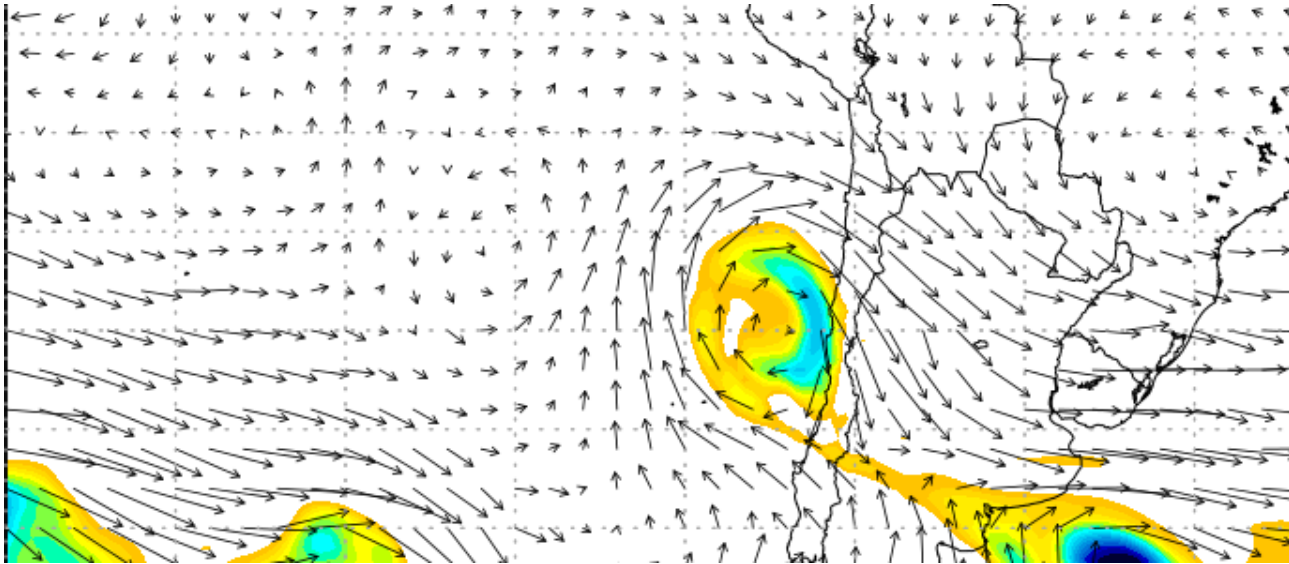


# Caracterización Meteorológica de la Tormenta de Atacama de Marzo de 2015



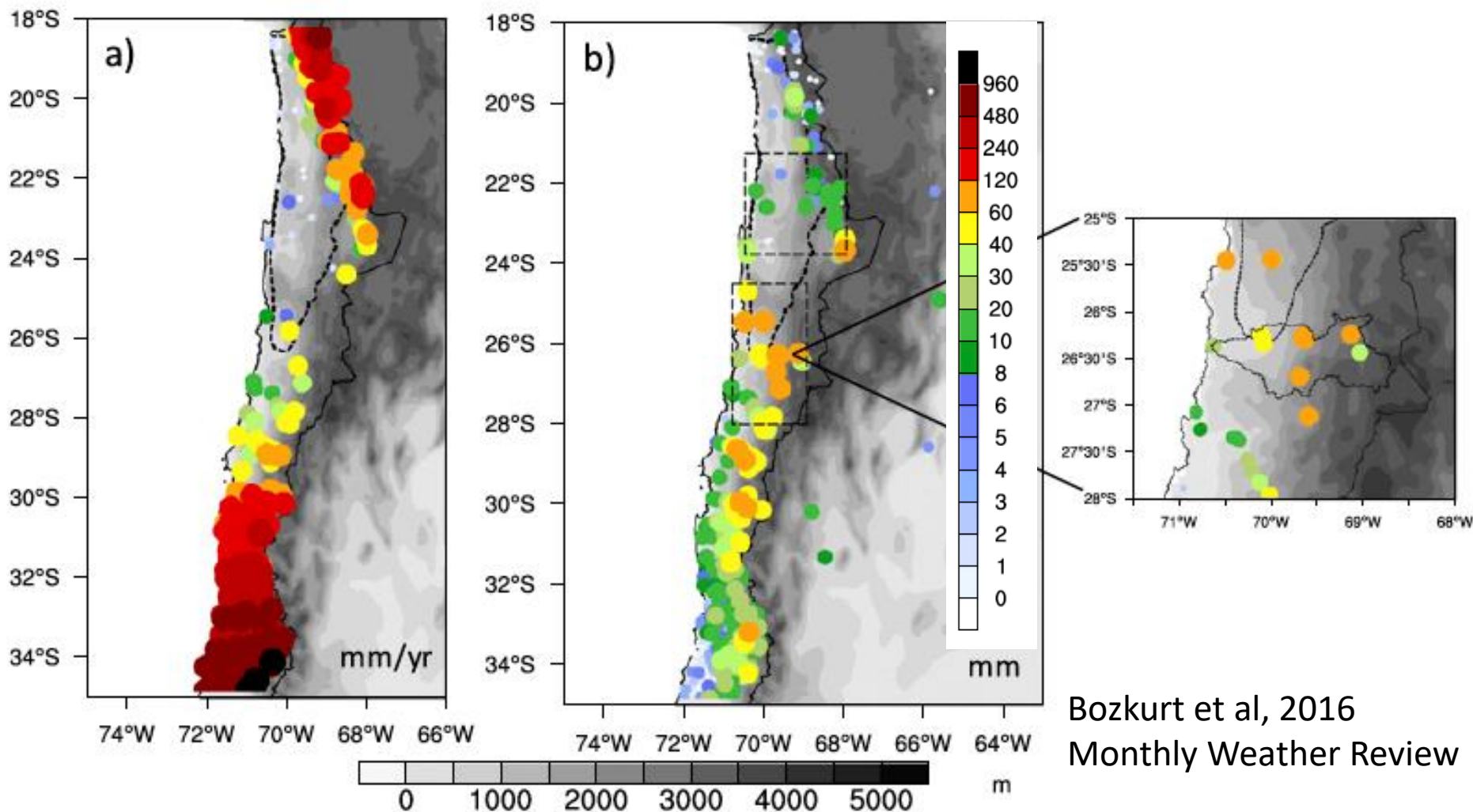
Roberto Rondanelli

Departamento de Geofísica, Universidad de Chile

Centro del Clima y la Resiliencia, CR2

Deniz Bozkurt, René Garreaud, José Rutllant, Raul Fuentes, Julio Marín, Brad Barrett, Andrés Arriagada, Alejandra Molina, Diego Campos, José Vicencio, C. Barahona, J. Carrasco, R. Jaña

