -use 20L "hybrid-mode"
  - Outer nest Data Assimilation will improve inner nest results based on the results seen in NCOM->NCOM nesting

Questions/Suggestions/Discussion