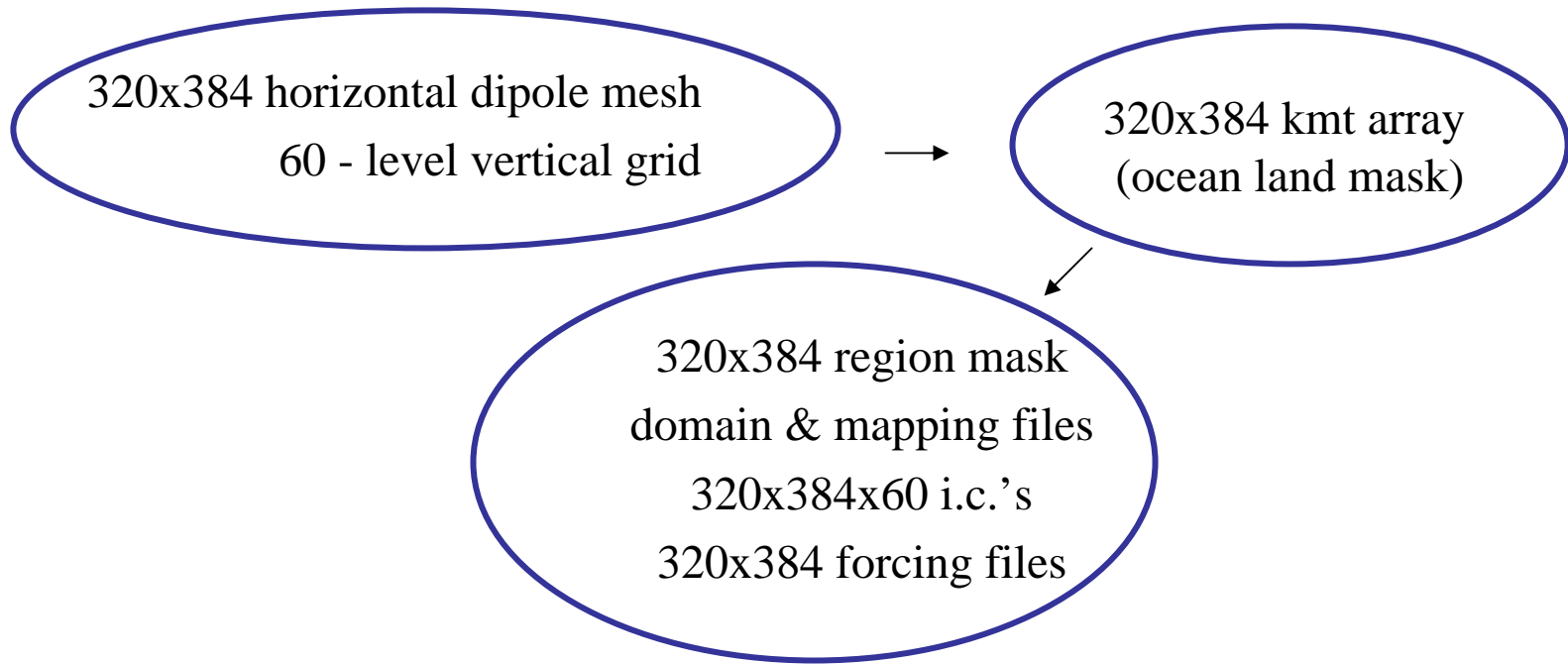
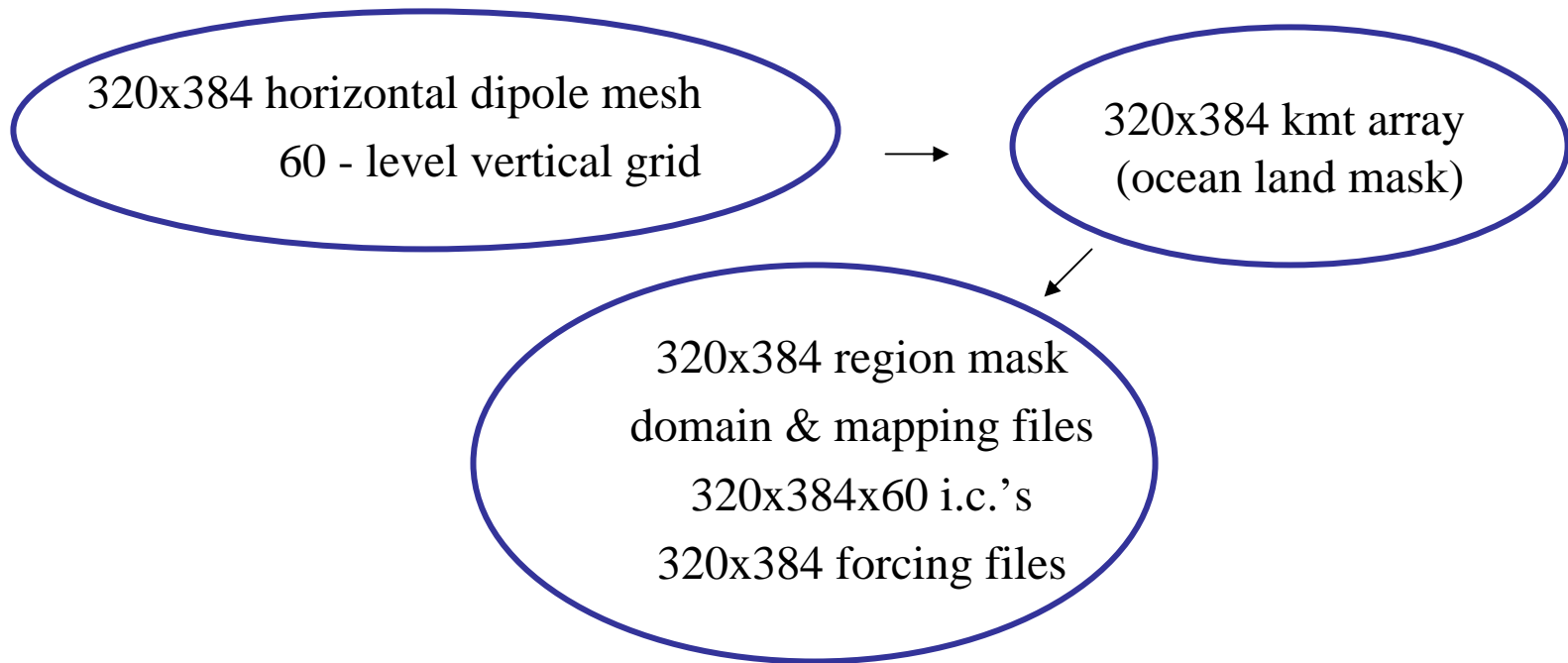