# 24 al 26 de Marzo de 2015





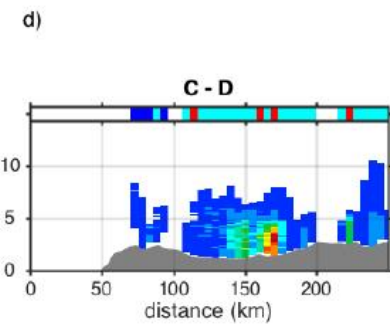
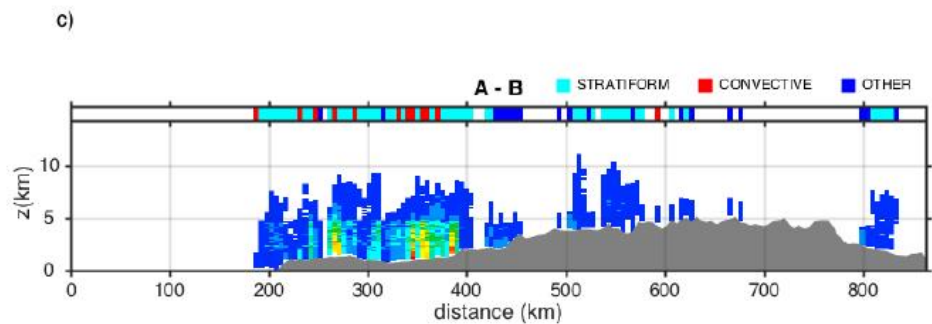
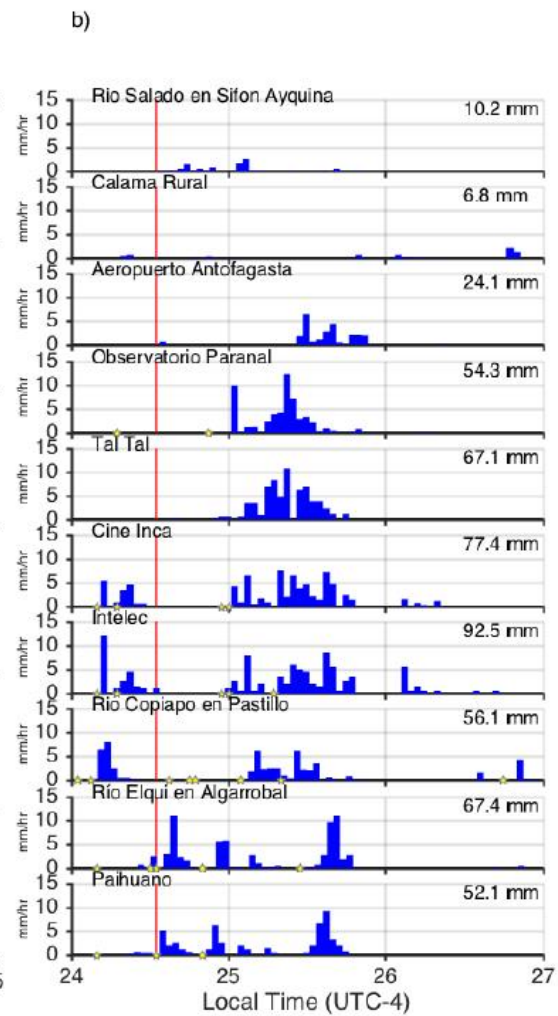
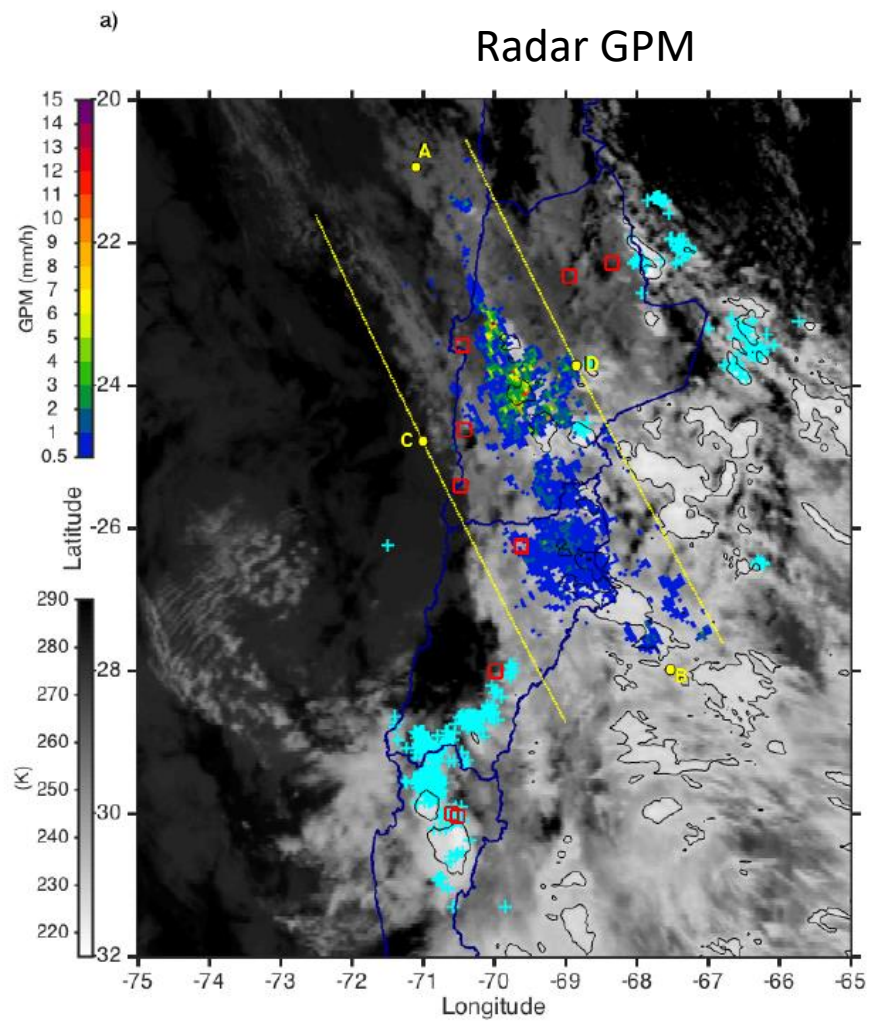
Quillagua station DGA-DMC (lat -21.6, lon -69),  
The driest “documented” place on earth 0.05 -0.5  
mm/ year (based on 33 years of data from 1964 to  
2000 (Middleton, 2001, 2016)

