



Meteorology and transport for TC-4

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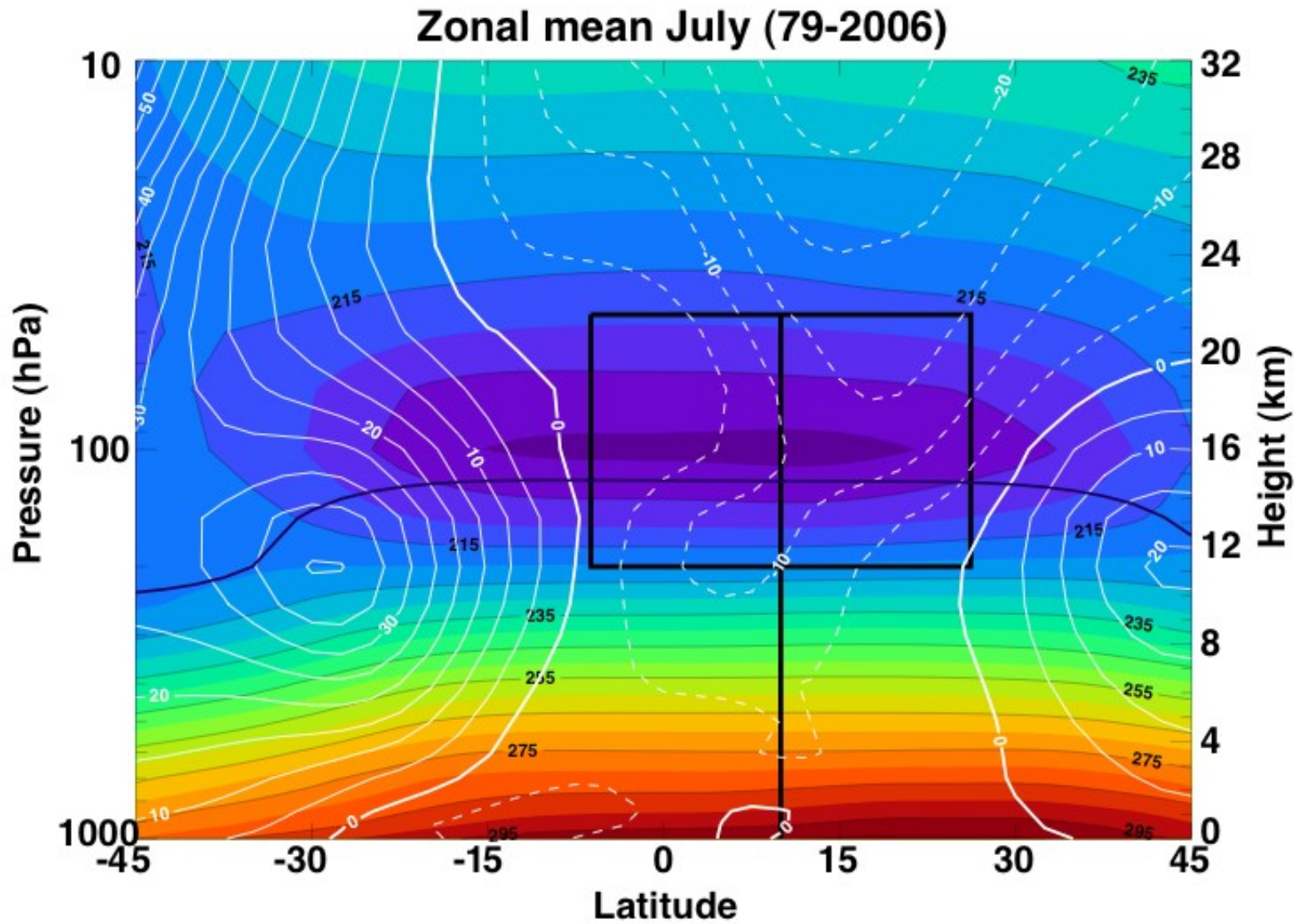
TC-4 science team meeting, April 26, 2007



Outline

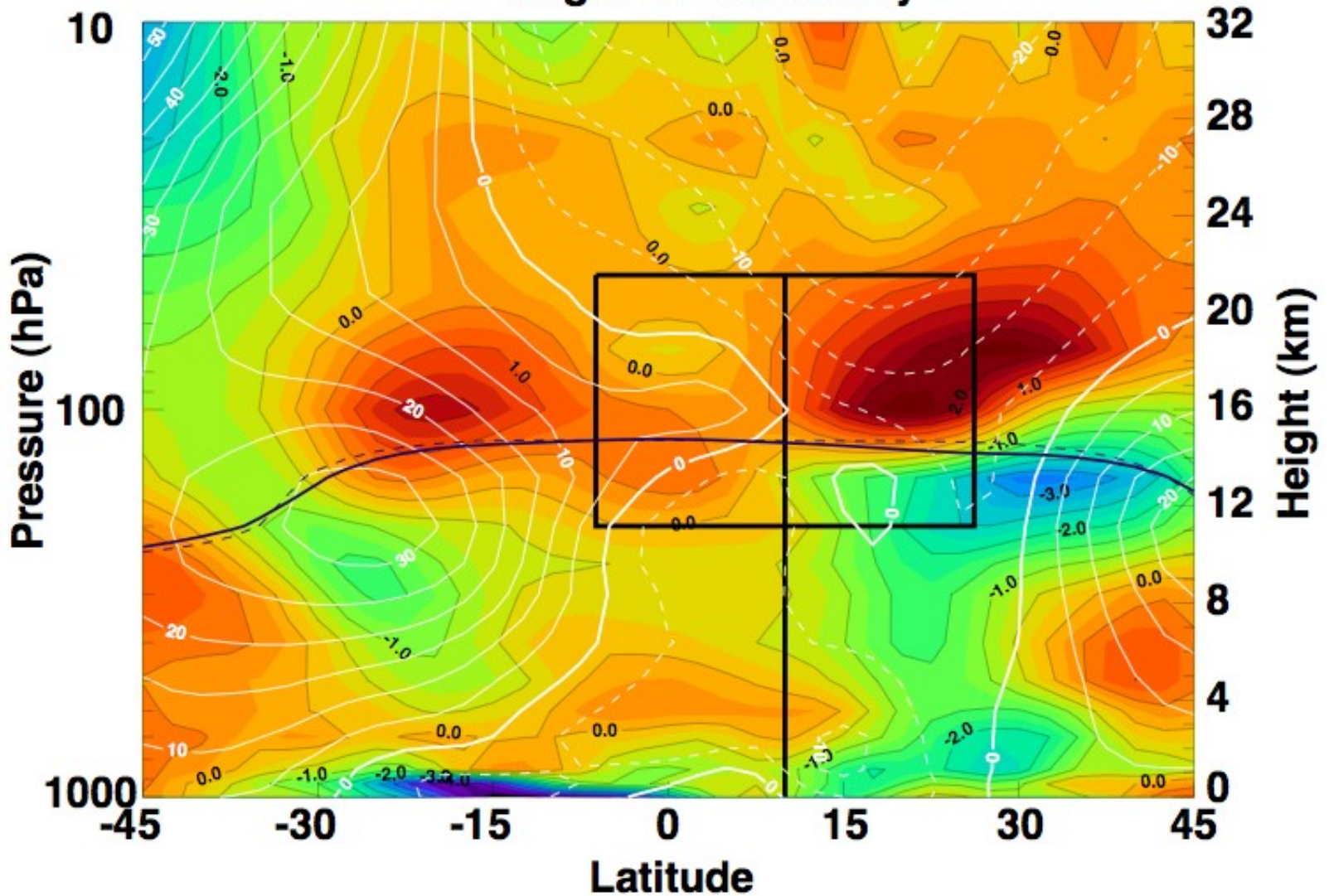
- Basic condition
 - Temperatures, zonal wind, OLR
- 2007 summer La Niña?
- QBO
- Summary

Zonal mean T & U (July)