# Optimizing the POP Vertical Grid

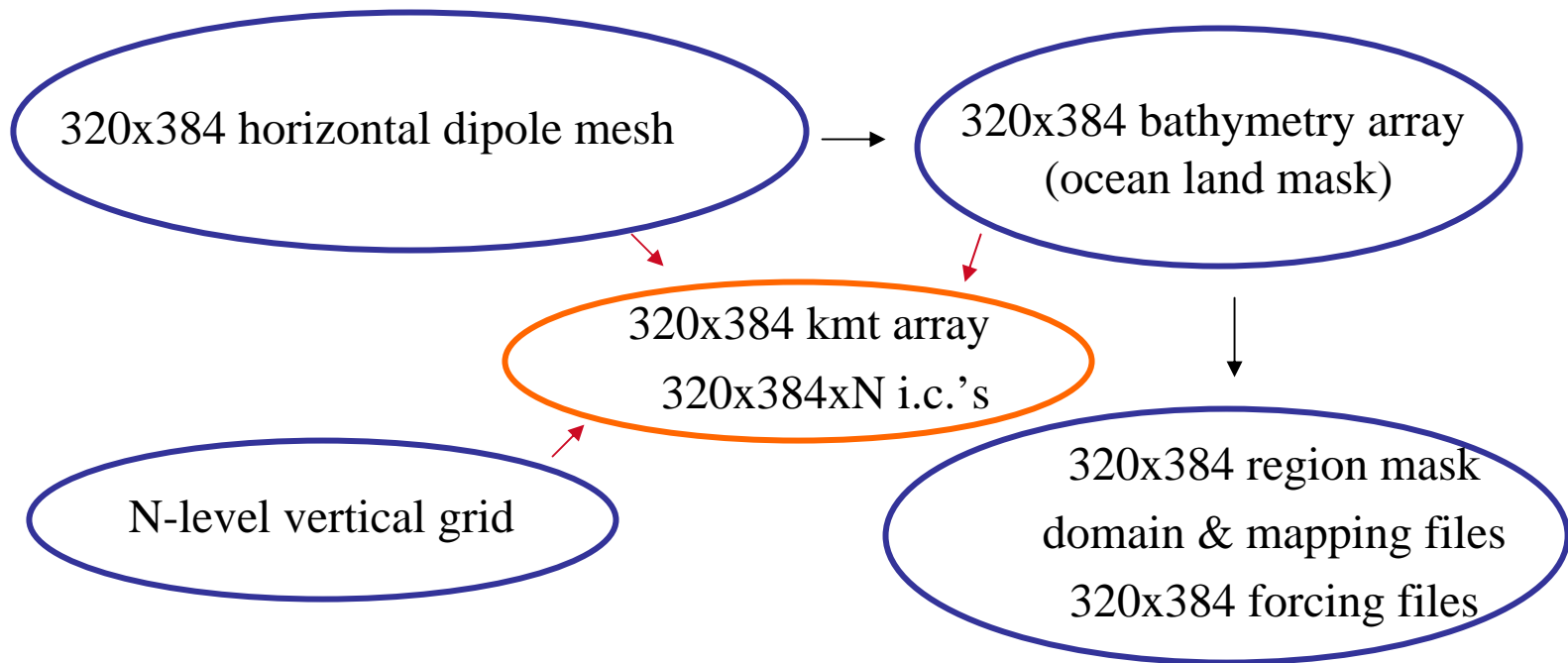
# CURRENT



# CURRENT

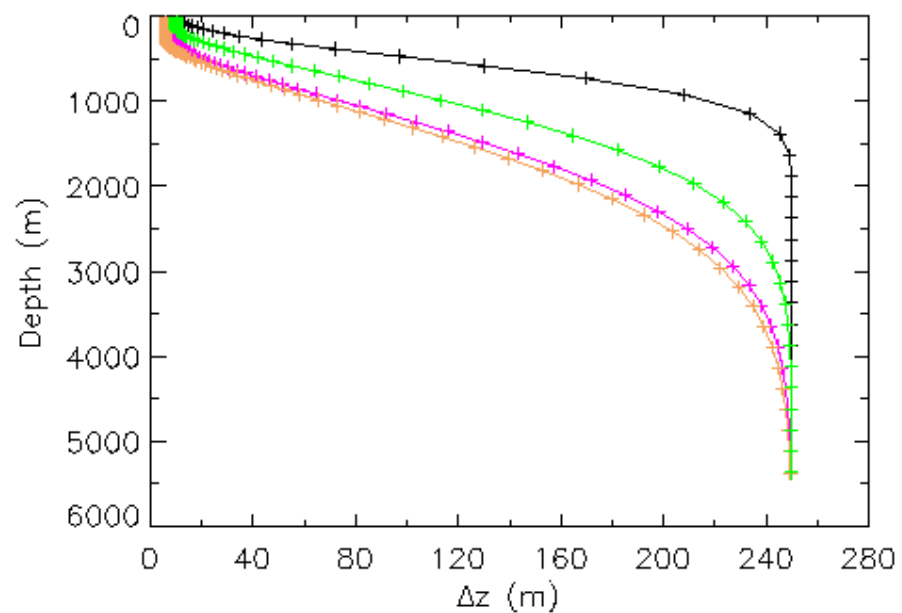
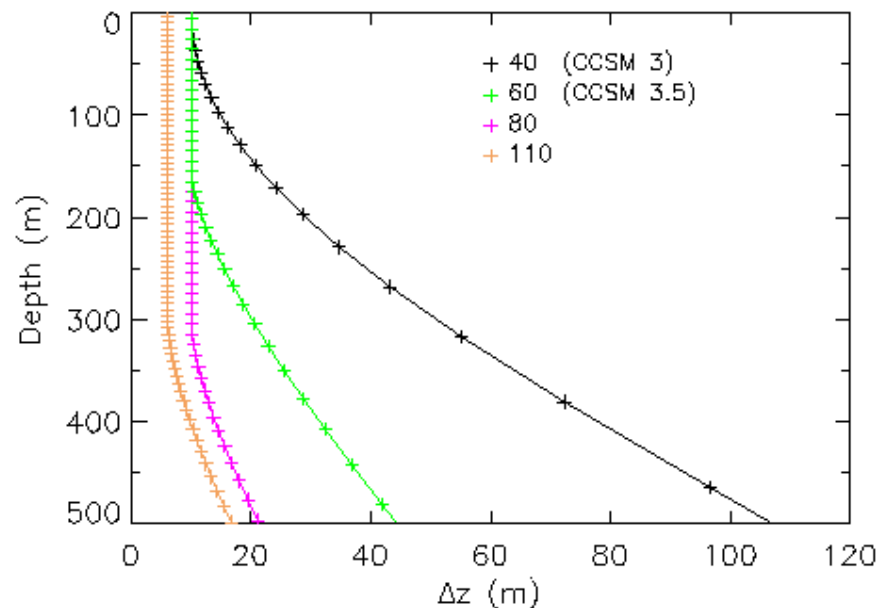


# NEW



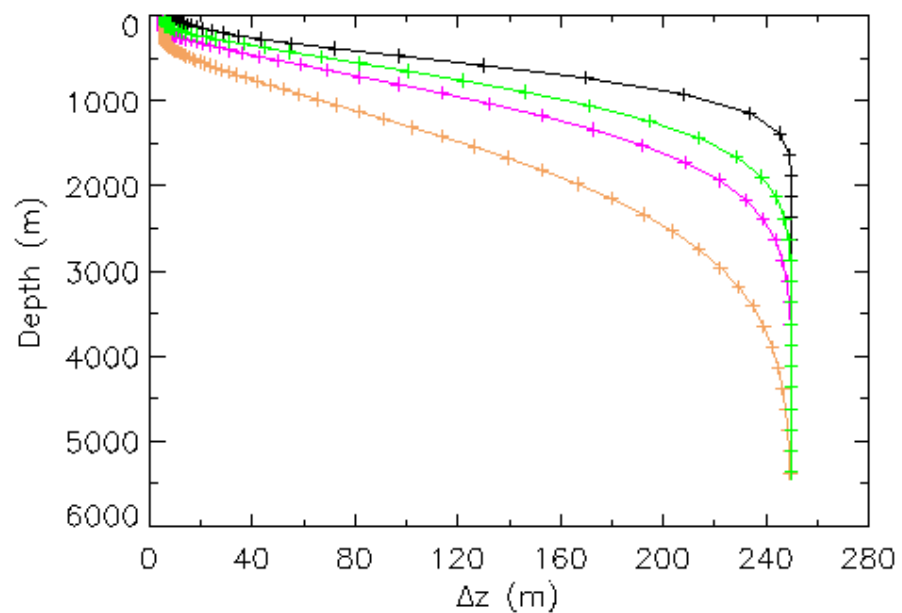
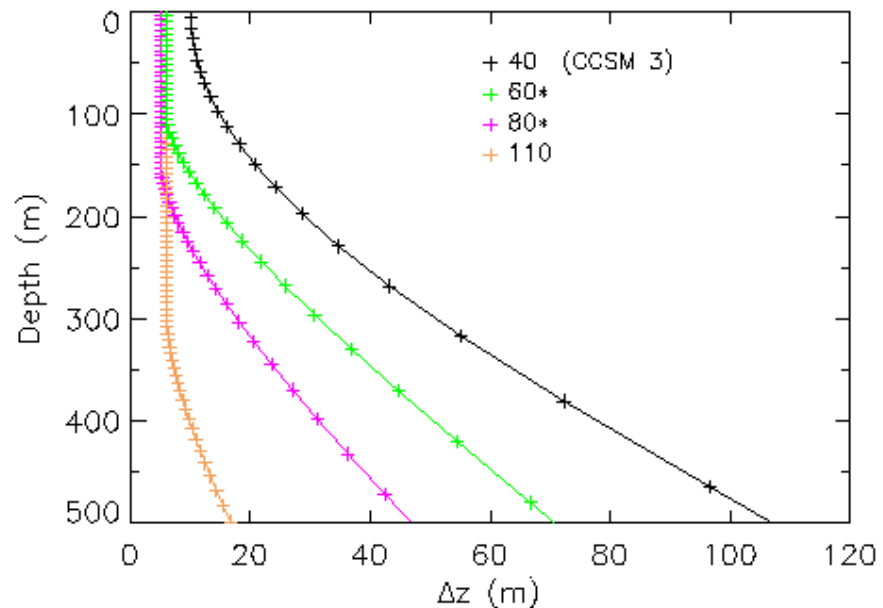
# Ocean-alone Sensitivity to vertical grid

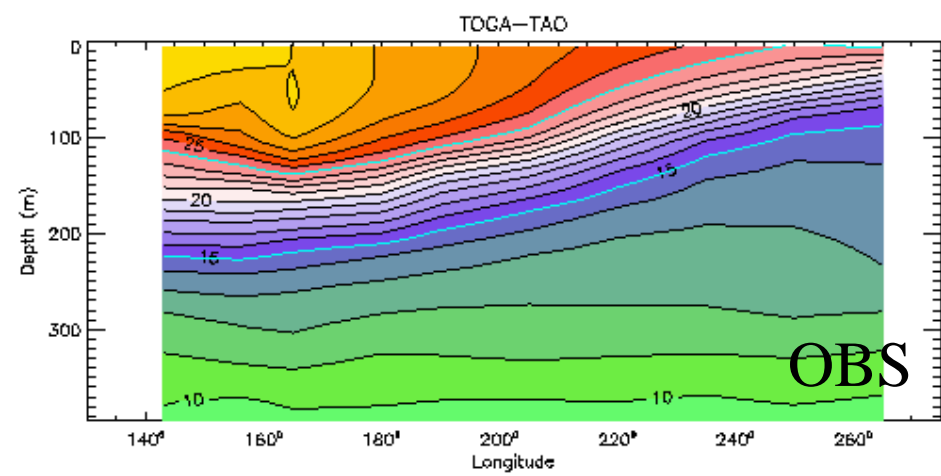
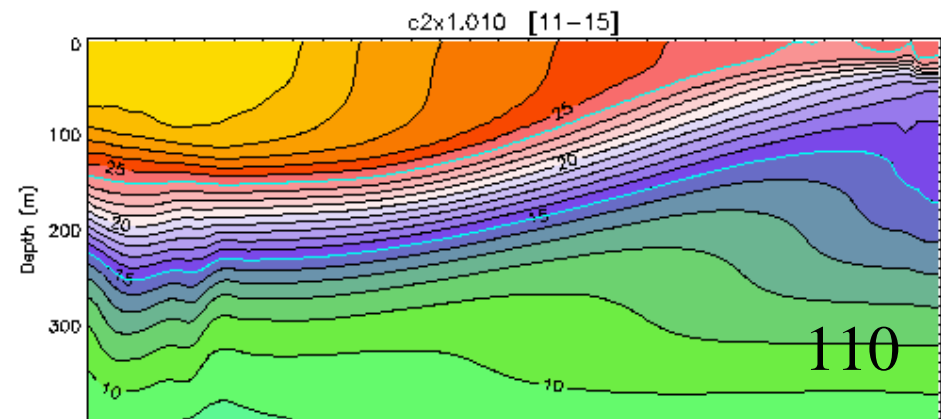
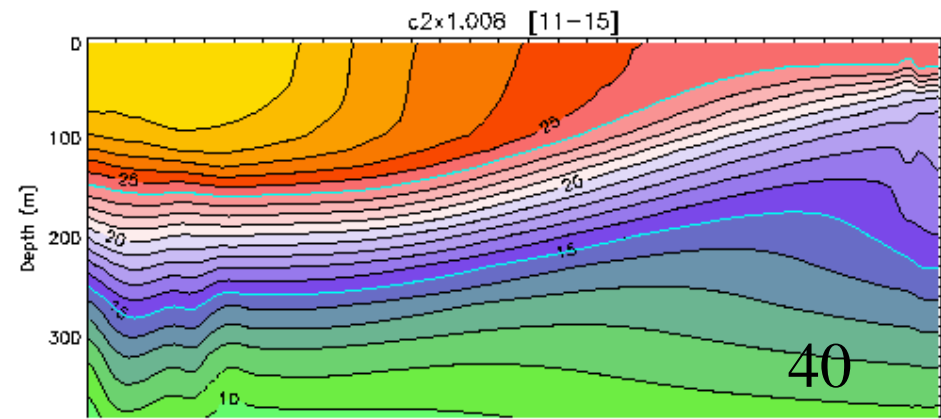
## Vertical Grid Cell Thickness