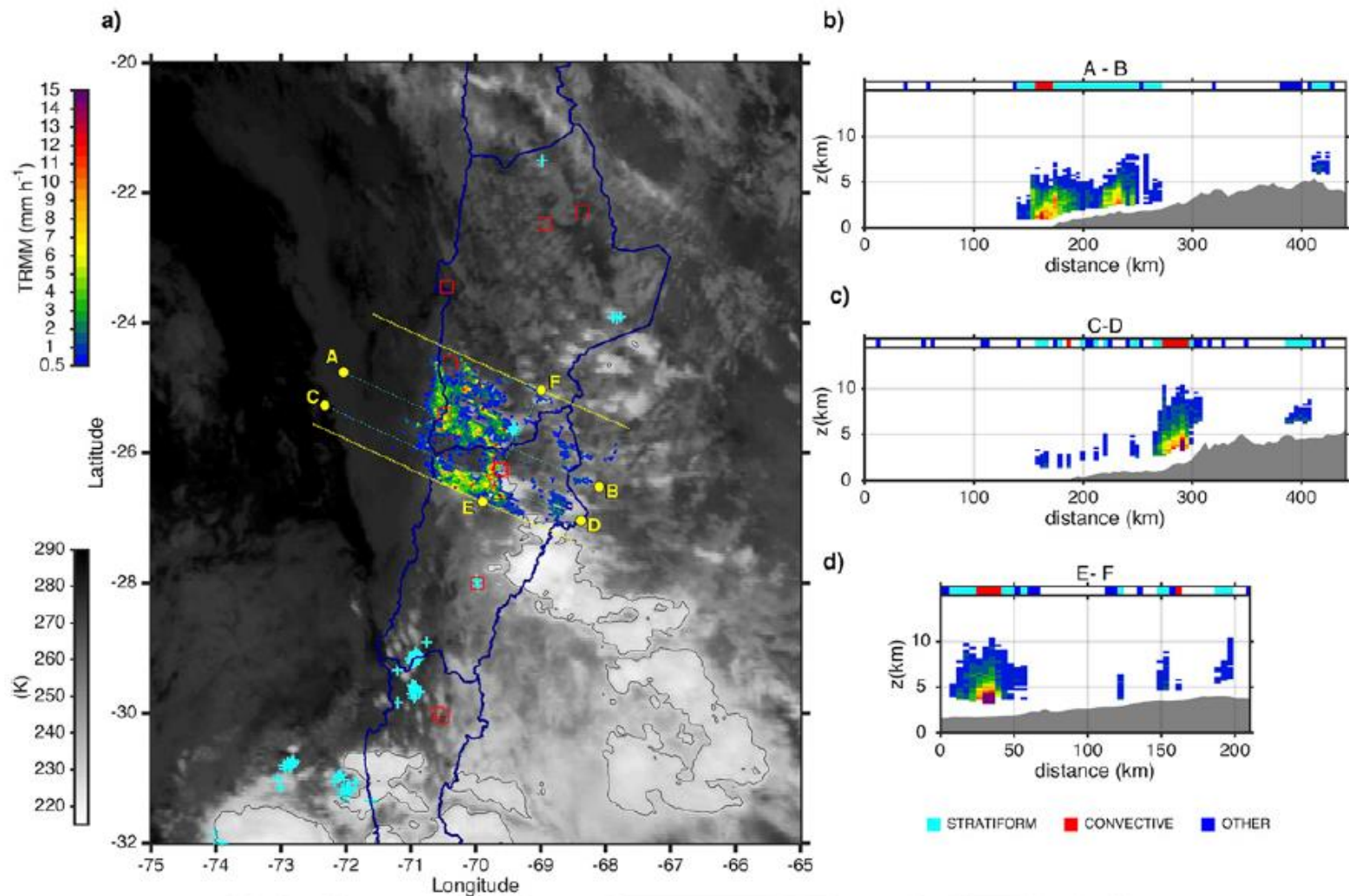
4 mm between 24 and 26 of March, 2015

# El Salado, Atacama