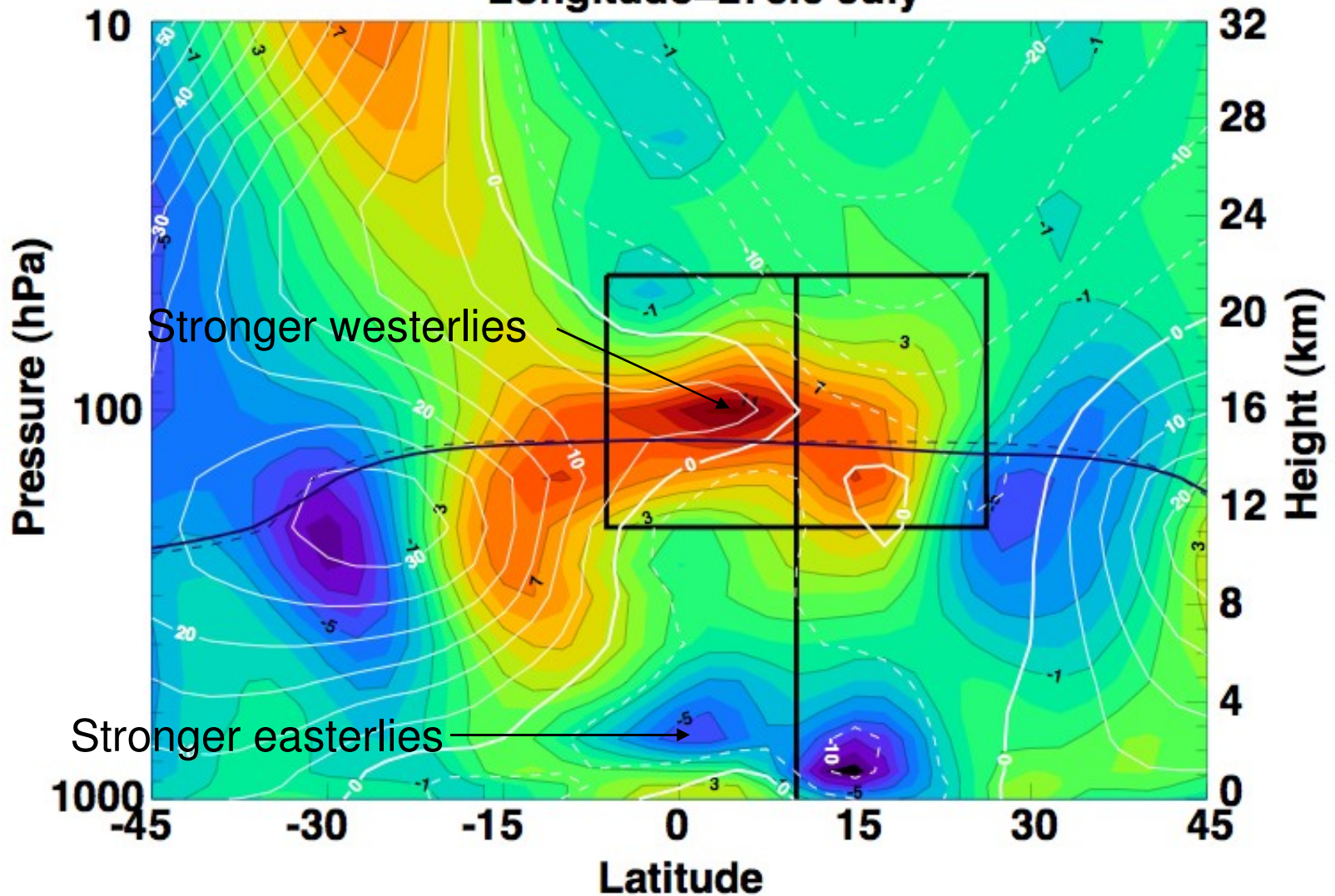
T Longitude cut: 85°W

Longitude=275.0 July



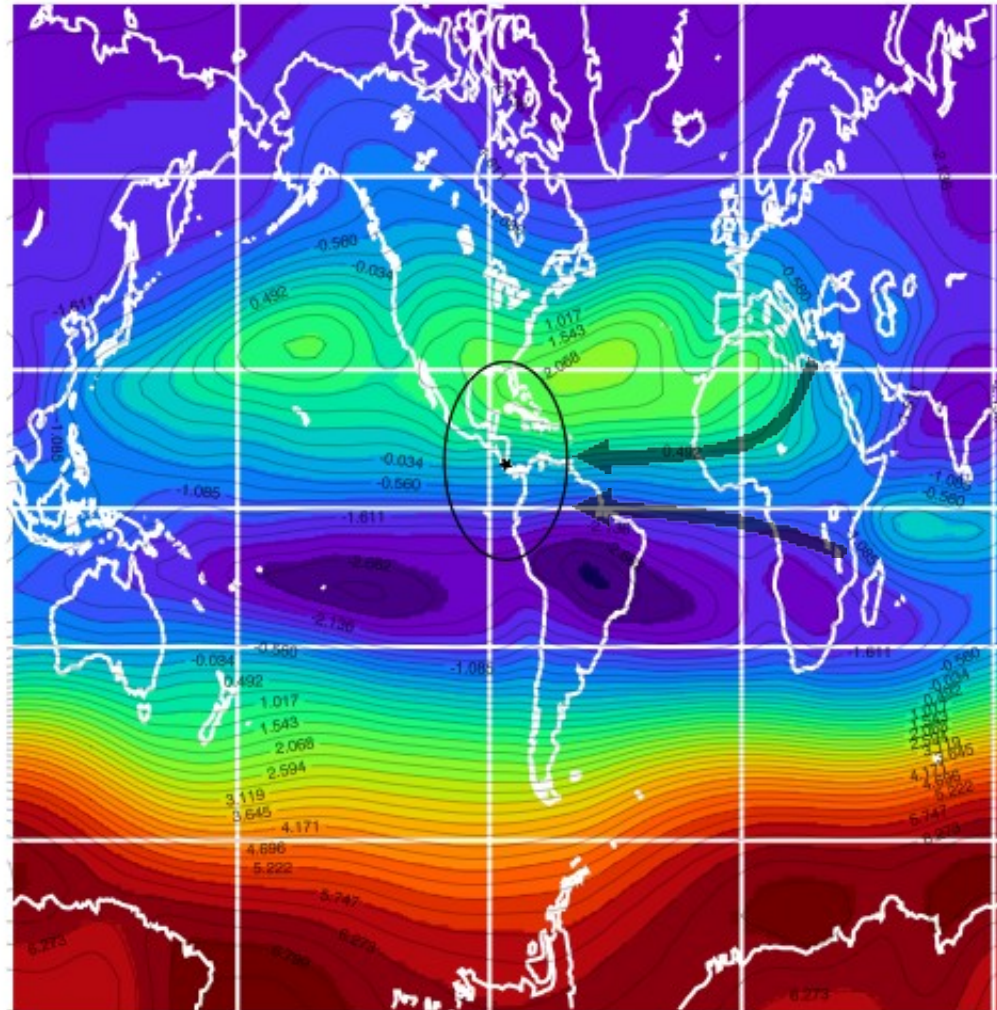
U Longitude cut: 85°W

Longitude=275.0 July



700 hPa (79-06) streamlines

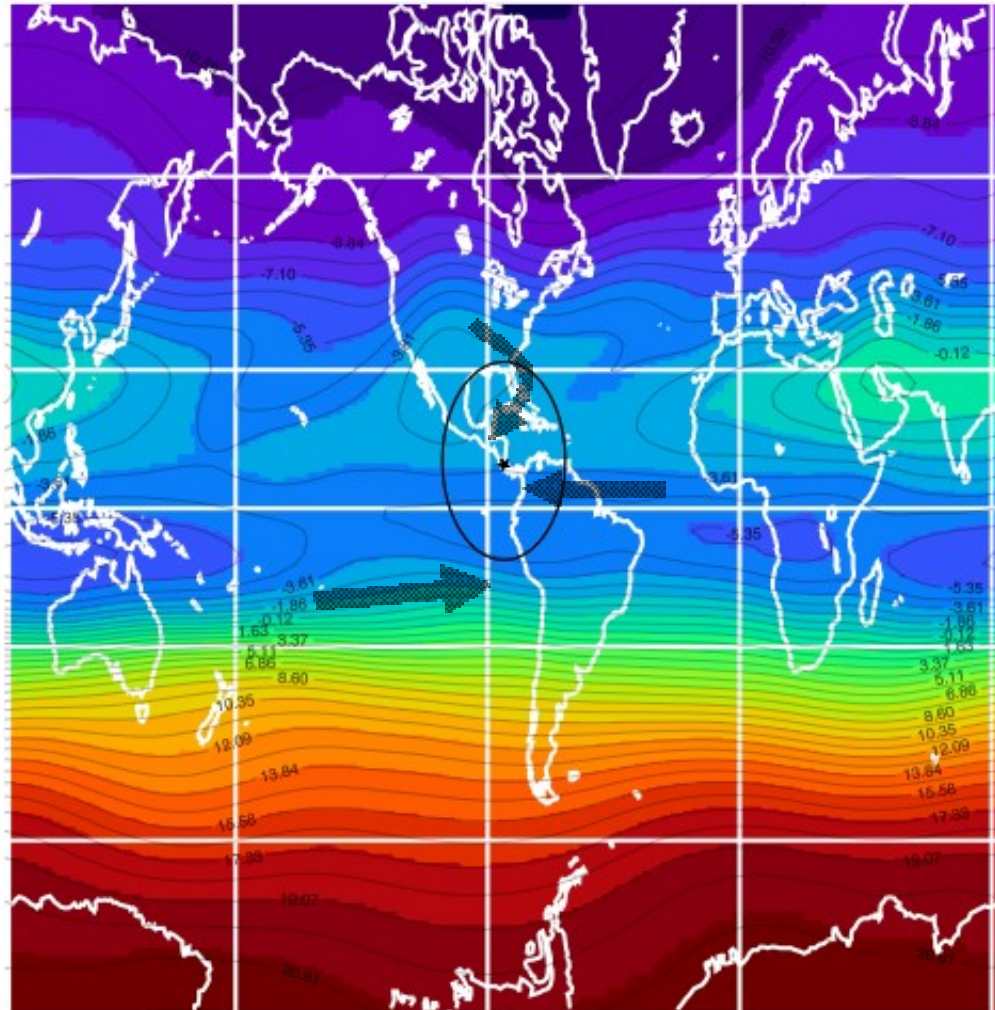
Stream Function July 1979-2006



700 hPa

250 hPa (79-06) streamlines

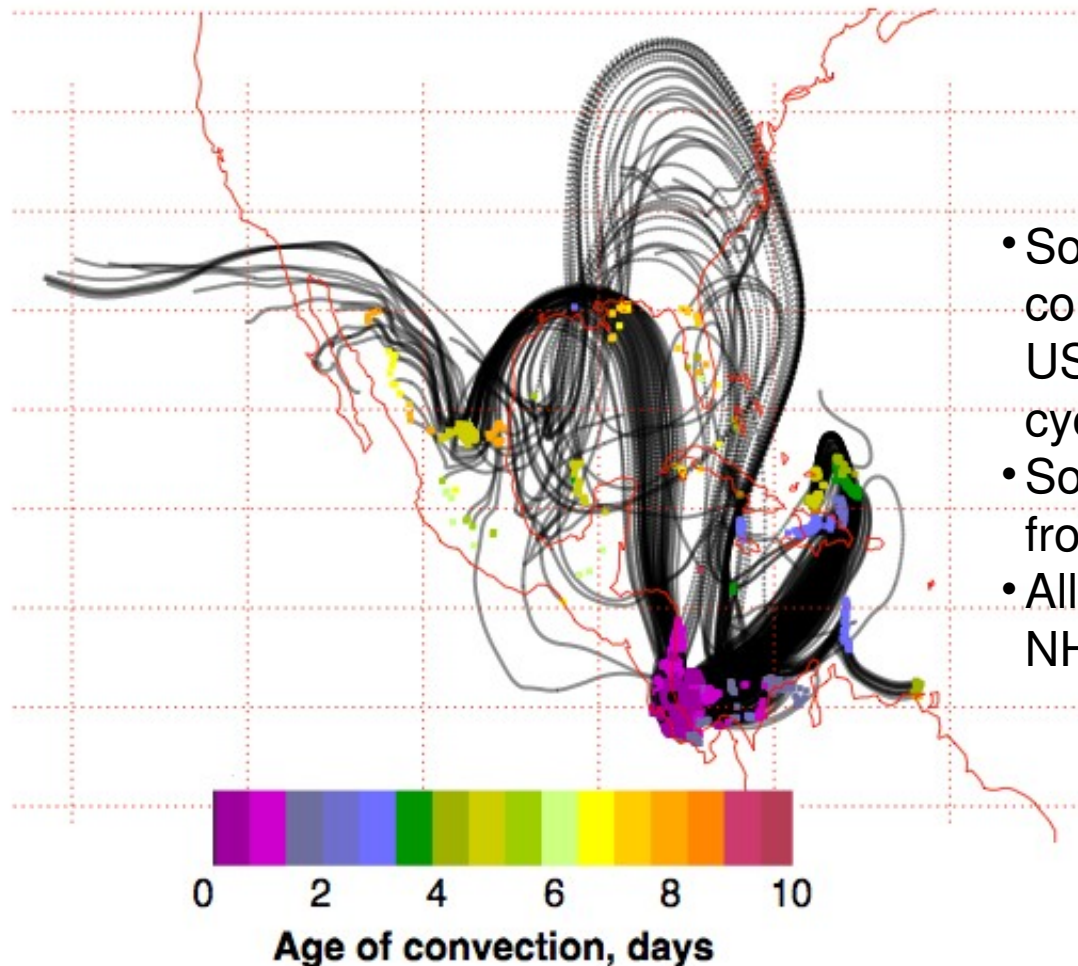
Stream Function July 1979-2006



250 hPa

Convective influence trajectories

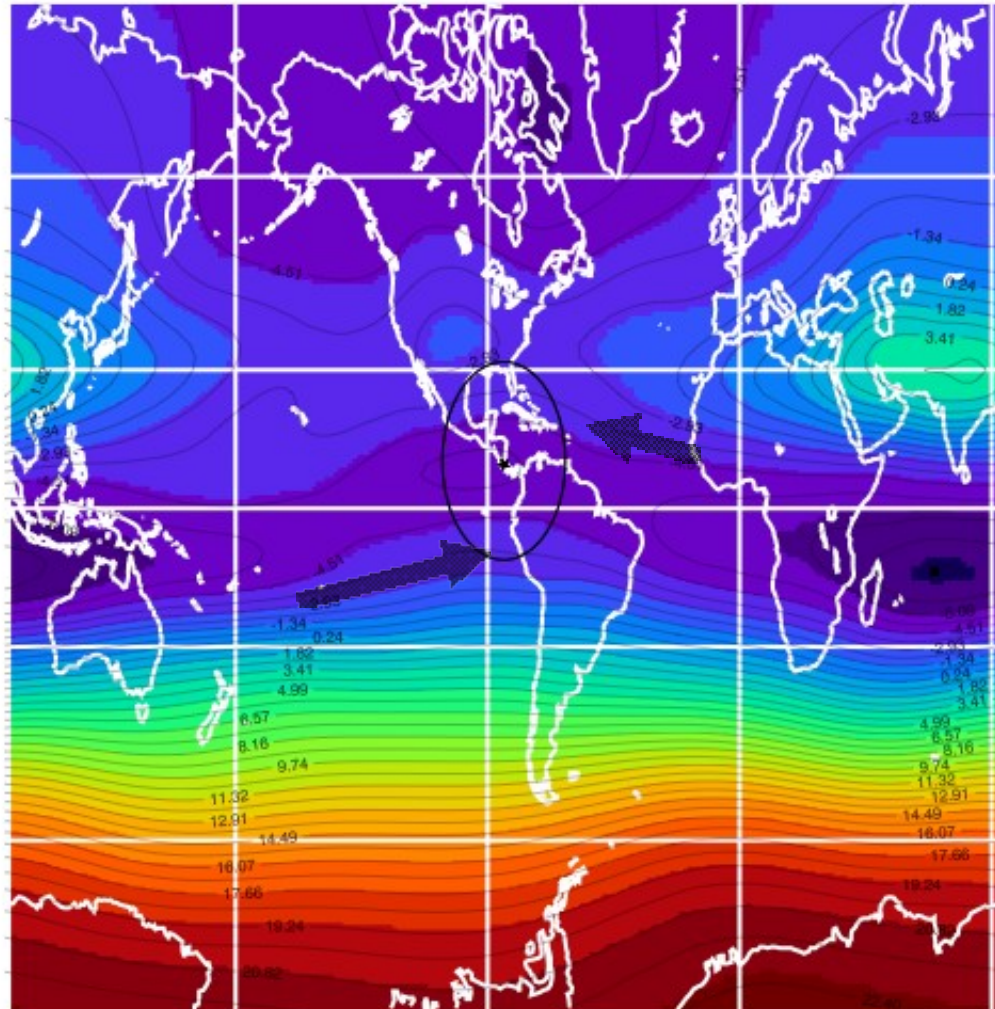
10-day Trajectories ending at SJO after convection, 13-14.5km



- Some air parcels coming south from US around anti-cyclone.
- Some air parcels from Caribbean
- All air parcels from NH.