# Ocean-alone Sensitivity to vertical grid

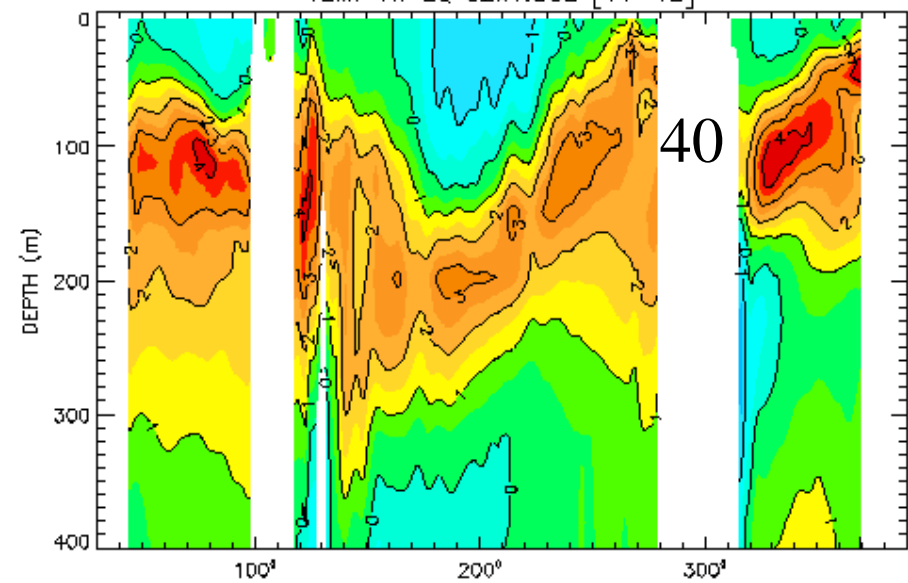
## Vertical Grid Cell Thickness



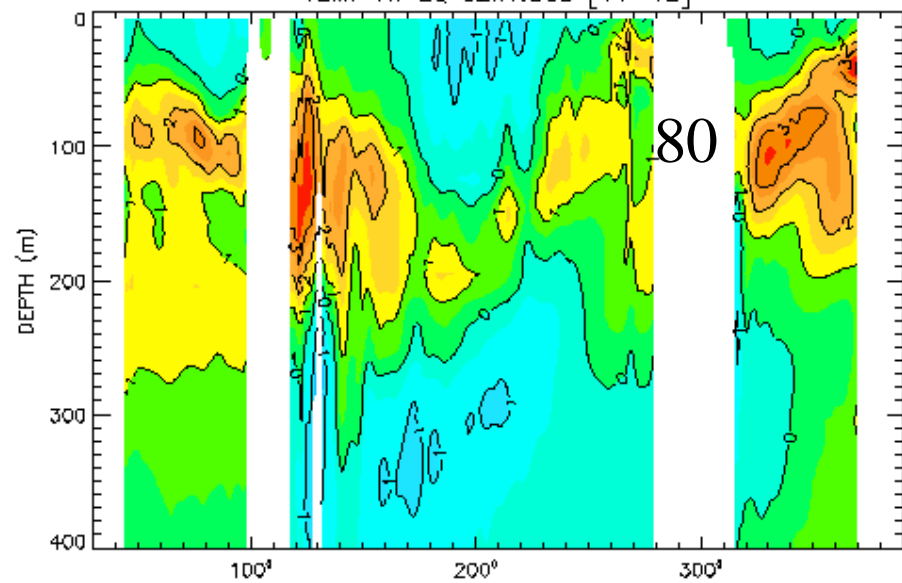


T

TEMP AT EQ c2x1.008 [11-15]

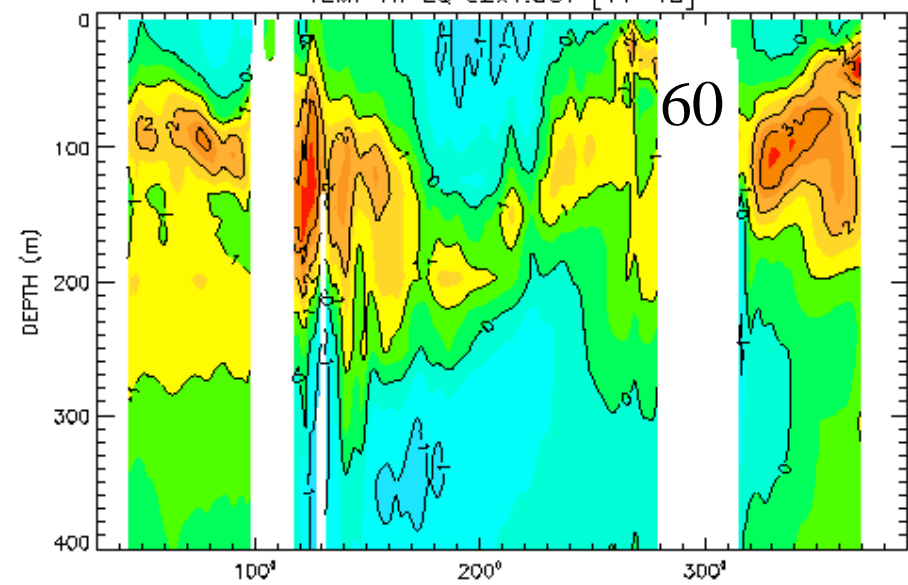


TEMP AT EQ c2x1.009 [11-15]

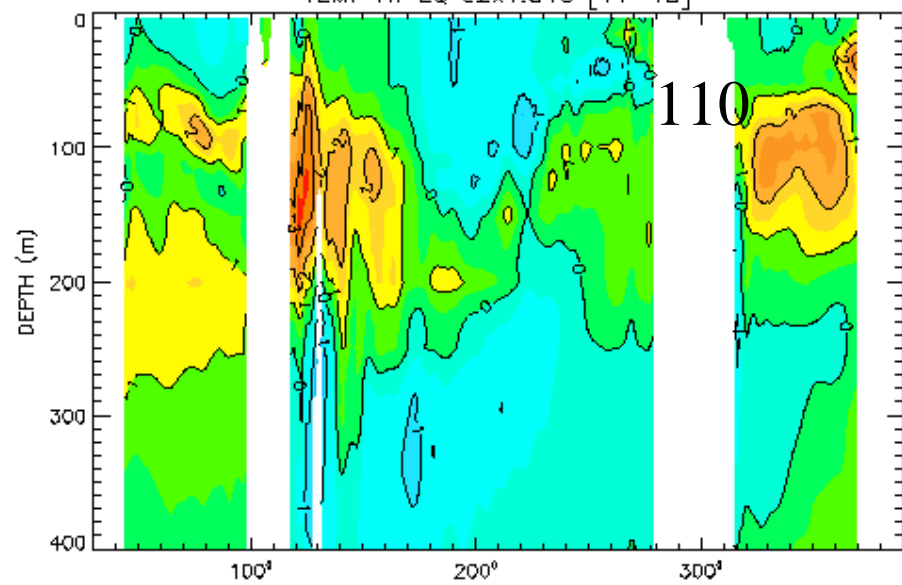


T'

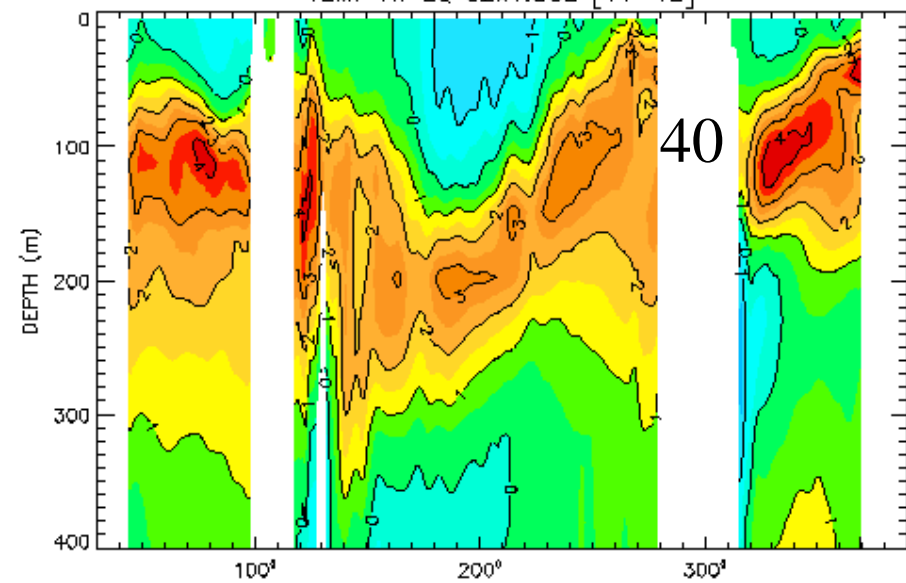
TEMP AT EQ c2x1.007 [11-15]



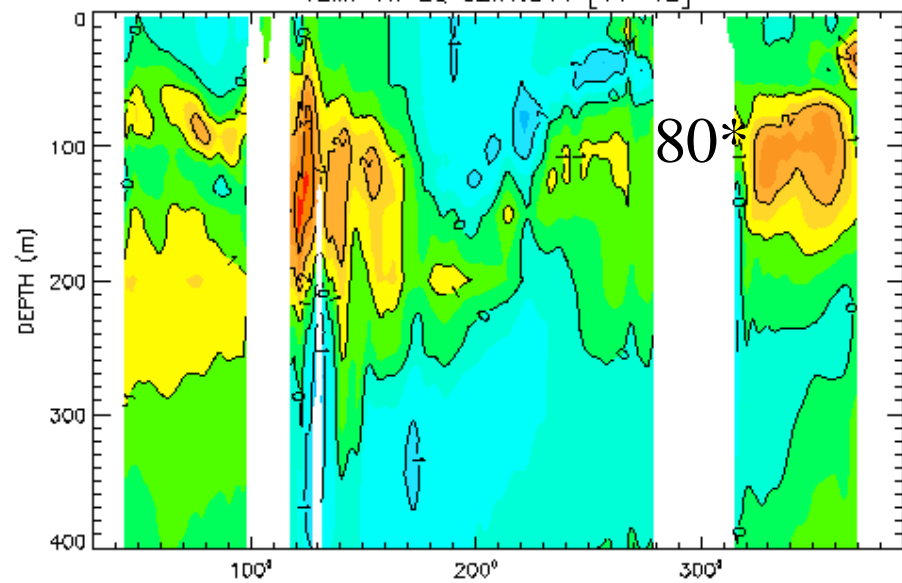
TEMP AT EQ c2x1.010 [11-15]



TEMP AT EQ c2x1.008 [11-15]

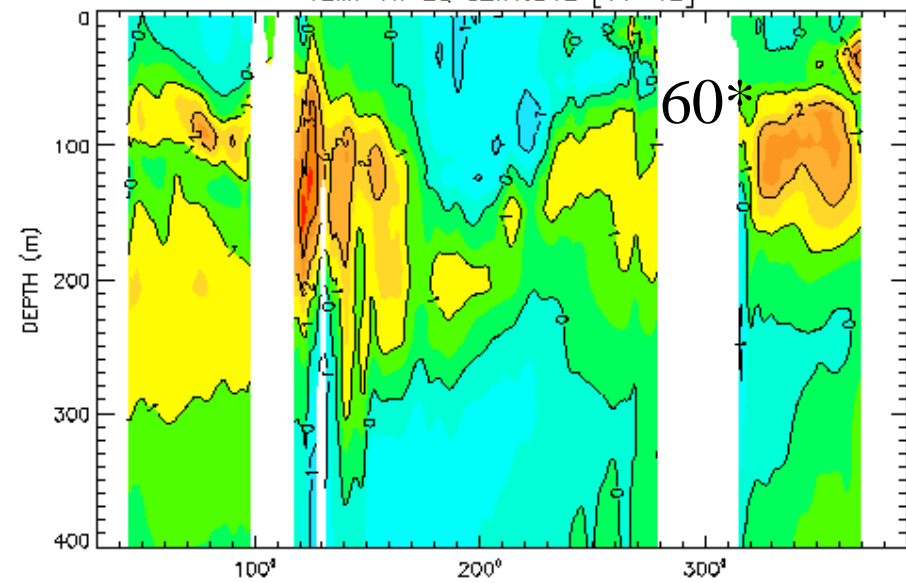


TEMP AT EQ c2x1.011 [11-15]