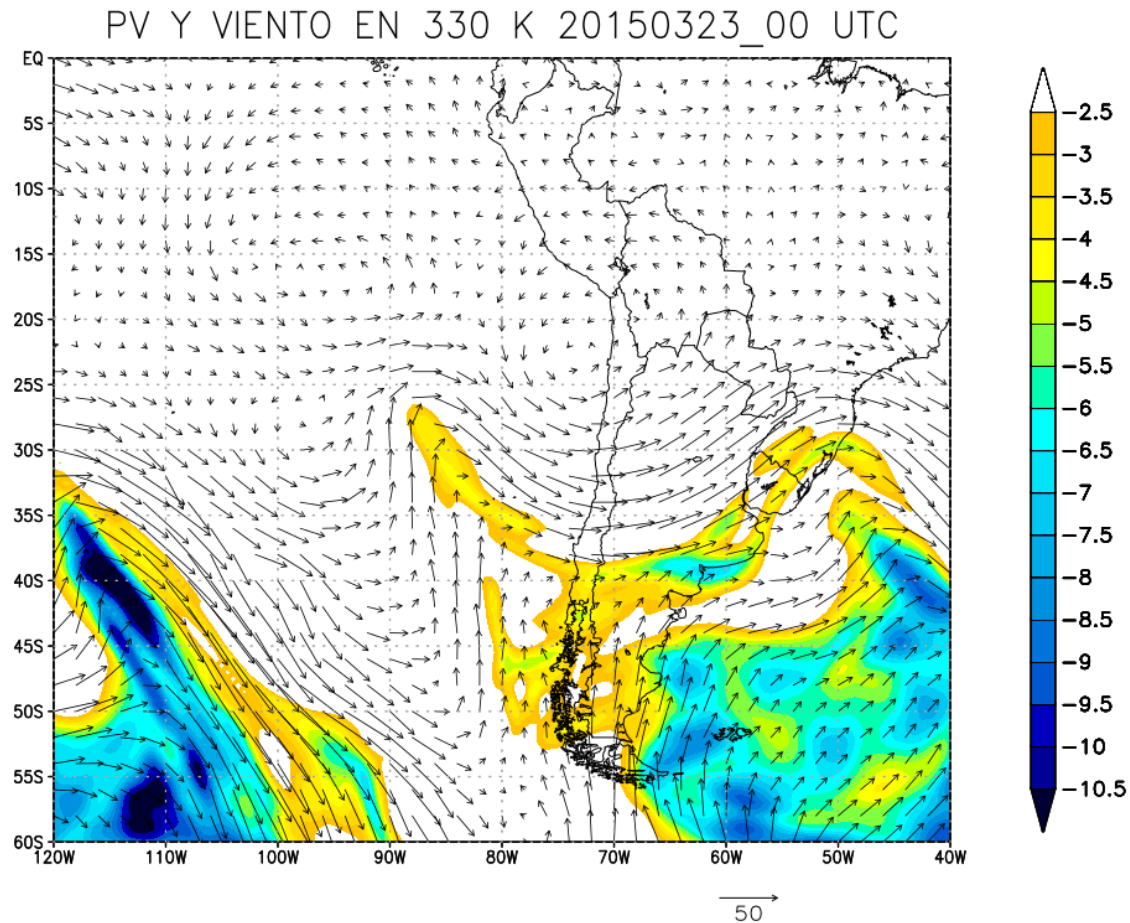




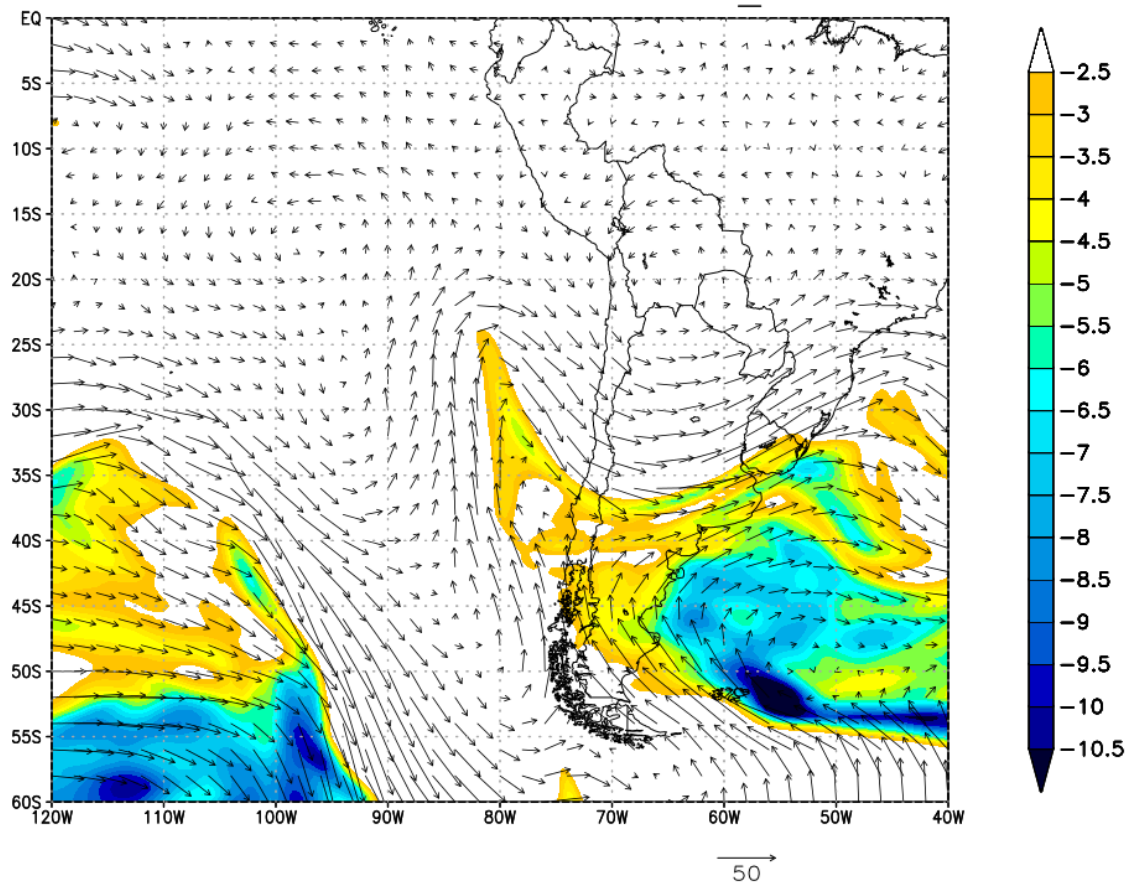