100 hPa (79-06) streamlines

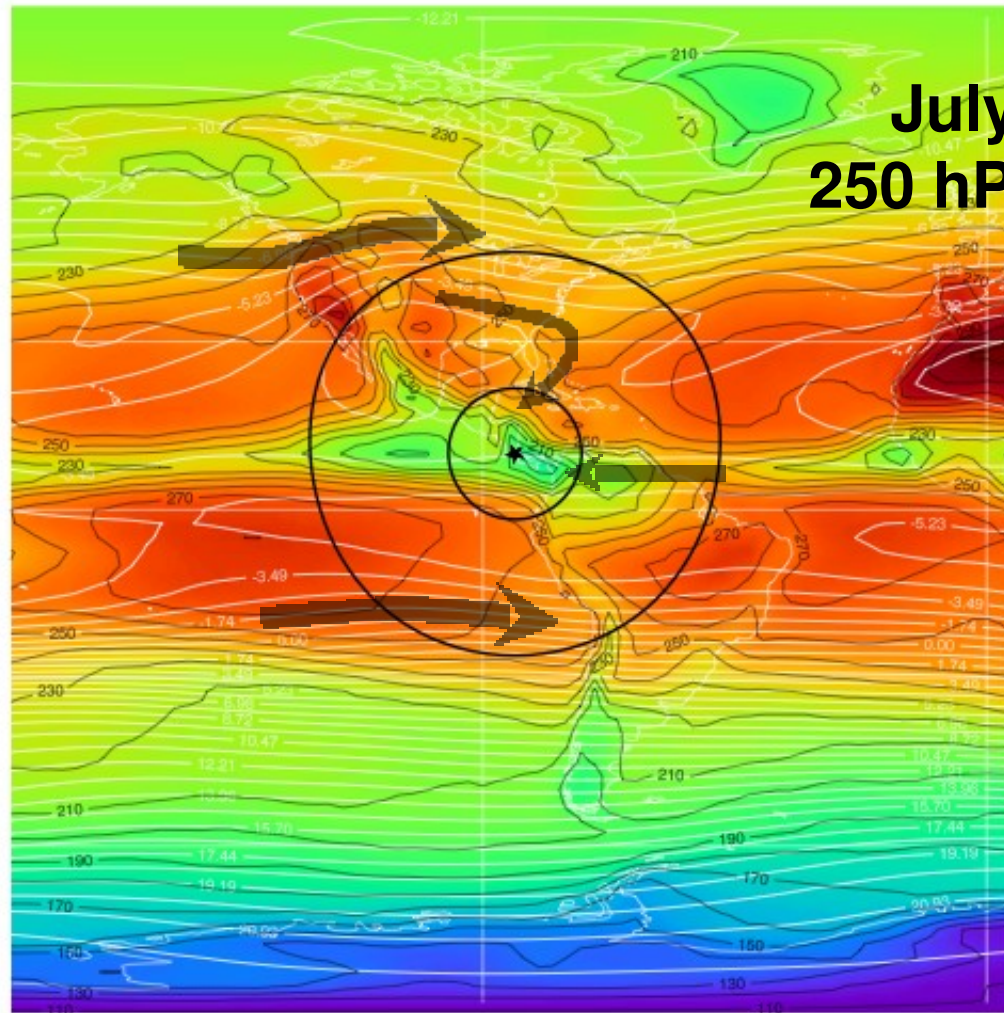
Stream Function July 1979-2006



100 hPa

July 1979-2006 OLR

OLR July 1979-2006

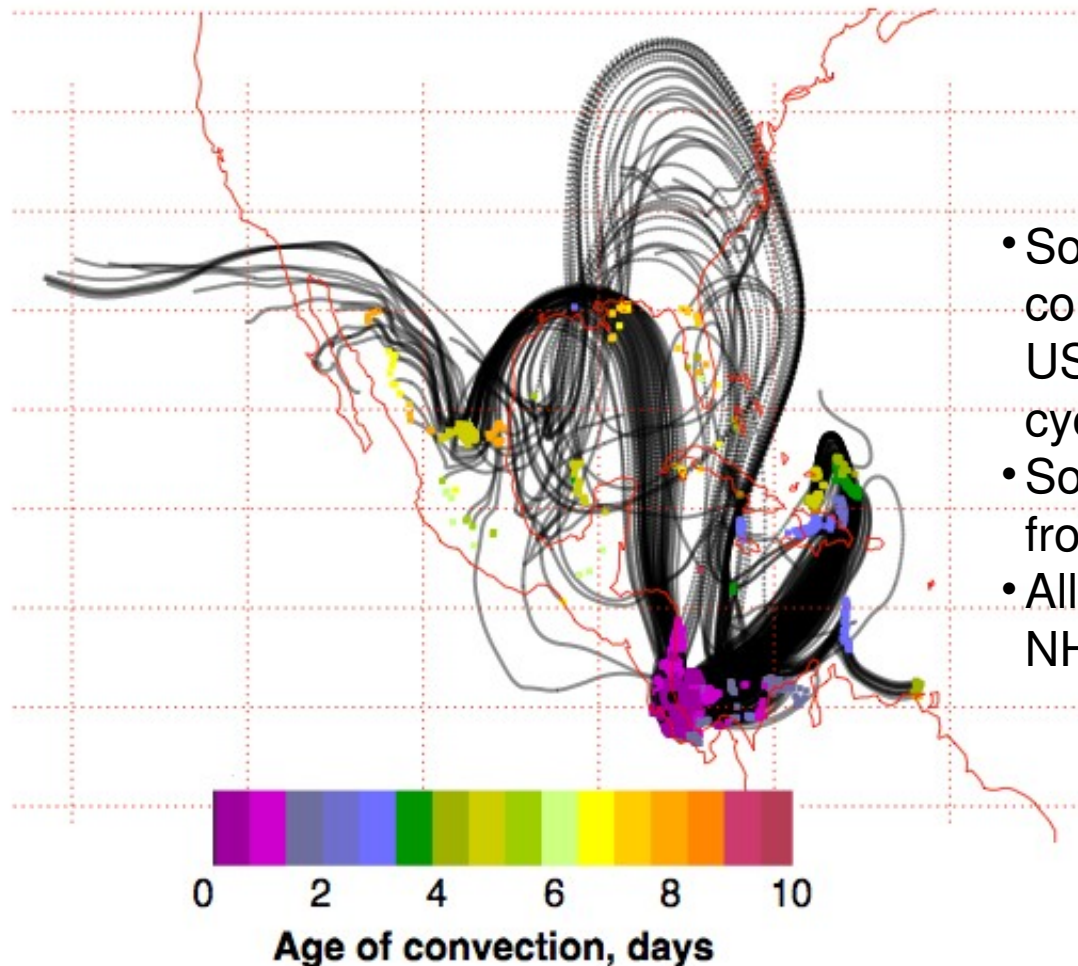


**July 1979-2006
250 hPa streamlines**

250 hPa

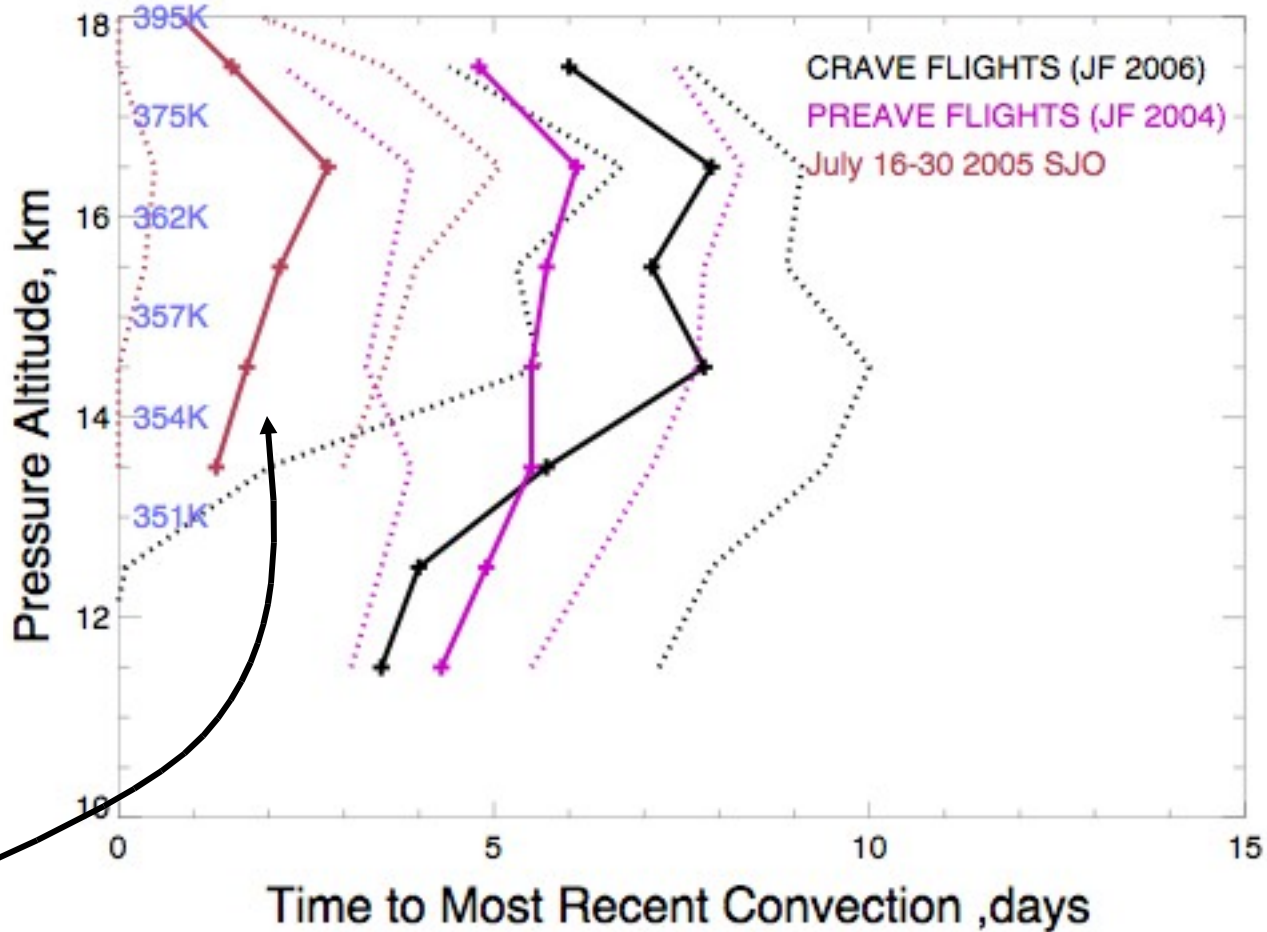
Convective influence trajectories

10-day Trajectories ending at SJO after convection, 13-14.5km



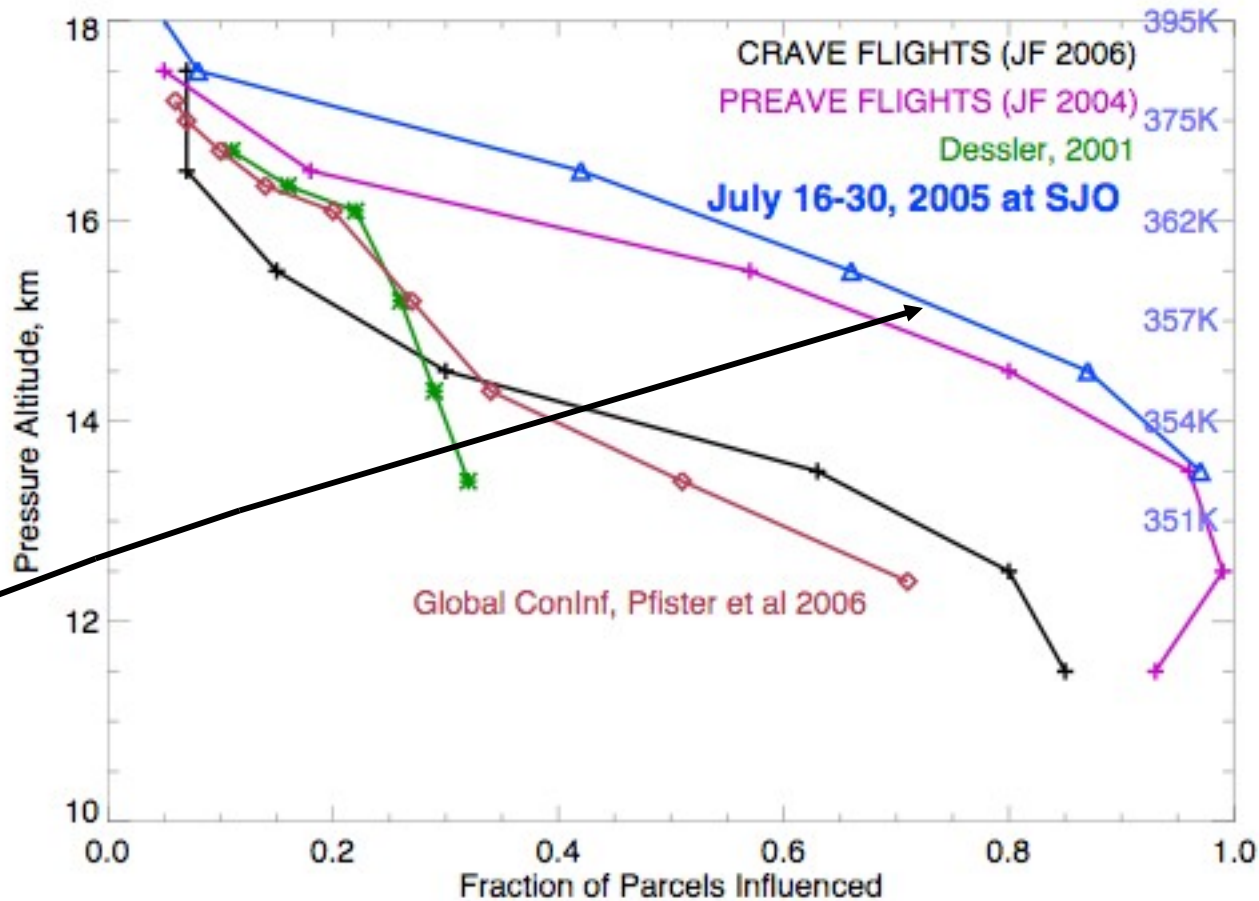
- Some air parcels coming south from US around anti-cyclone.
- Some air parcels from Caribbean
- All air parcels from NH.