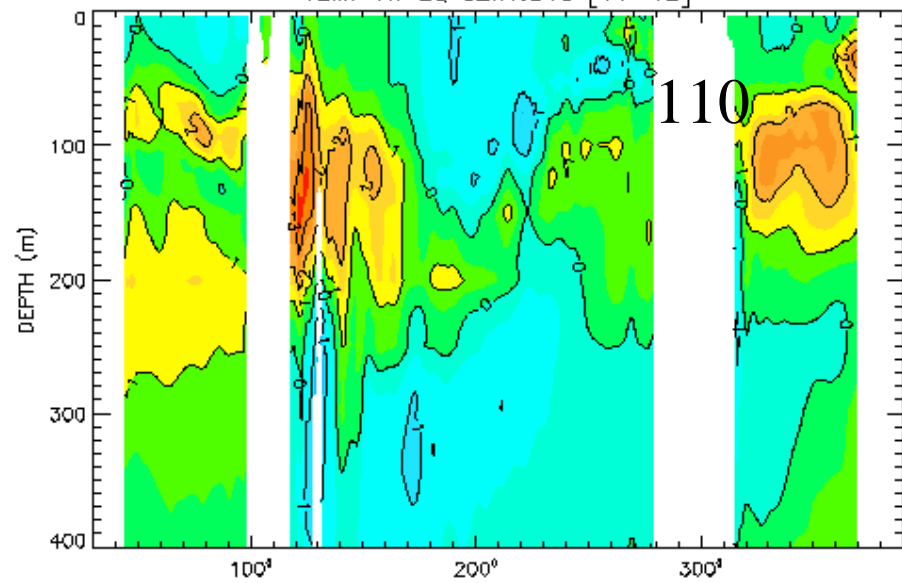


T'

TEMP AT EQ c2x1.012 [11-15]



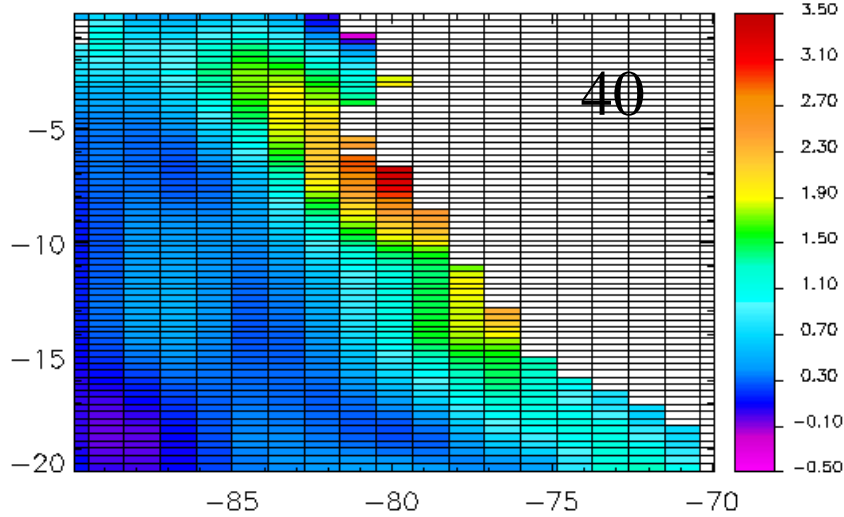
TEMP AT EQ c2x1.010 [11-15]



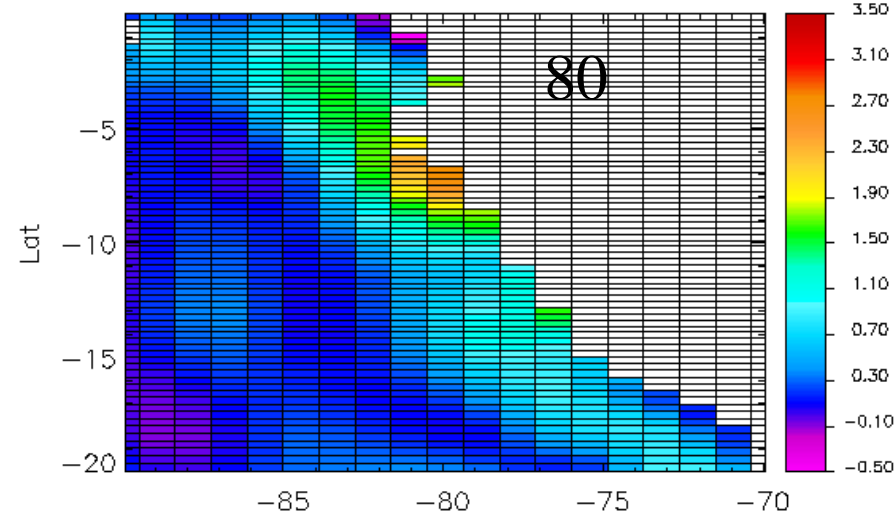


# S. America, SST - OBS

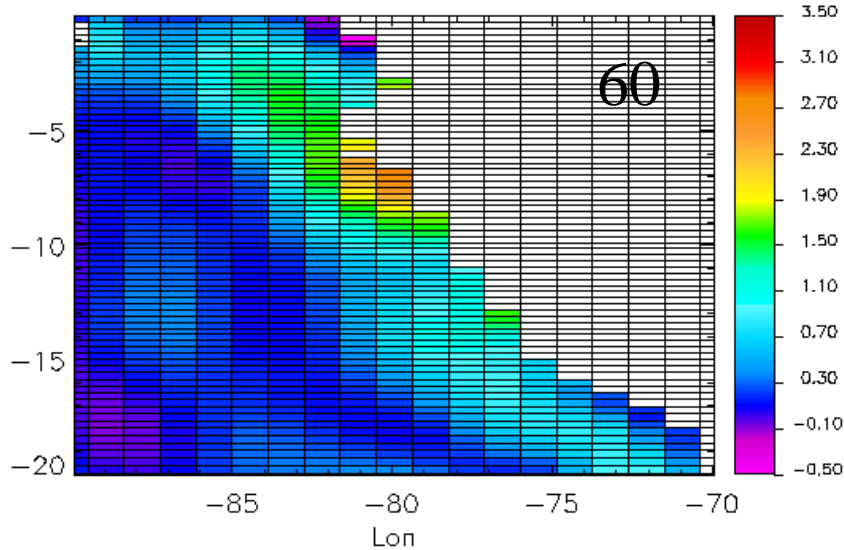
SSTA, c2x1.008 (40-lv), [11-15]



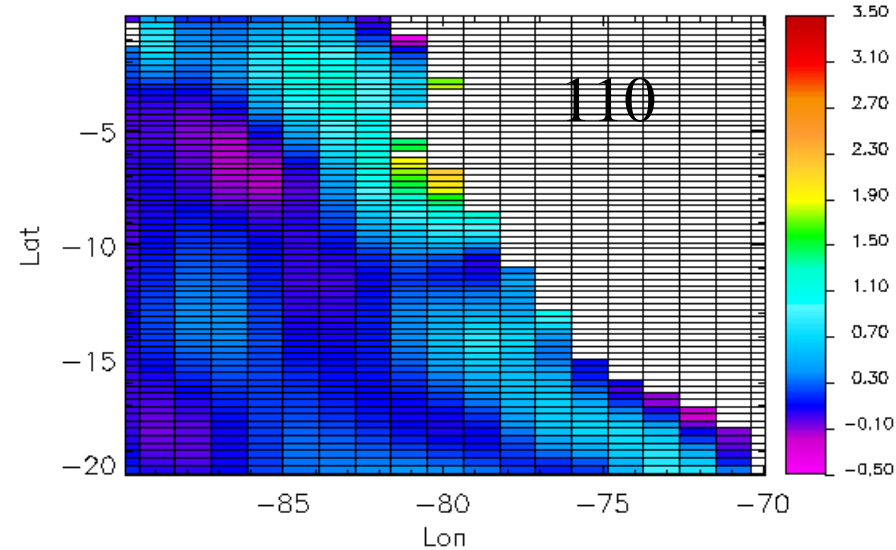
SSTA, c2x1.009 (80-lv), [11-15]



SSTA, c2x1.007 (60-lv), [11-15]

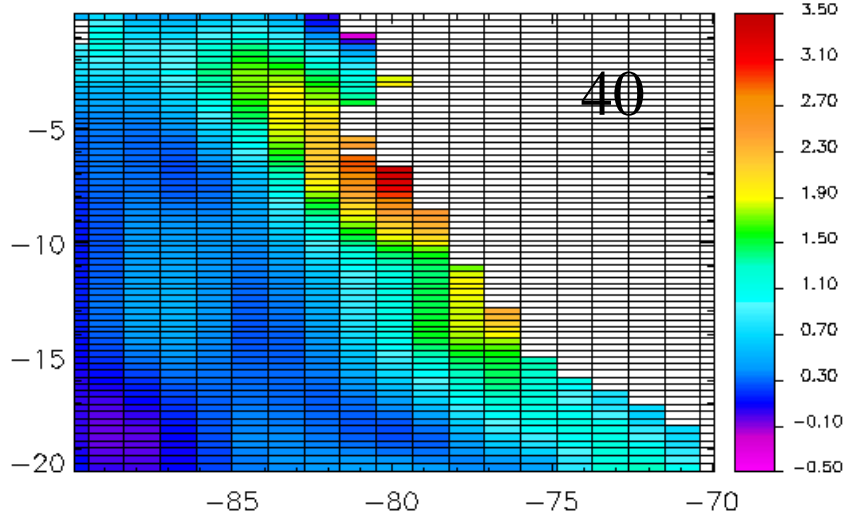


SSTA, c2x1.010 (110-lv), [11-15]

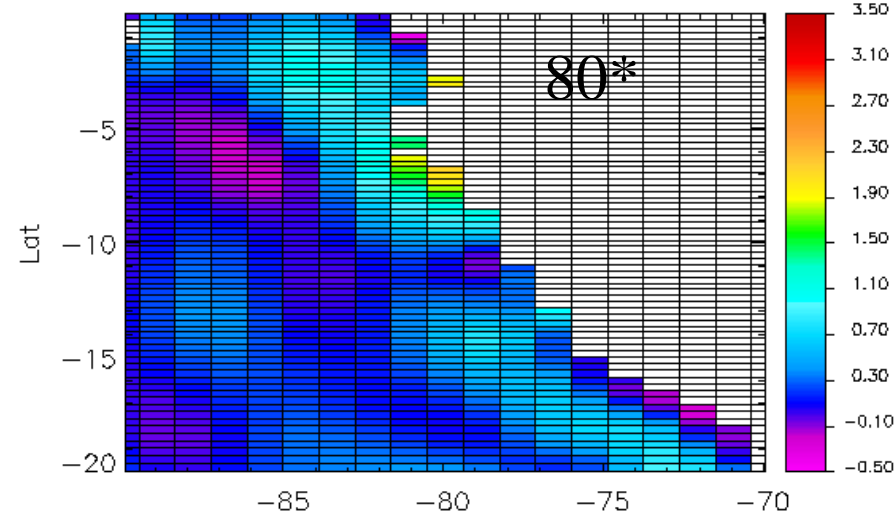


# S. America, SST - OBS

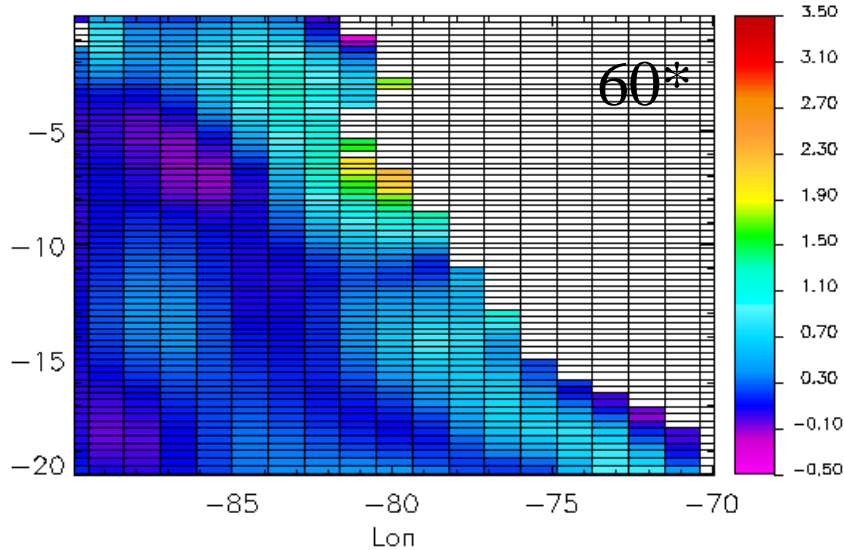
SSTA, c2x1.008 (40-lvl), [11-15]