Bozkurt et al, 2016, Monthly Weather Review

# Vorticidad Potencial 330 K y Viento

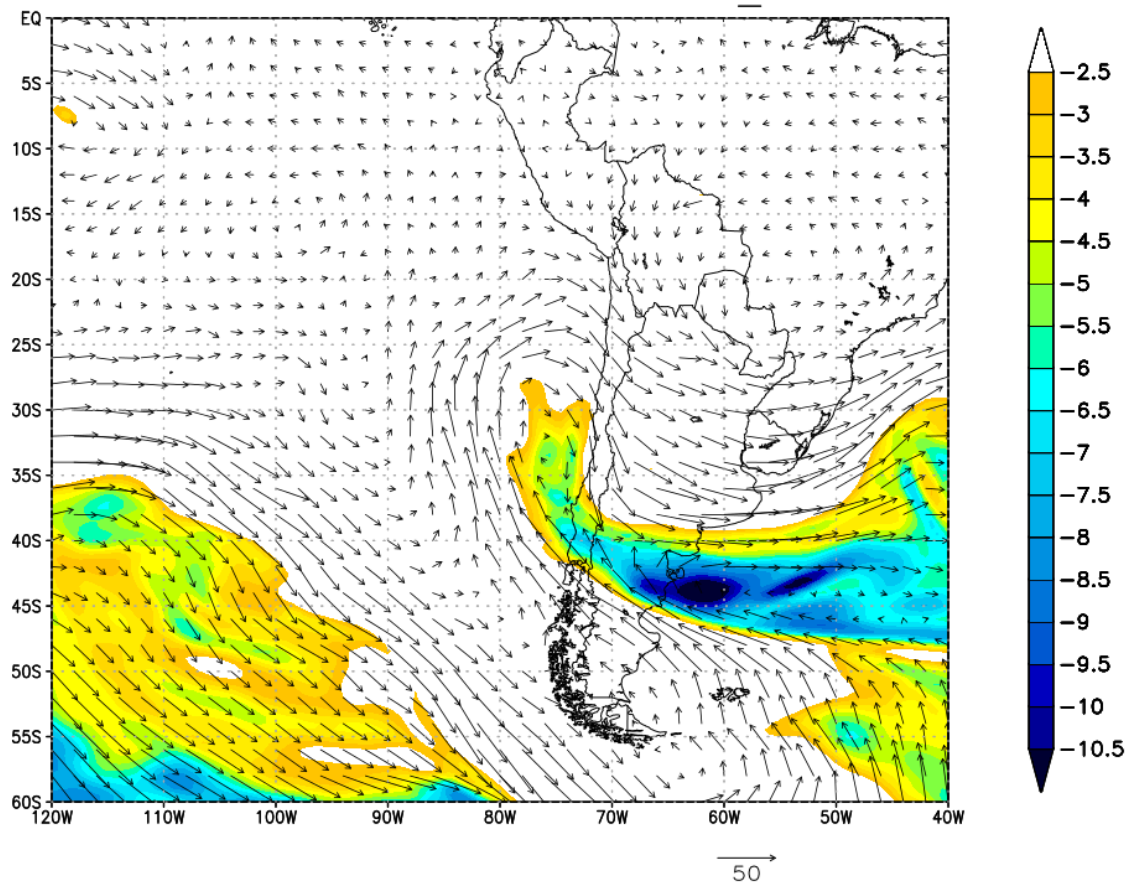