Convective Influence (timing)



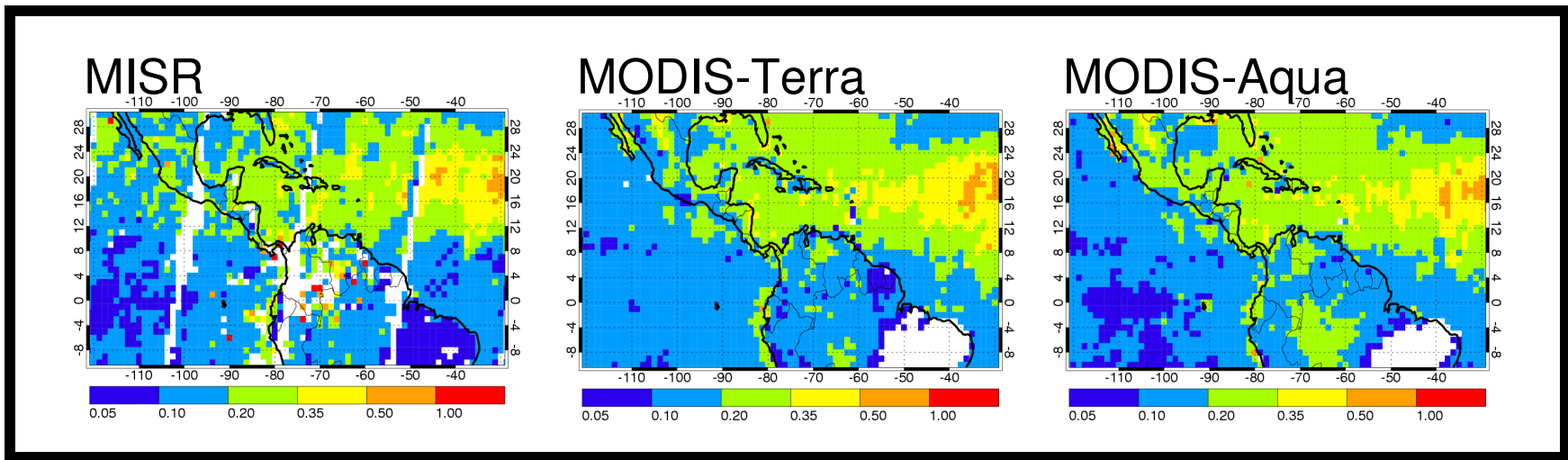
Air in the upper troposphere will have experienced convection within 1-2 days of being sampled during TC4

Convective influence (fraction)

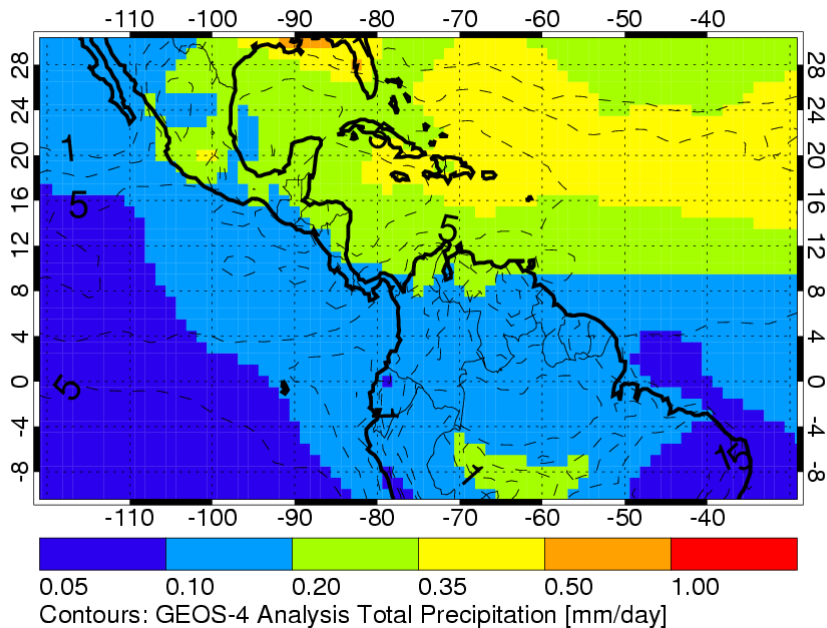


Air in the upper troposphere heavily influenced by convection in the San Jose region.

Aerosol Optical Thickness



GEOS-4 Model τ_{550} July 15 - August 15, 2006

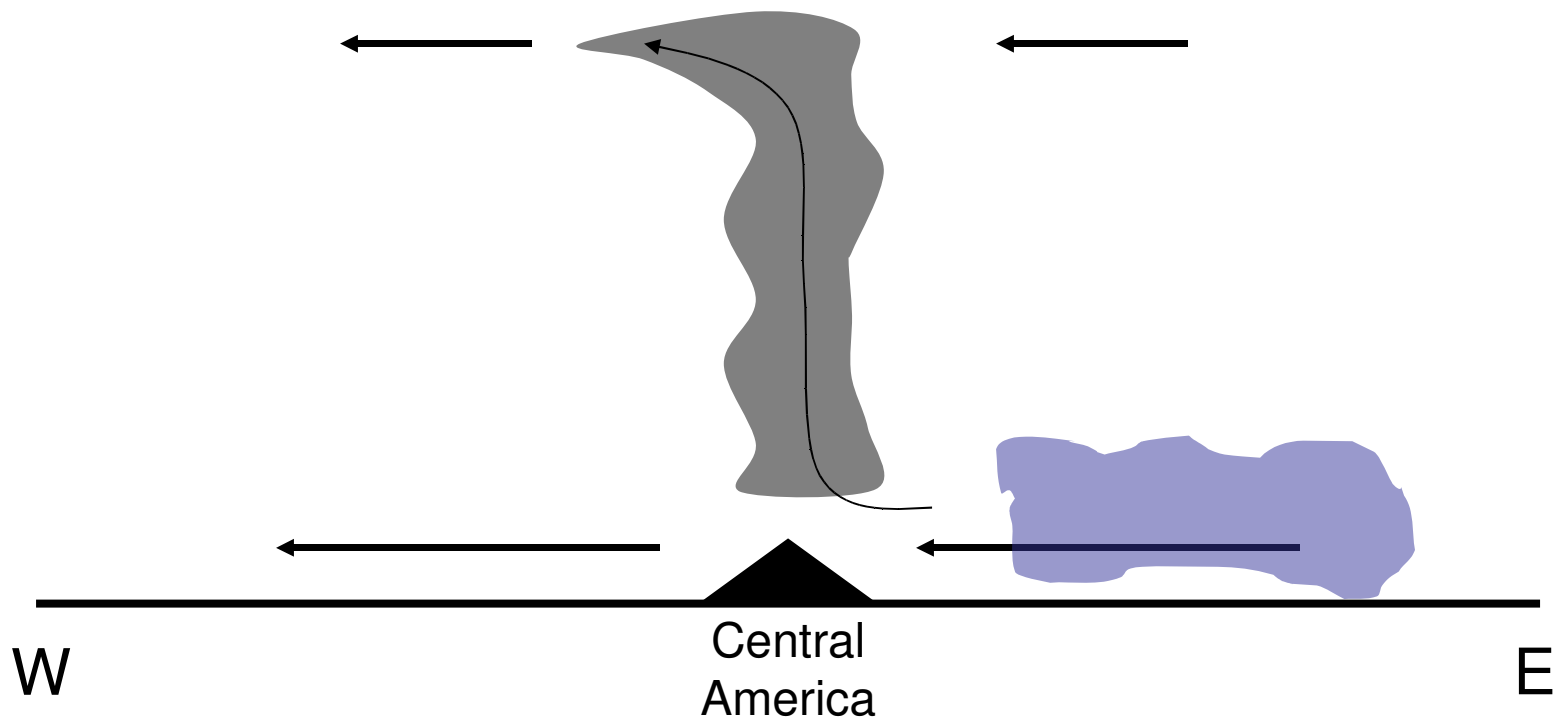


July 15 - August 15, 2006

Aerosols for the same period from the online GOCART model running inside GEOS operational DAS

For TC4 will run in new GEOS-5 system at global $0.5^\circ \times 0.5^\circ$ resolution