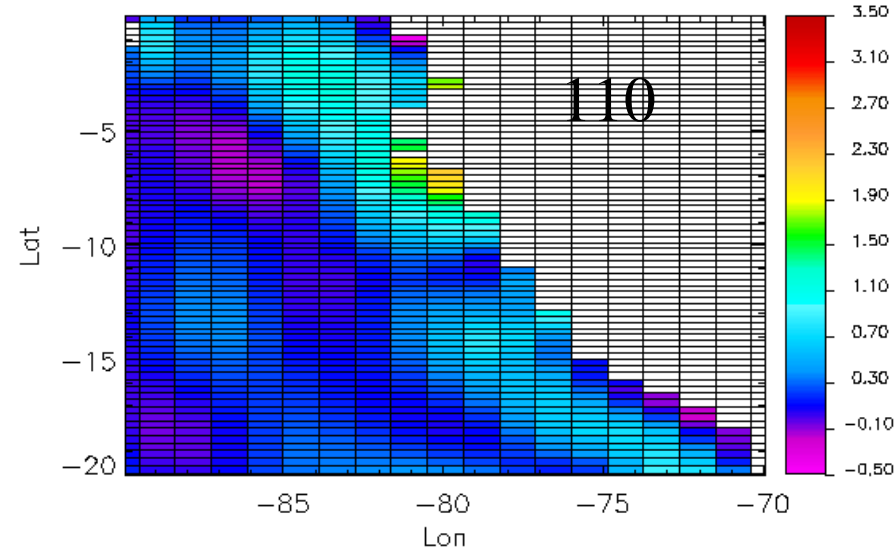
SSTA, c2x1.011 (80\*-lvl), [11-15]



SSTA, c2x1.012 (60\*-lvl), [11-15]

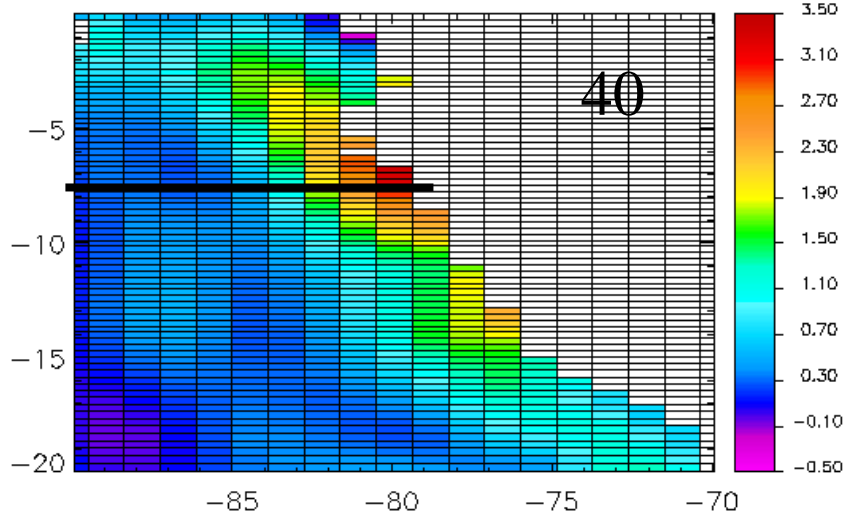


SSTA, c2x1.010 (110-lvl), [11-15]

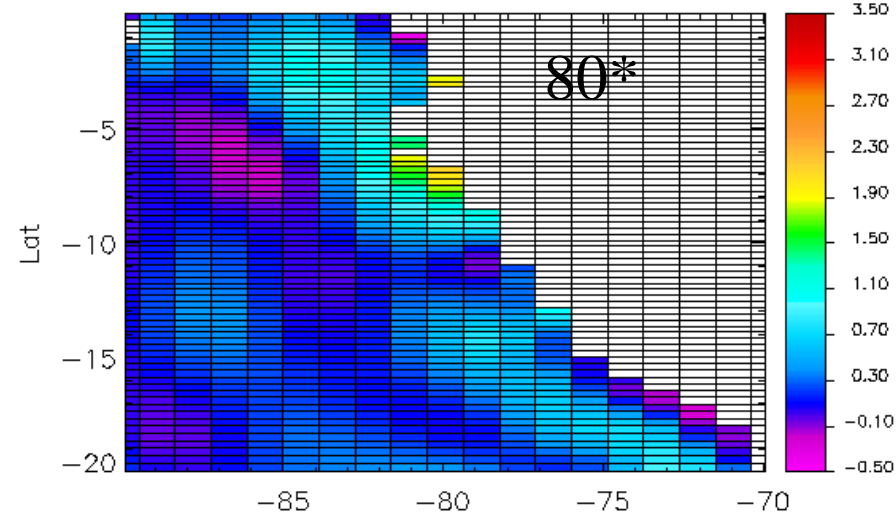


# S. America, SST - OBS

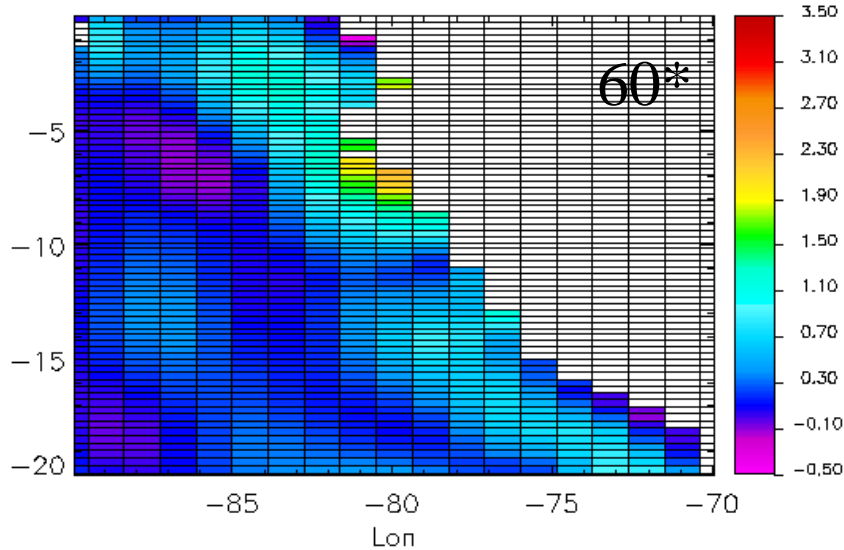
SSTA, c2x1.008 (40-lvl), [11-15]



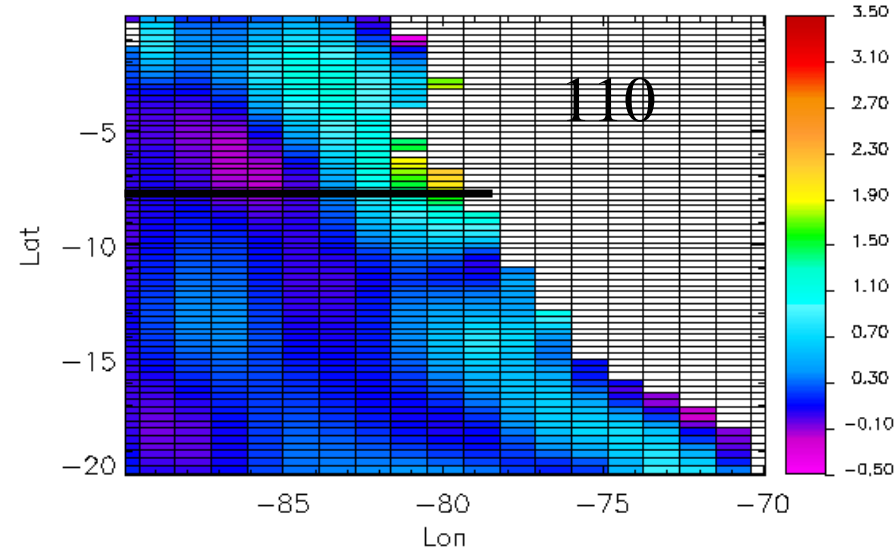
SSTA, c2x1.011 (80\*-lvl), [11-15]



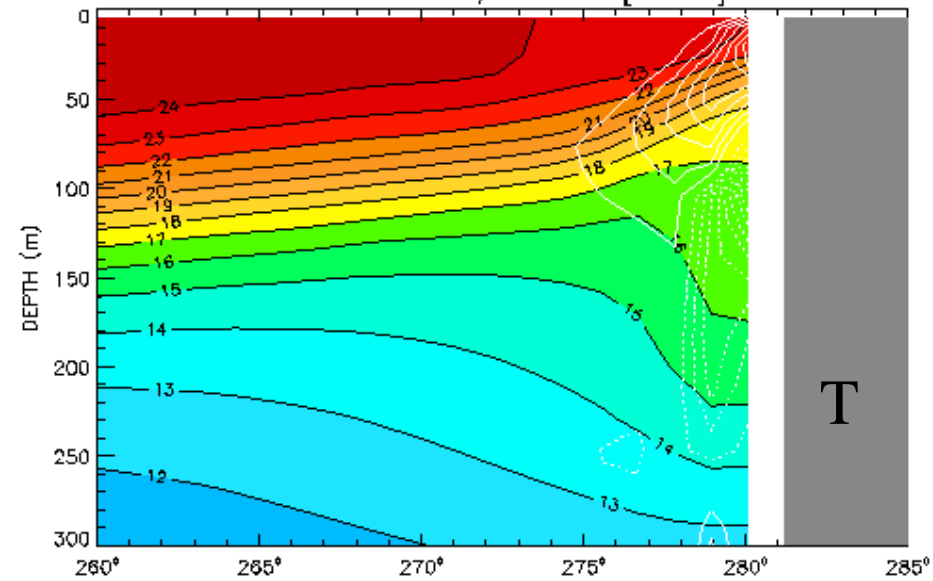
SSTA, c2x1.012 (60\*-lvl), [11-15]