# PV Y VIENTO EN 330 K 20150323\_18 UTC

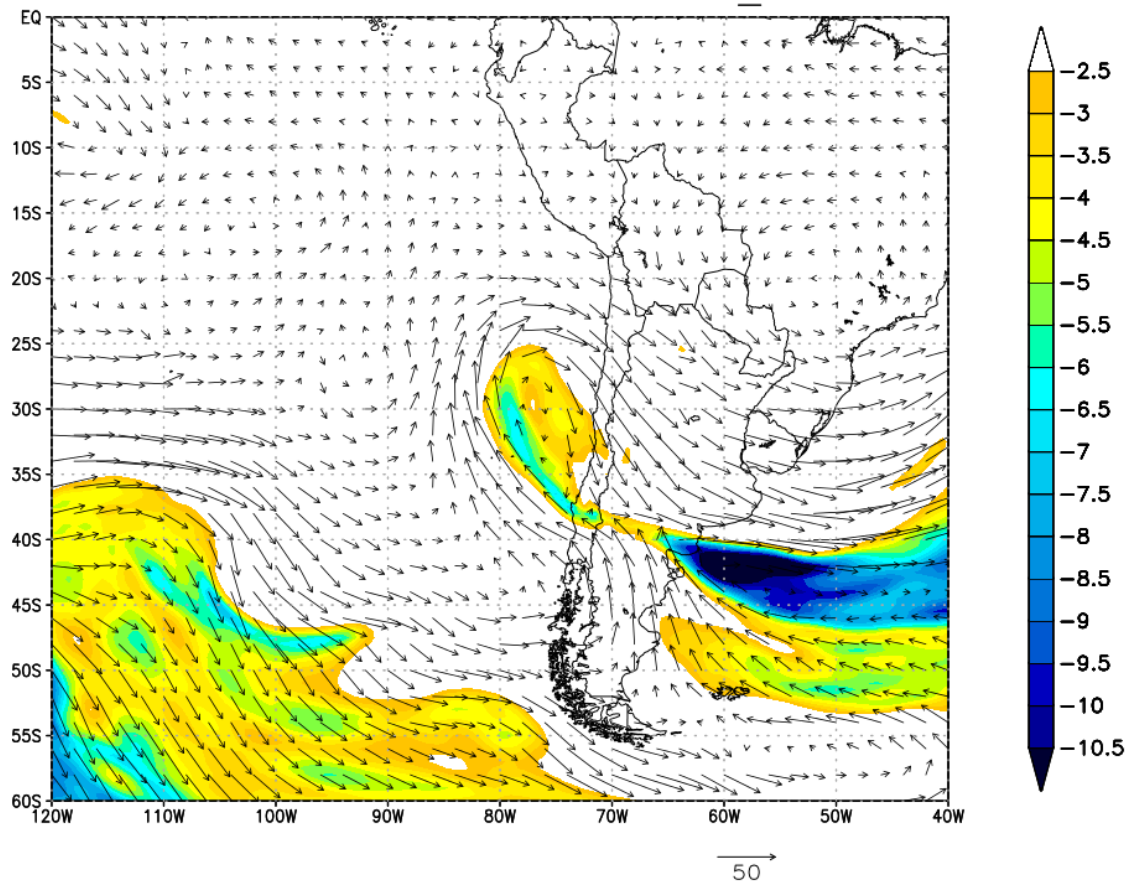