Aerosol loss + transport of short lived compounds





Easterly waves

$c \approx 6 \text{ m/s}$

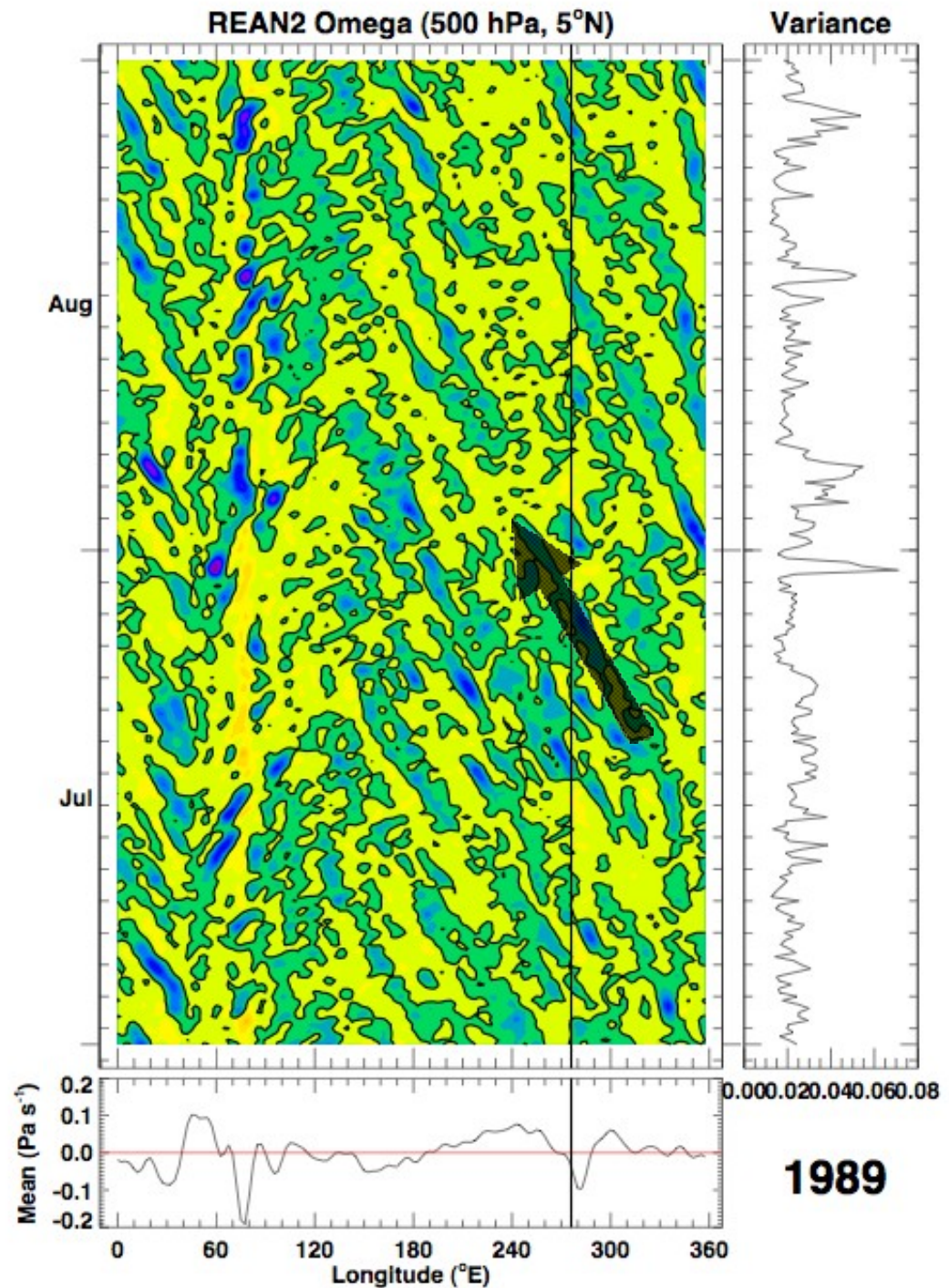
$\lambda \approx 3000 \text{ km}$

$T \approx 6 \text{ days}$

Omega field

Blue = rising motion,

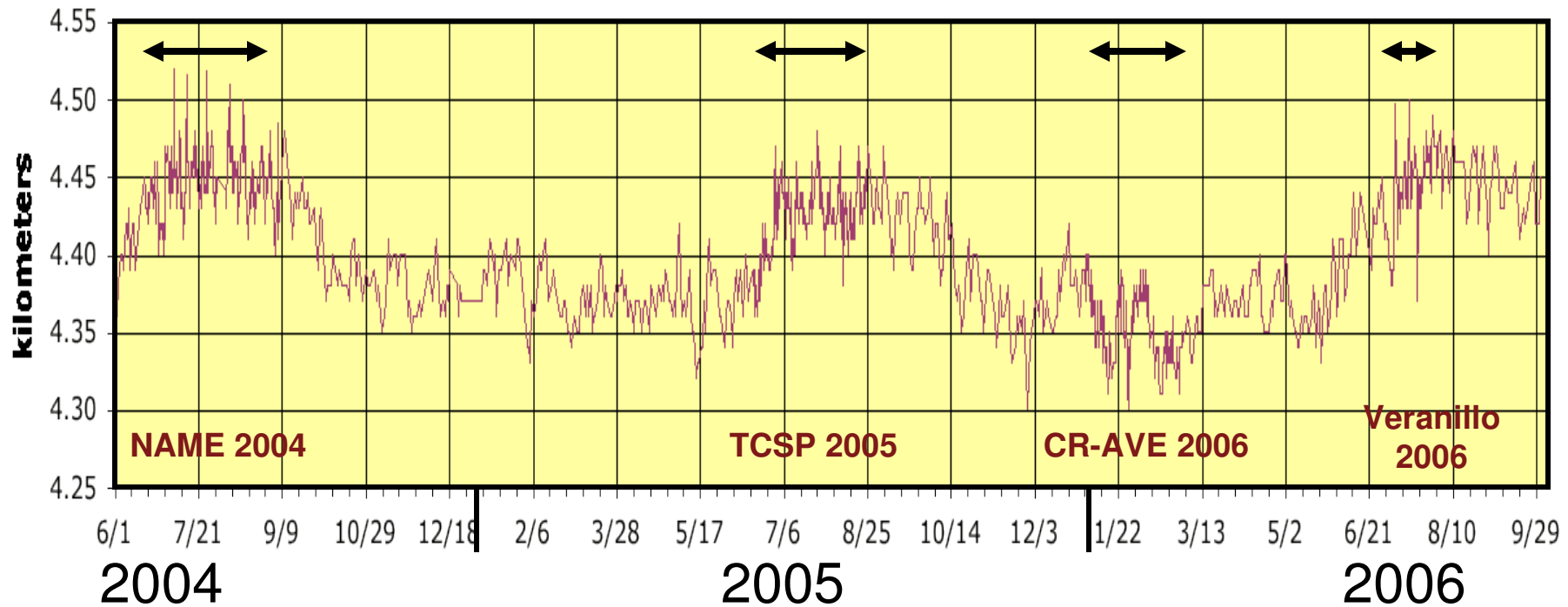
Yellow = sinking





Seasonal variations of the Tropical Tropopause Layer

TTL depth: $dZ(70/150 \text{ hPa})$

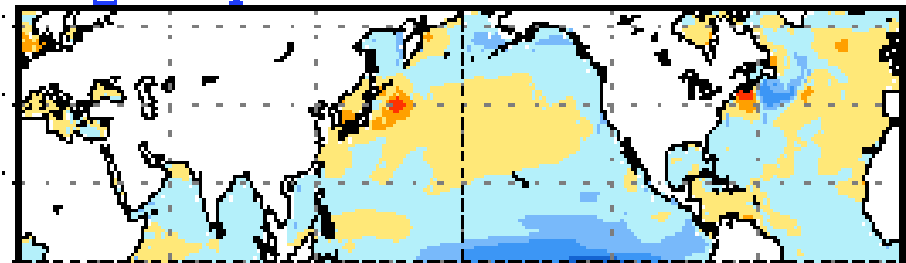




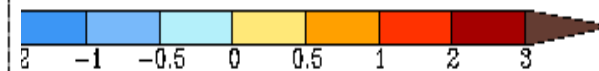
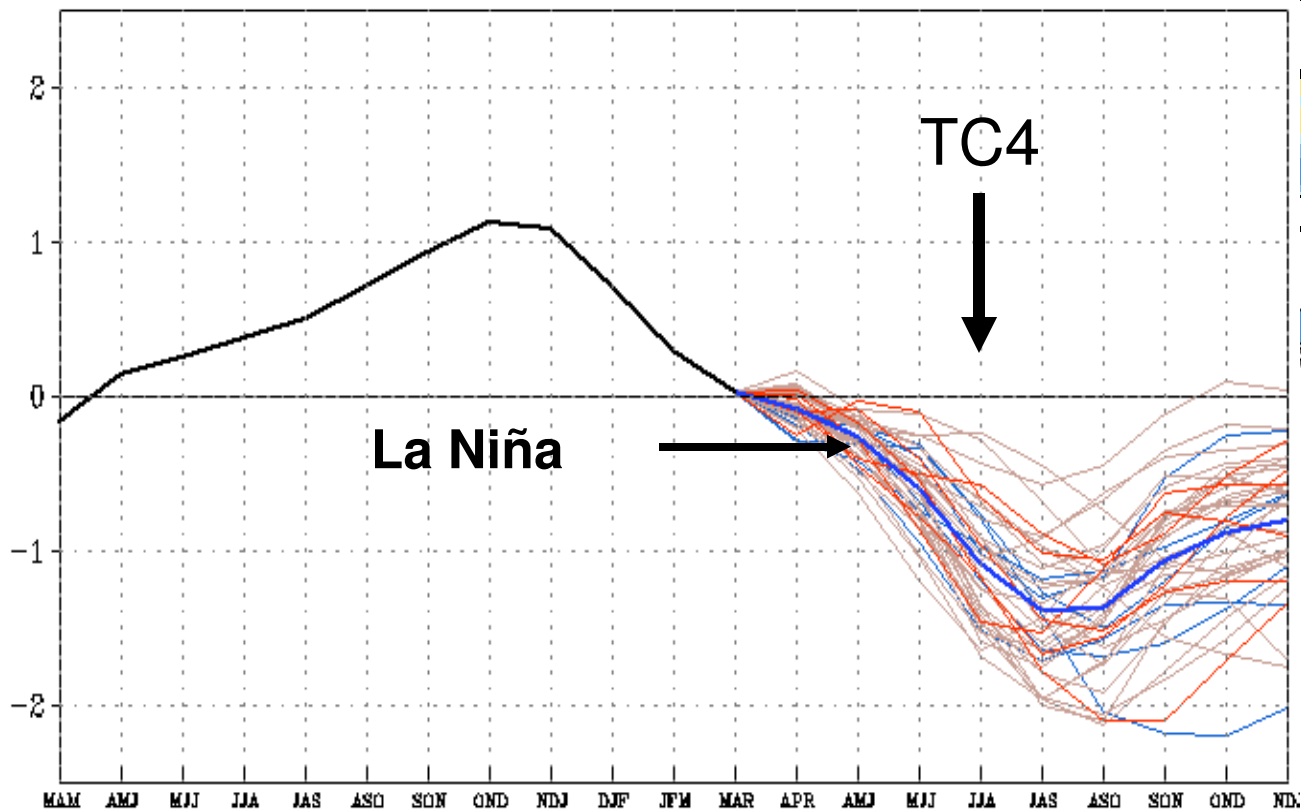
SST Outlook: NCEP CFS Forecast Issued 16 April 2007

The CFS ensemble mean (heavy blue line) indicates a transition from neutral to La Niña conditions during the next 3 months.

Aug-Sep-Oct 2007



Forecast Niño3.4 SST anomalies from CFS



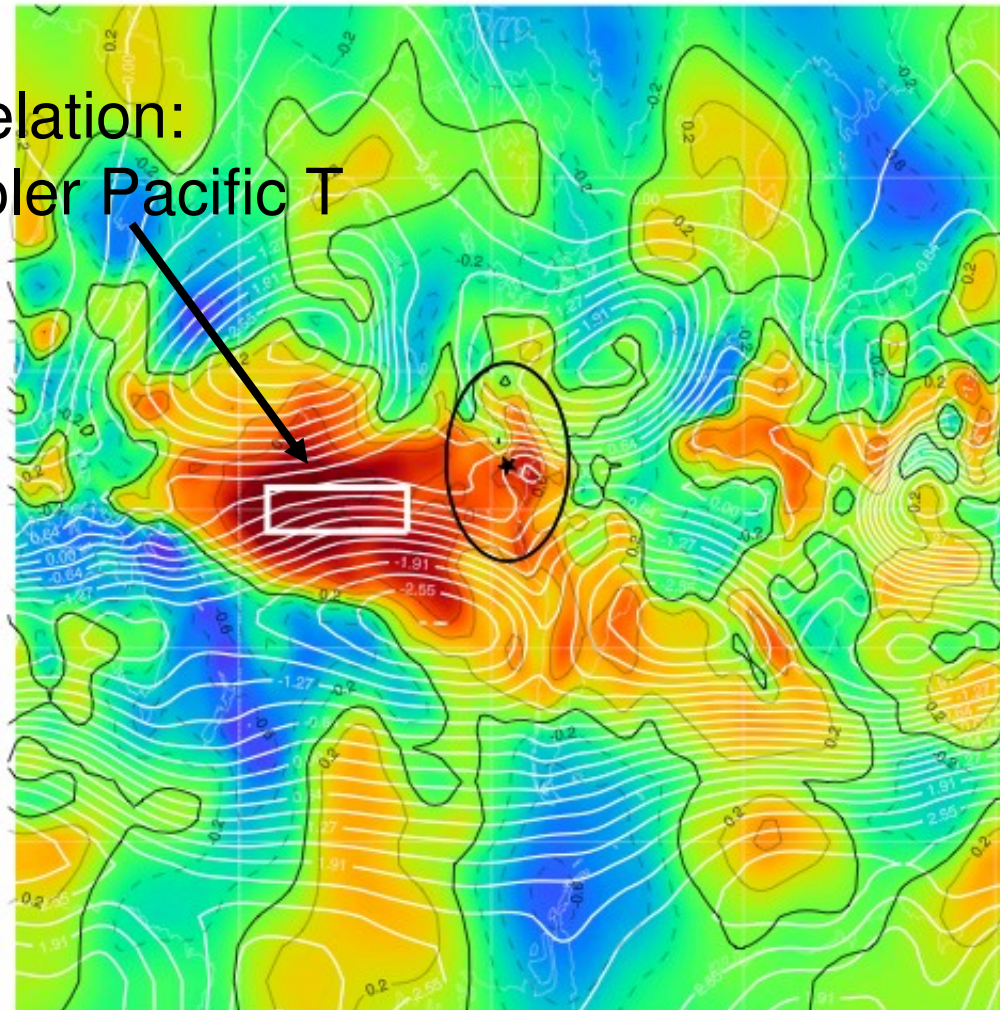


How might a La Niña impact
the meteorology & dynamics?