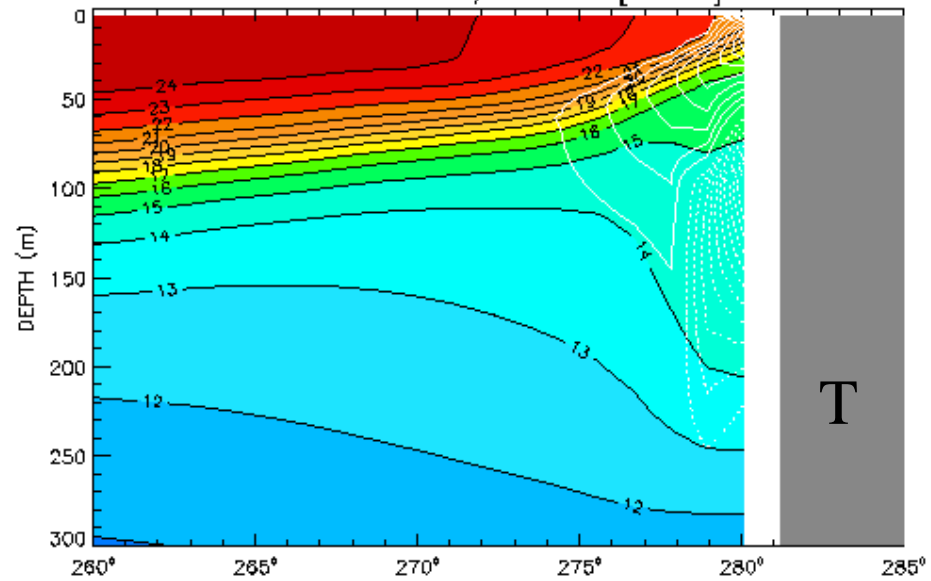
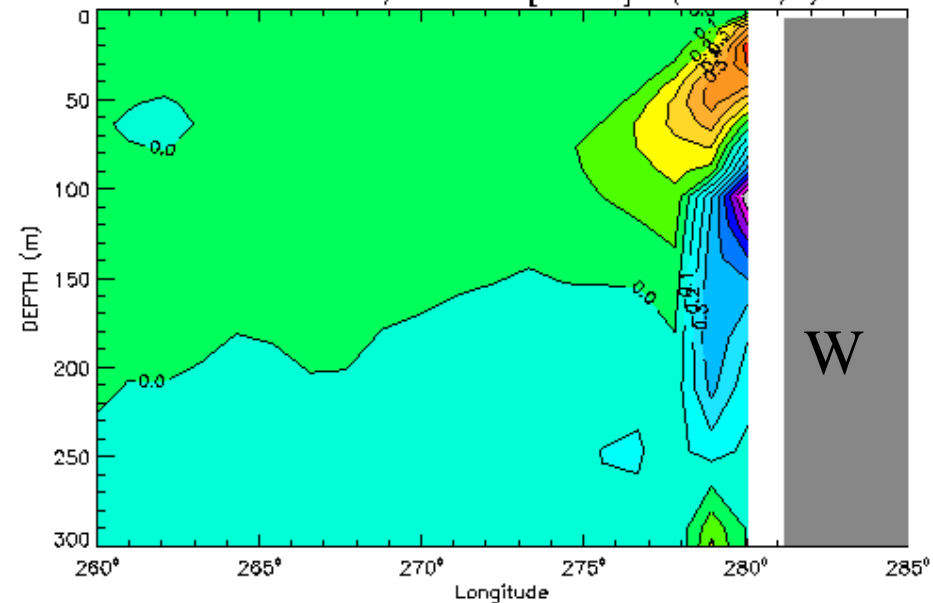
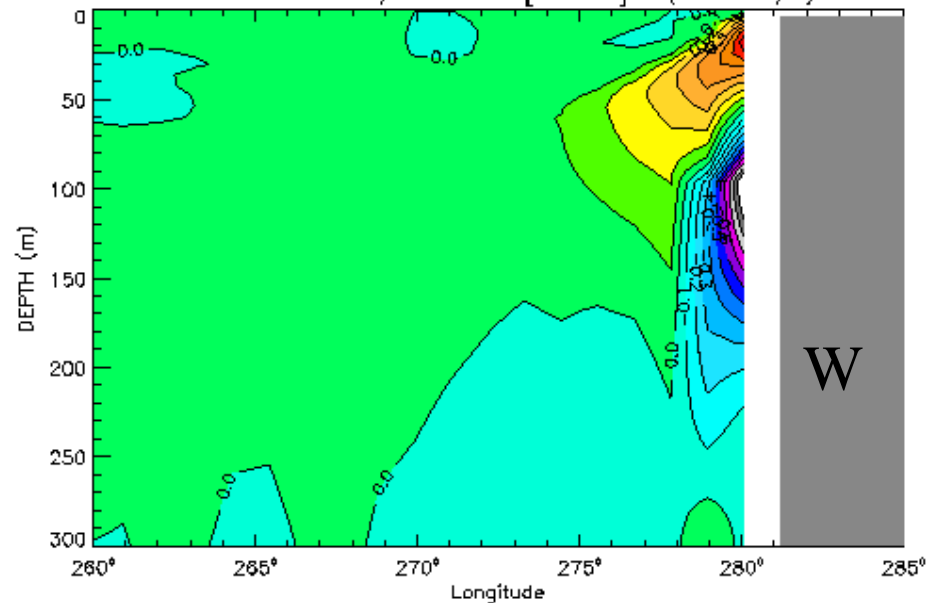
SSTA, c2x1.010 (110-lvl), [11-15]

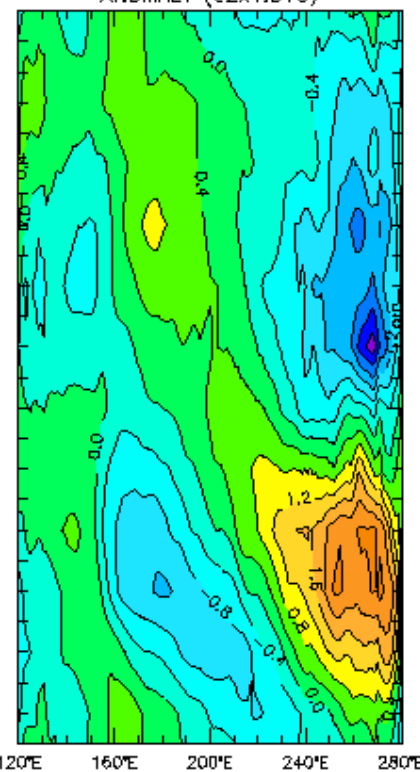
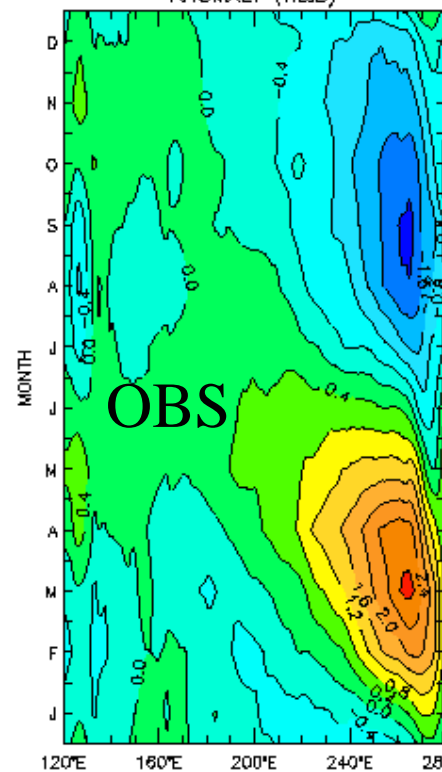
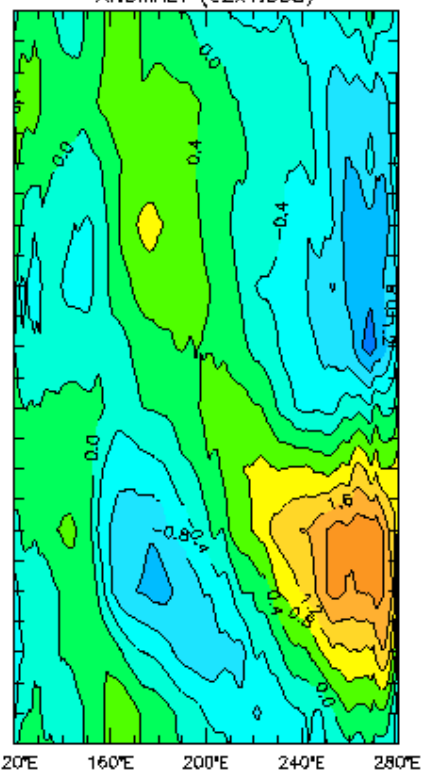
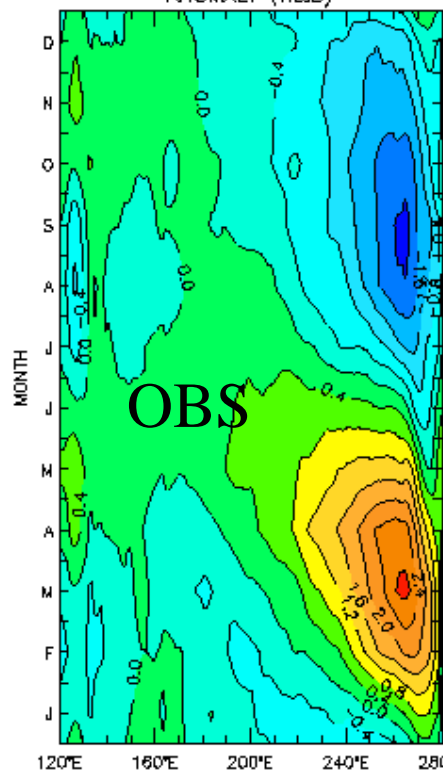
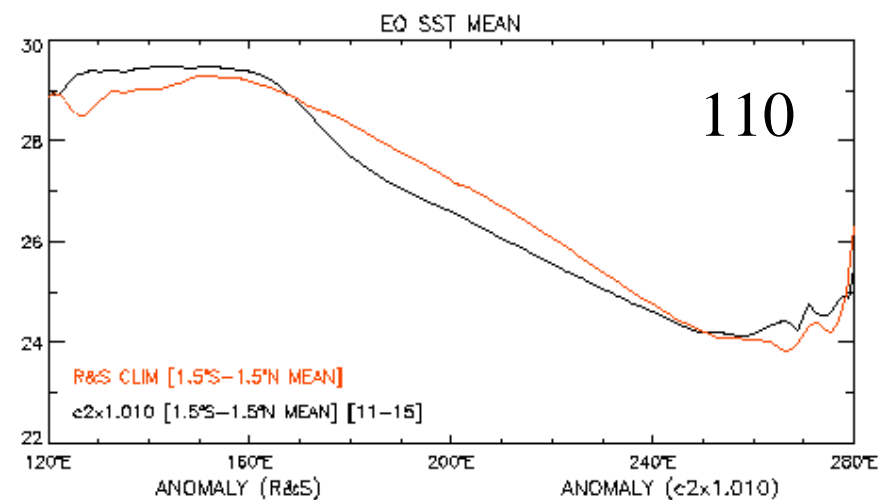
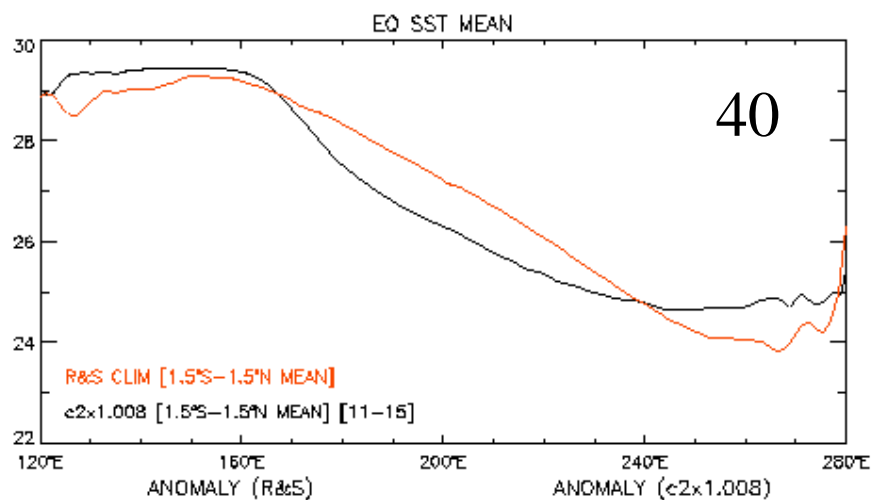