El Niño 3.4 corr. T (925 hPa)

925hPa

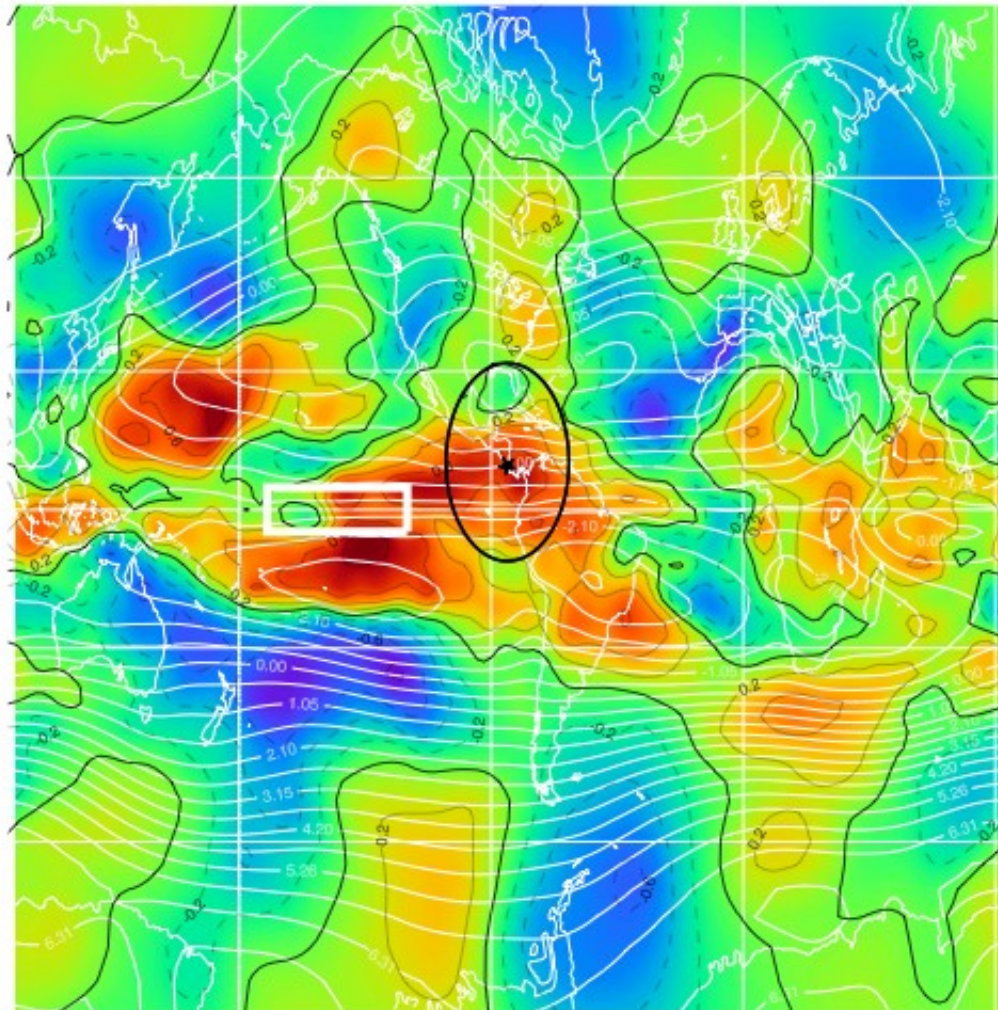
Excellent correlation:
La Niña → cooler Pacific T



N34-T_jul_925hPa.ps

El Niño 3.4 corr. T (700 hPa)

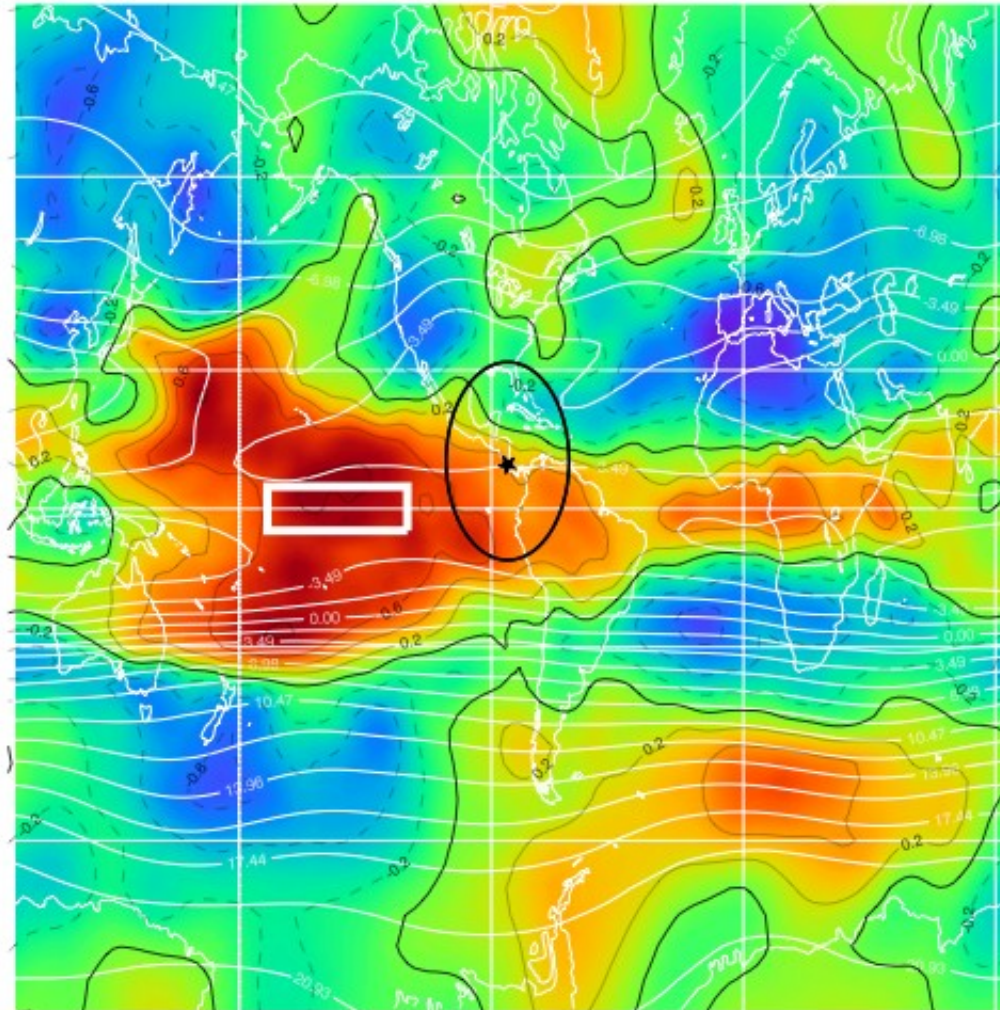
700hPa



N34-T_jul_700hPa.ps

El Niño 3.4 corr. T (250 hPa)

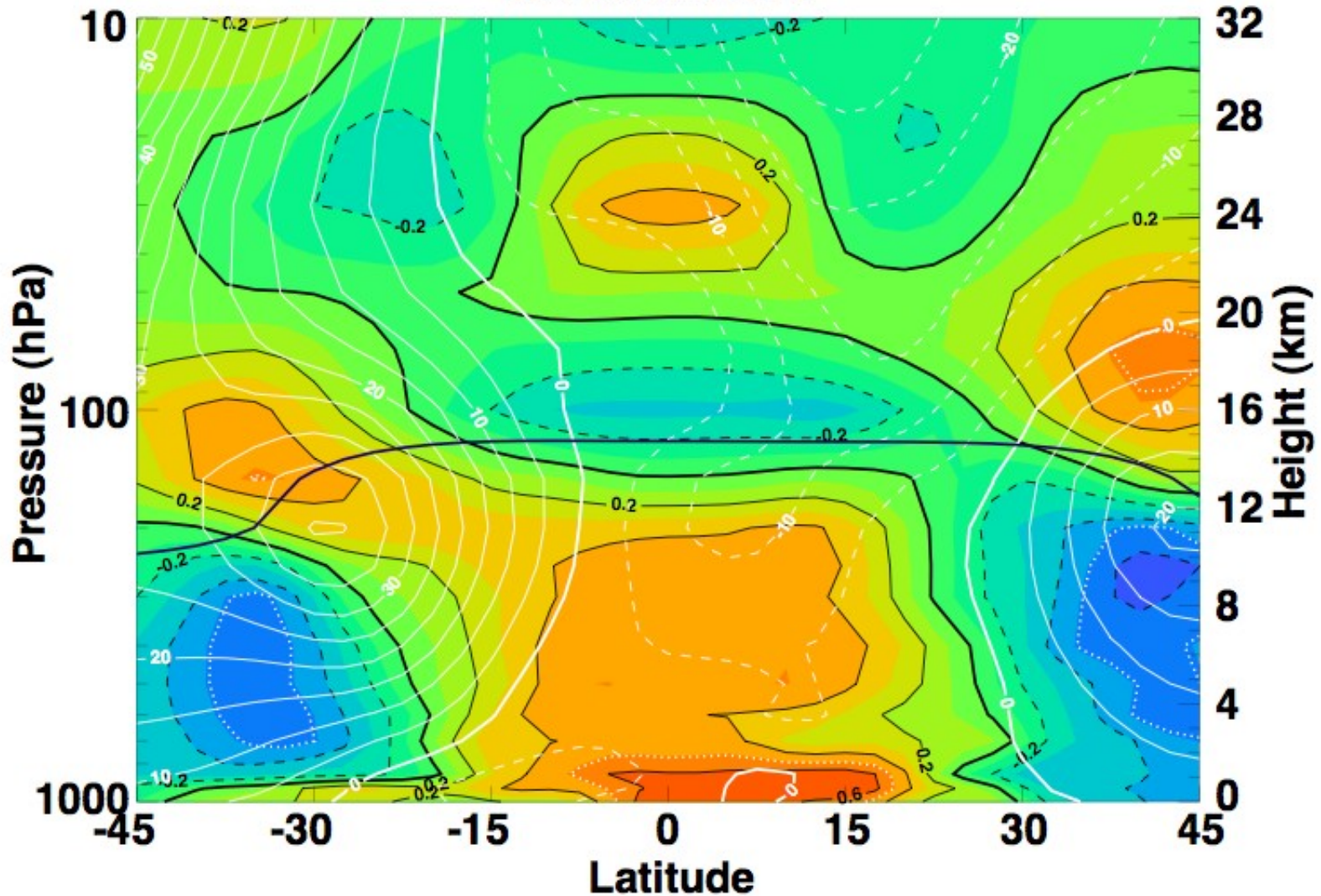
250hPa



N34-T_jul_250hPa.ps

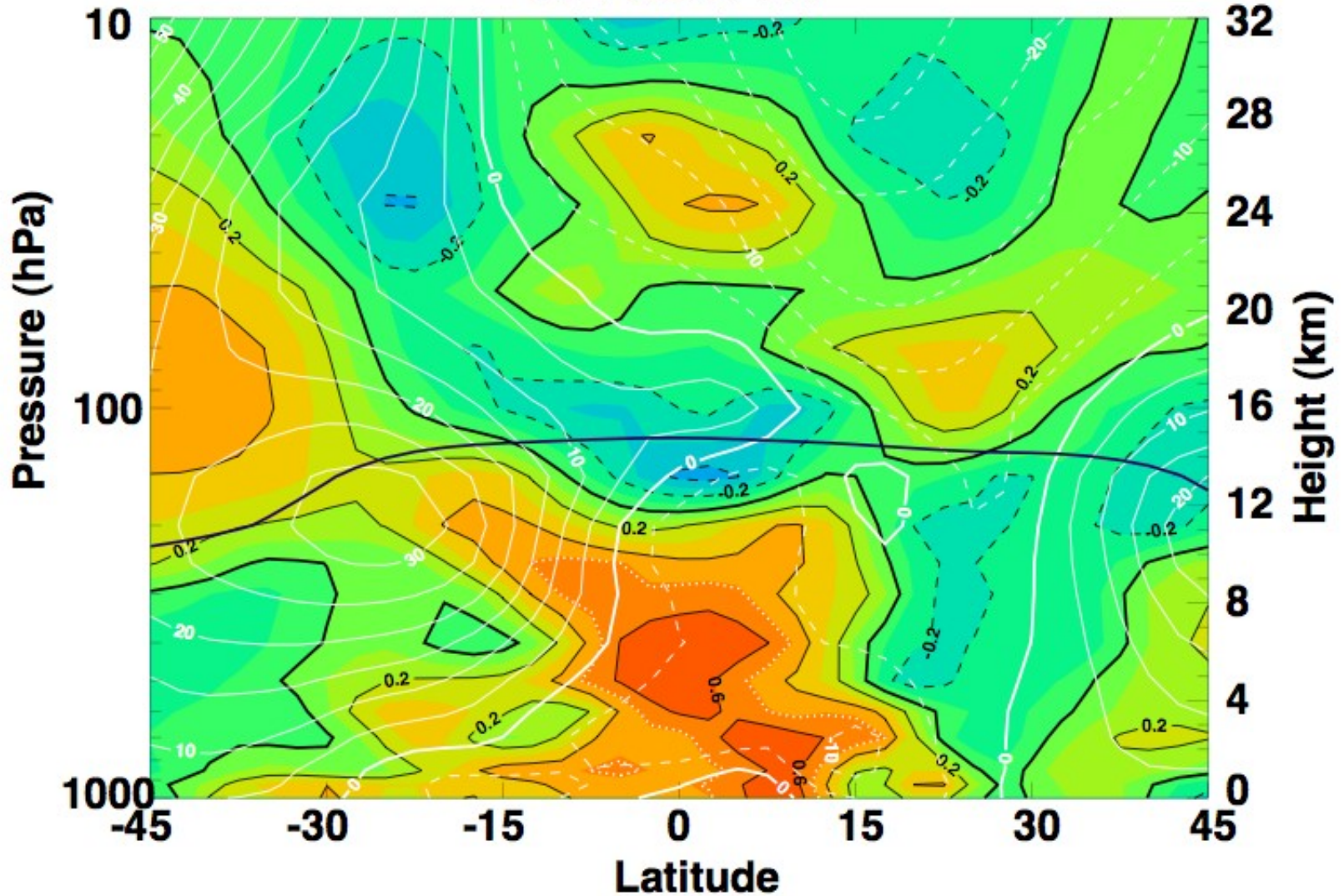
El Niño corr. T (July)

N34 vs. Tzm Jul



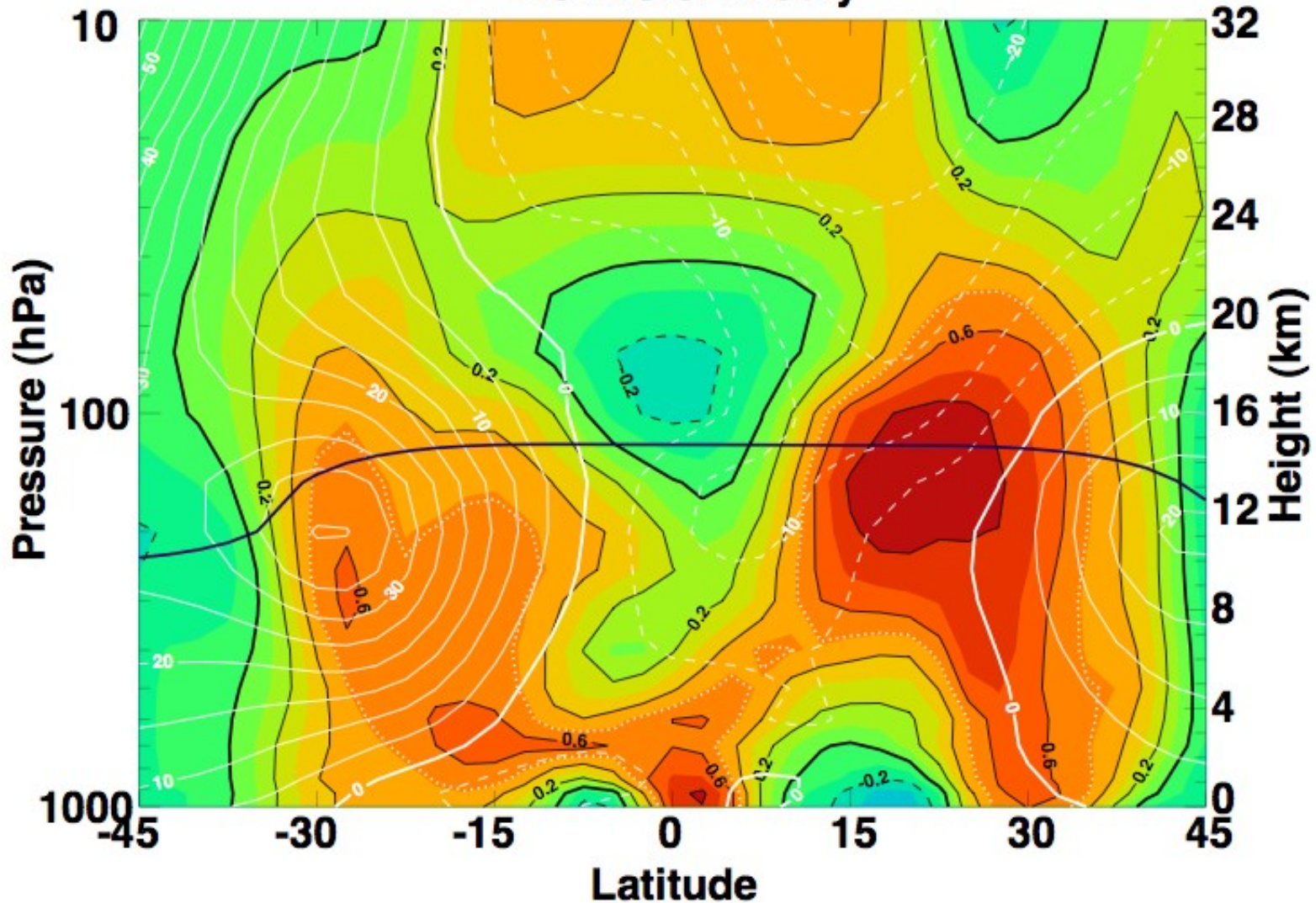
El Niño 3.4 corr. T (CR) (July)

N34 vs. Tcr Jul



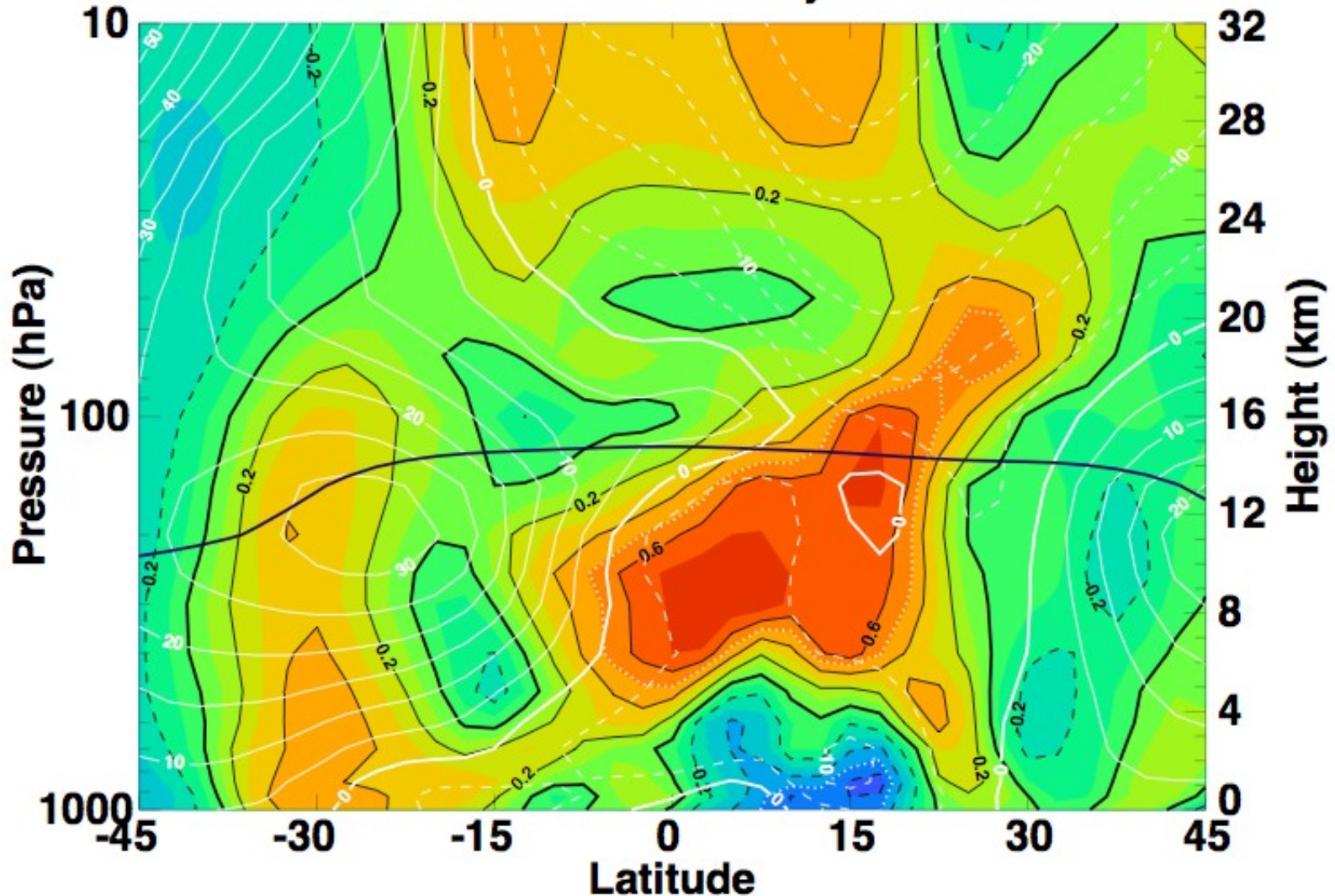
El Niño 3.4 corr. U (zm) (July)

N34 vs. Uzm July



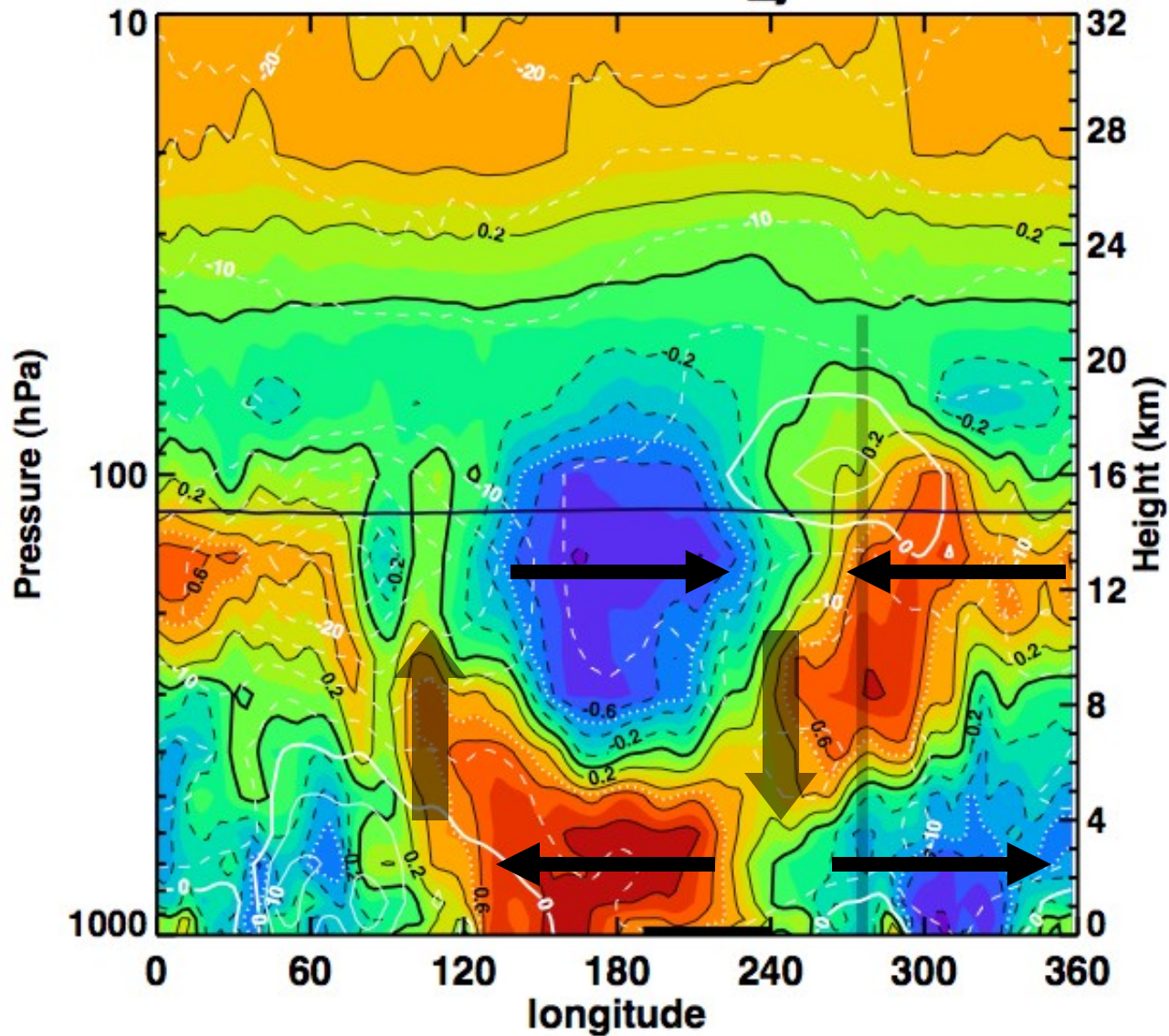
El Niño 3.4 corr. U (CR) (July)