40

TEMP AT  $-7.9^{\circ}\text{S}$ ,  $c2 \times 1.008$  [11-15]

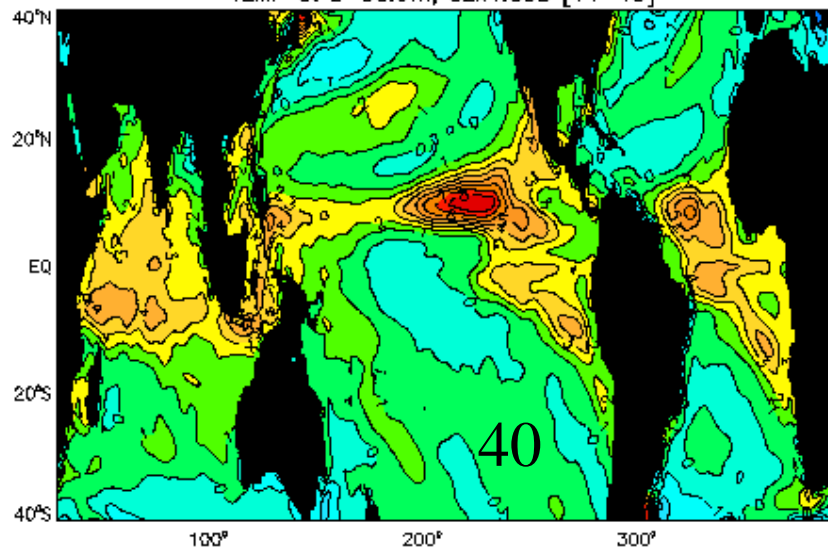
110

TEMP AT  $-7.9^{\circ}\text{S}$ ,  $c2 \times 1.010$  [11-15]WVEL AT  $-7.9^{\circ}\text{S}$ ,  $c2 \times 1.008$  [11-15] ( $10^{-3}$  cm/s)WVEL AT  $-7.9^{\circ}\text{S}$ ,  $c2 \times 1.010$  [11-15] ( $10^{-3}$  cm/s)



TEMP at z=96.9m, c2x1.008 [11-15]

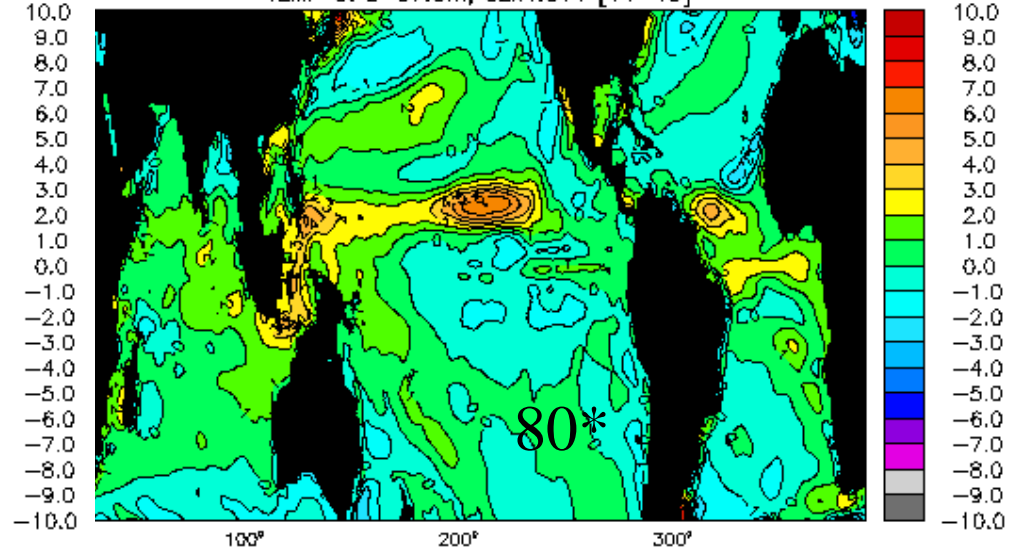
mean= 1.18



(-7.19e+00 to 8.99e+00 by 1.00 °C)

TEMP at z=97.5m, c2x1.011 [11-15]

mean= 0.37

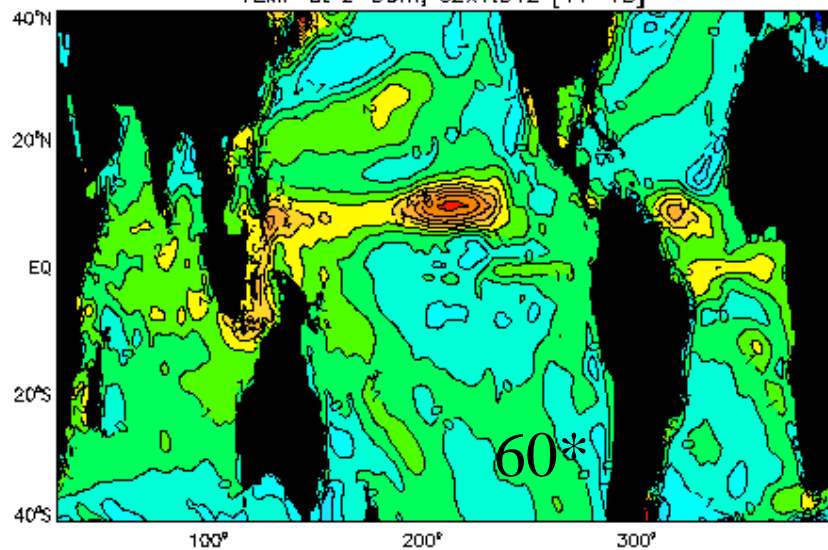


(-9.08e+00 to 8.29e+00 by 1.00 °C)

## 100m T'

TEMP at z=99m, c2x1.012 [11-15]

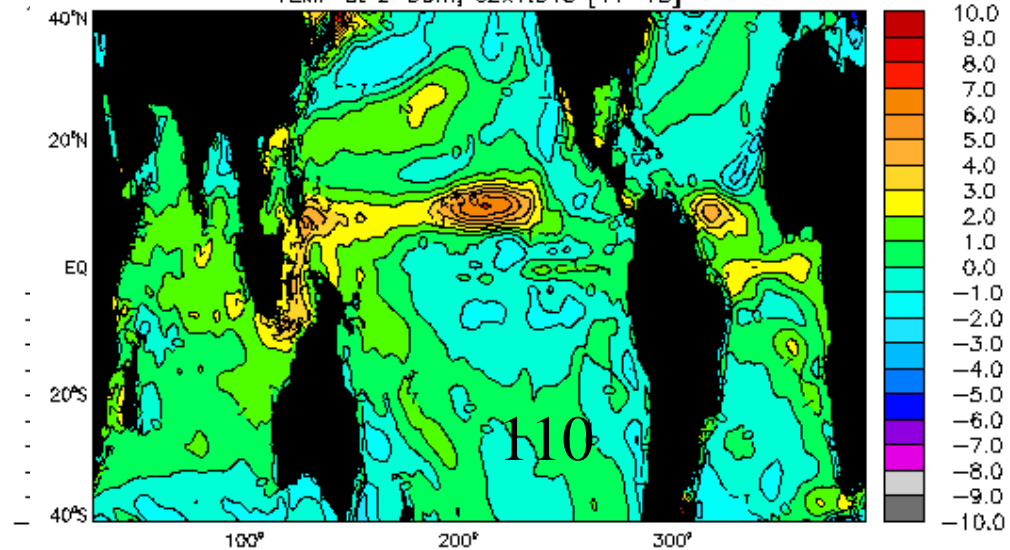
mean= 0.4



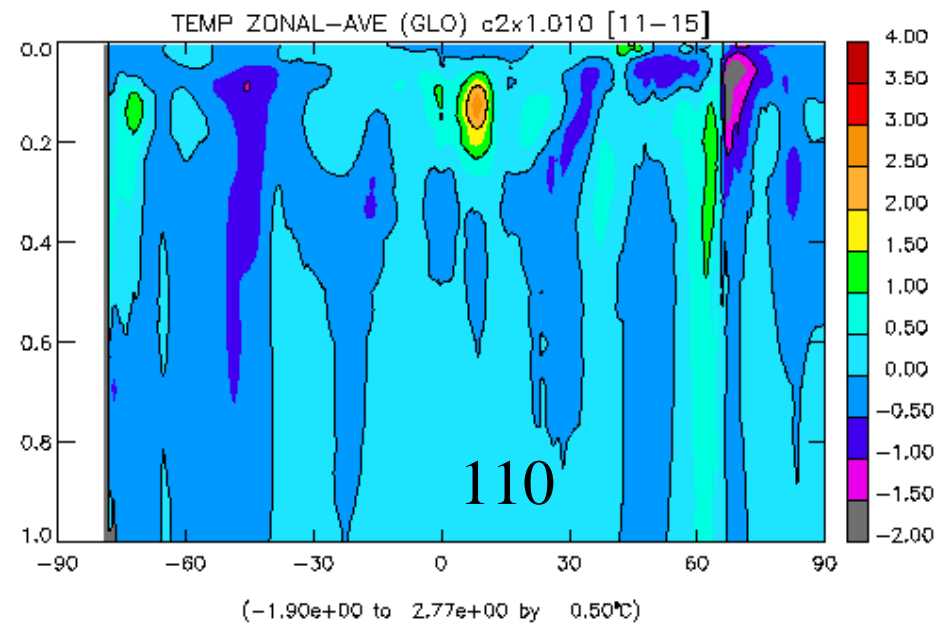
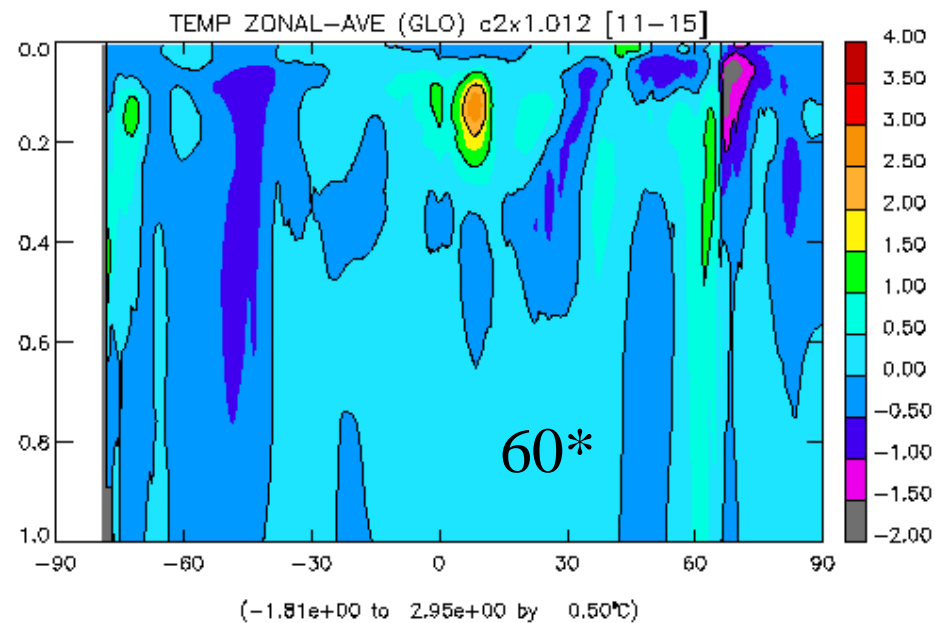
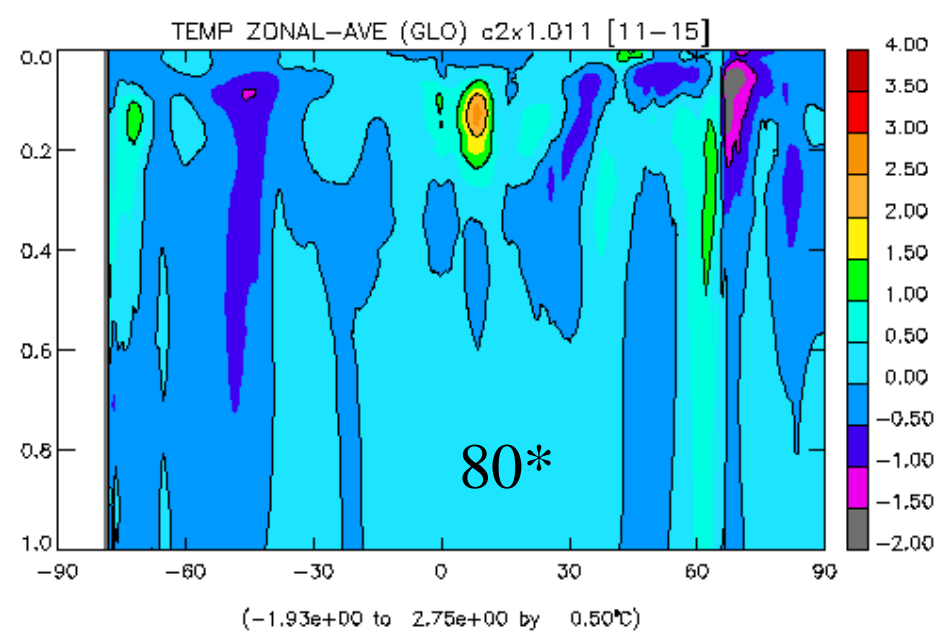
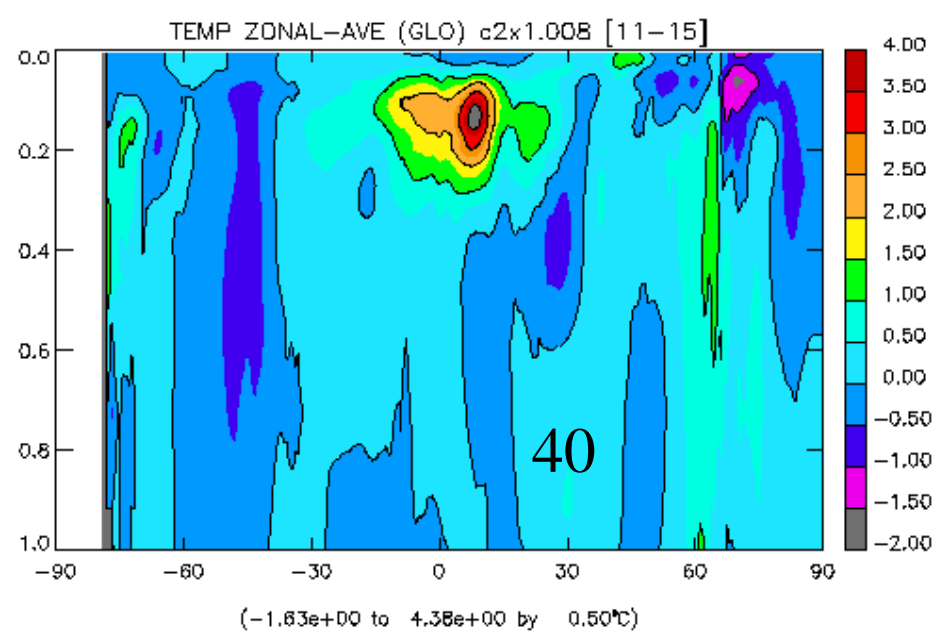
(-9.23e+00 to 8.22e+00 by 1.00 °C)

TEMP at z=99m, c2x1.010 [11-15]

mean= 0.41



(-8.73e+00 to 8.39e+00 by 1.00 °C)



# Conclusions

- Flexible, runtime vertical resolution/grid selection is now possible in CCSM POP2
- Vertical resolution convergence studies are underway; preliminary results suggest that the current default (60 lvl) vertical grid is not optimal for reducing upper ocean biases.
- Sensitivity studies using passive tracers are needed
- For CCSM4, the ability to run at (very) high vertical resolution may prove particularly beneficial for experiments that place a premium on upper ocean fidelity (ie, hindcasts, short term forecasts) and for experiments to be run on processor-rich platforms



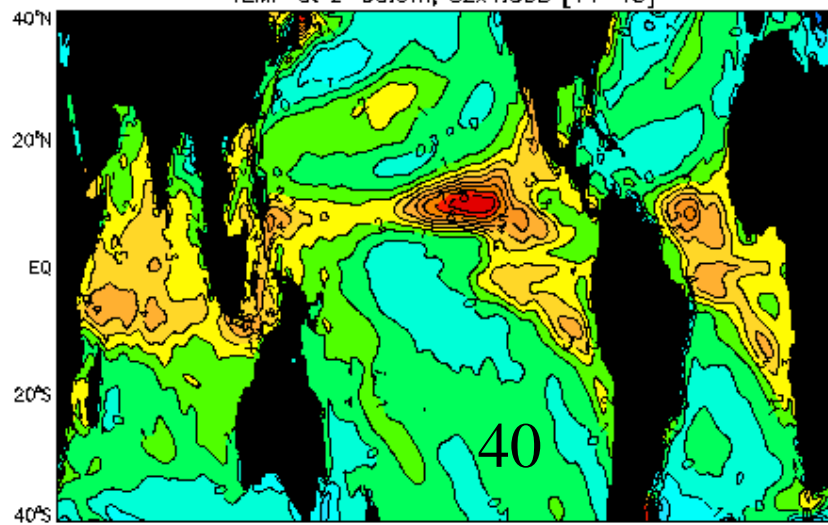
Vertical Grid

Timestep

|     |             |
|-----|-------------|
| 40  | 63 min      |
| 60  | 63 min      |
| 60* | 63 min      |
| 80  | 63 min      |
| 80* |             |
| 110 | 51 - 63 min |

TEMP at z=96.9m, c2x1.008 [11-15]

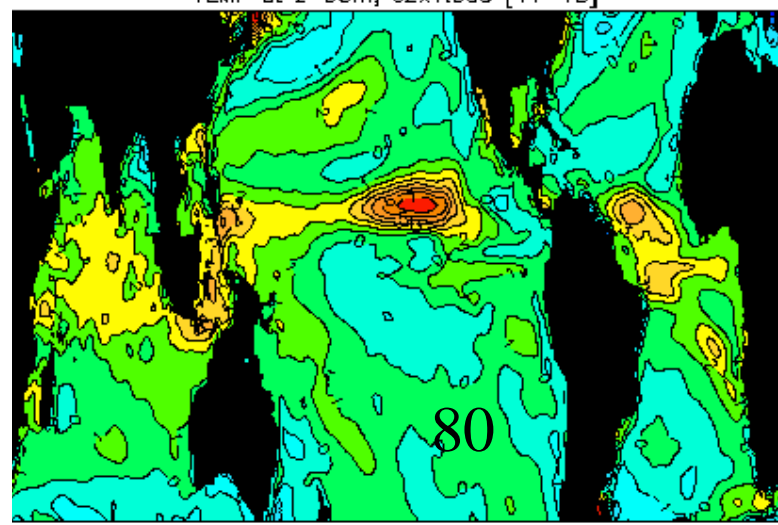
mean= 1.18



(-7.19e+00 to 8.99e+00 by 1.00 °C)

TEMP at z=95m, c2x1.009 [11-15]

mean= 0.70

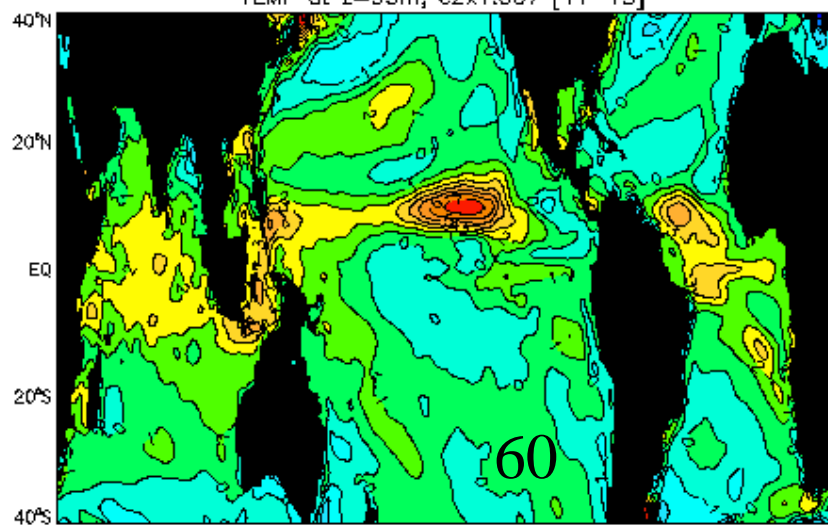


(-7.41e+00 to 8.51e+00 by 1.00 °C)

## 100m T'

TEMP at z=95m, c2x1.007 [11-15]

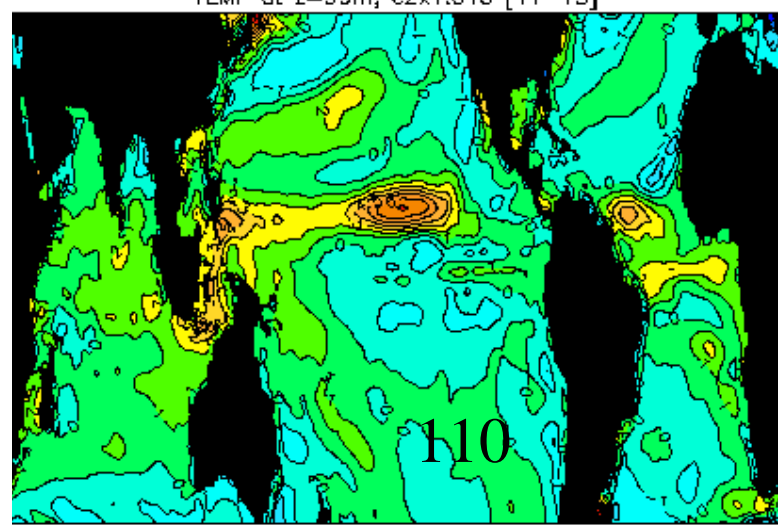
mean= 0.71



(-7.73e+00 to 8.49e+00 by 1.00 °C)

TEMP at z=99m, c2x1.010 [11-15]

mean= 0.41



(-8.73e+00 to 8.39e+00 by 1.00 °C)