N34 vs. Ucr July



El Niño 3.4 corr. U (July)

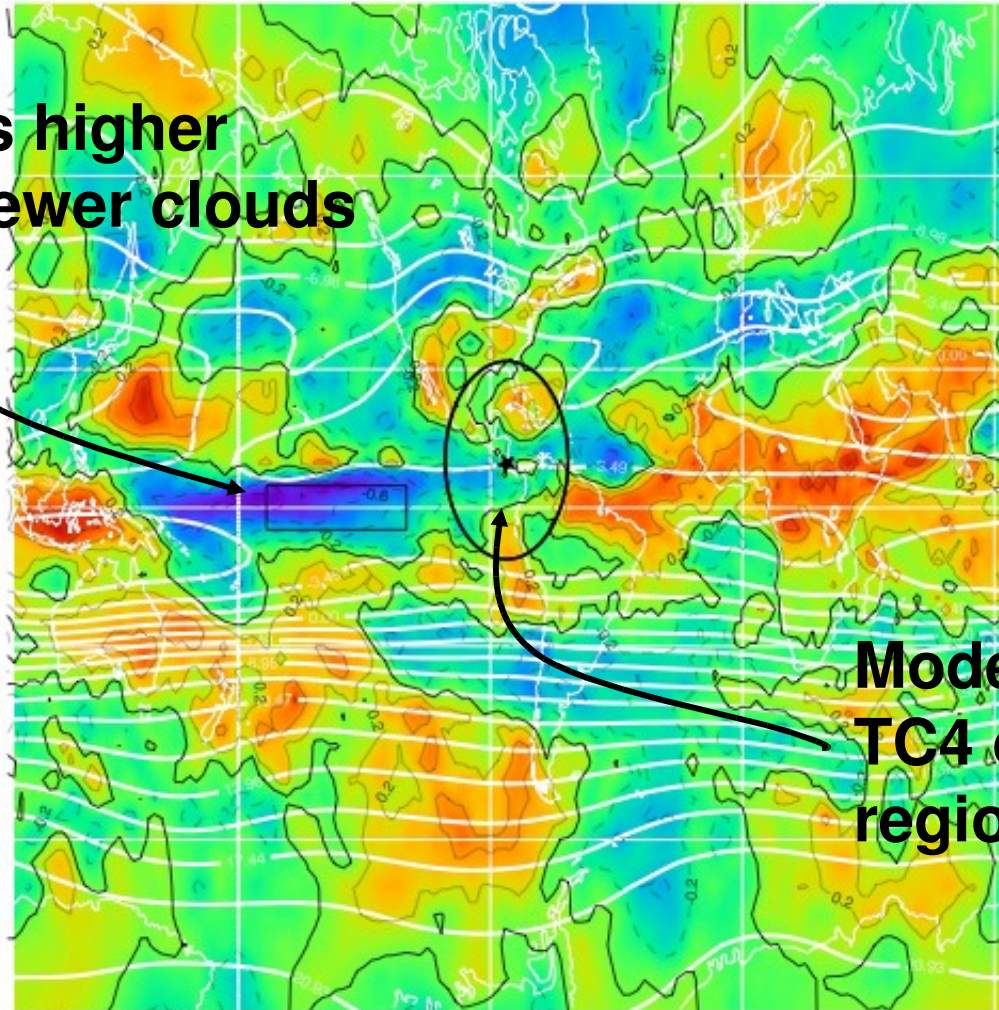
N34 vs.Ulon5N_jul



El Niño 3.4 corr with OLR (July)

250hPa

La Niña implies higher OLR or lower/fewer clouds



Modest impact in TC4 operations region.



La Niña

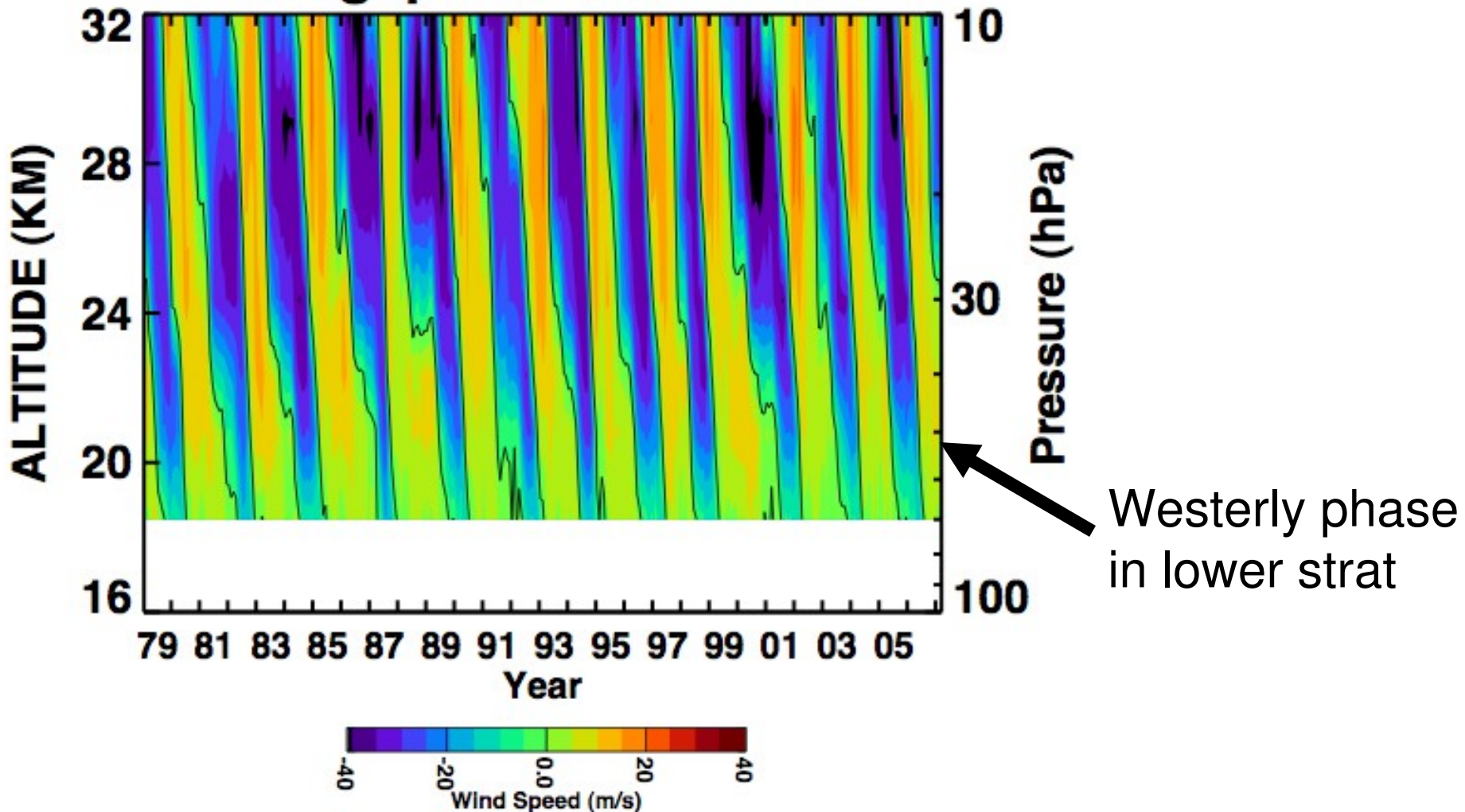
- Excellent correlations:
- La Niña implies cooler zonal mean in troposphere, perhaps slightly warmer near the tropopause
- Enhances the Walker circulation with increased downwelling in the CR region - suppressing convective activity.
- Winds become more easterly in the upper troposphere, more westerly in the lower troposphere



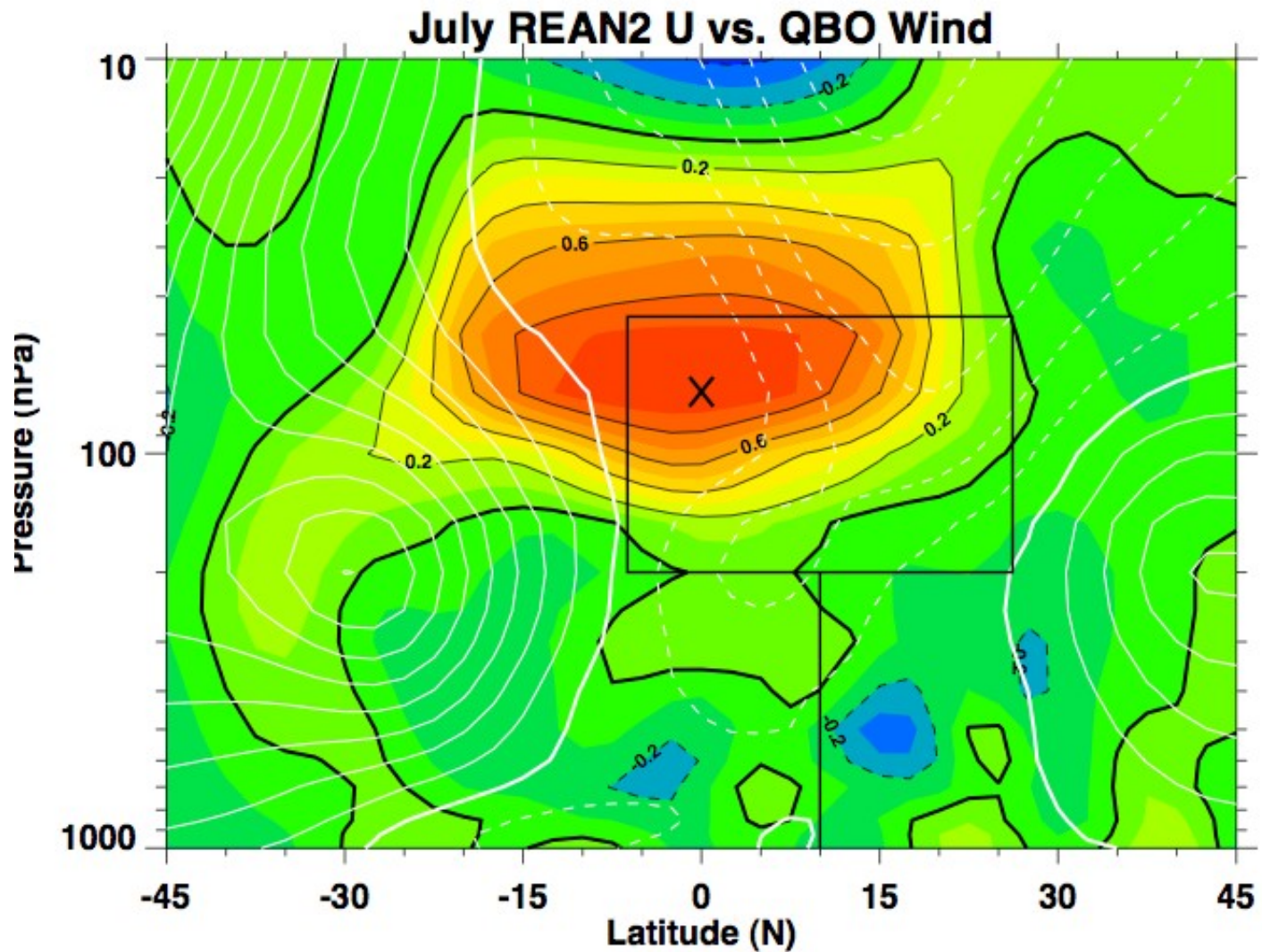
QBO

Quasi-biennial oscillation

Singapore zonal wind



QBO wind corr. with U



QBO has a small influence near tropopause.



Summary

- Flow
 - low altitudes: flow is dominated by easterlies over the region
 - Upper tropo: easterlies to the south of San Jose (air from So. America)
 - Air over San Jose is mainly influenced by anticyclonic flow from NH and from Caribbean and northern South America
- Temperatures are warmer in the San Jose region than the rest of the tropics
- Plenty of convection
- La Niña may create some anomalous conditions
- Westerly QBO is not a major factor

MJO

**20-100 day band-pass
filtered 200-hPa
velocity potential**