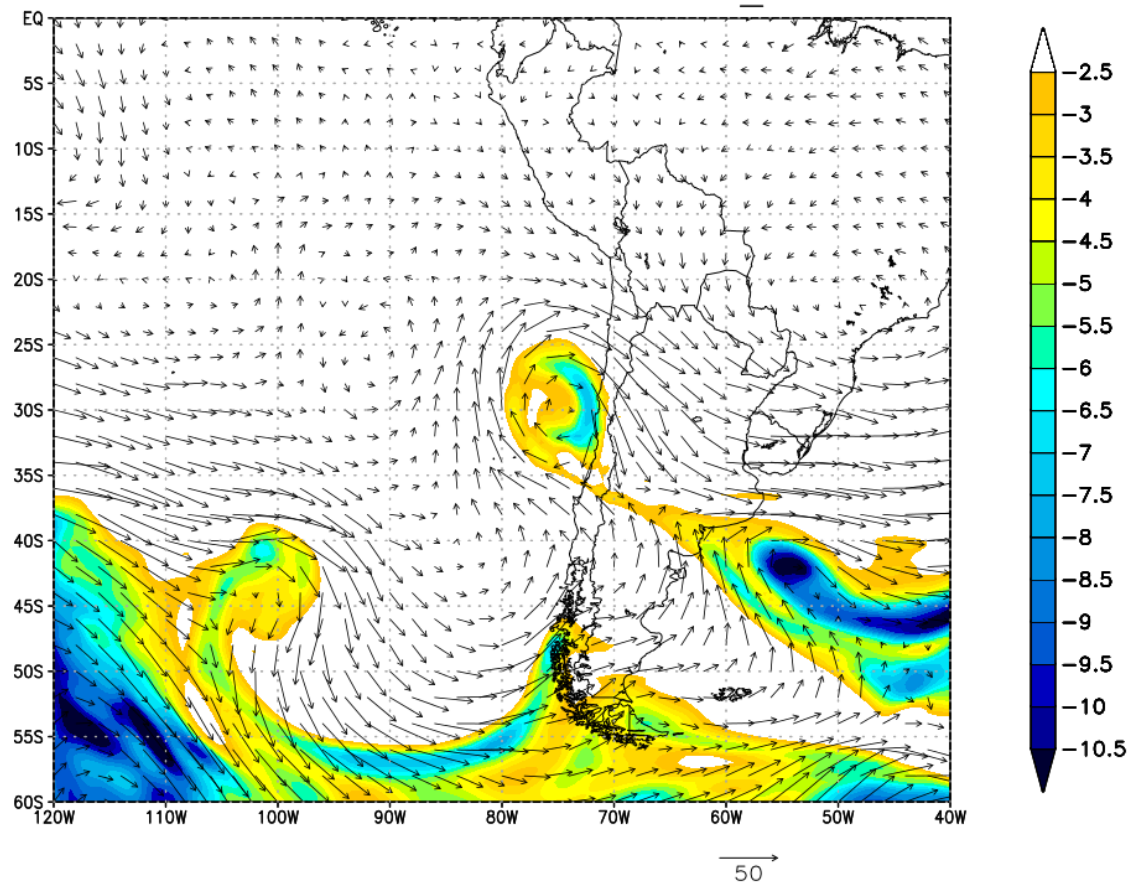
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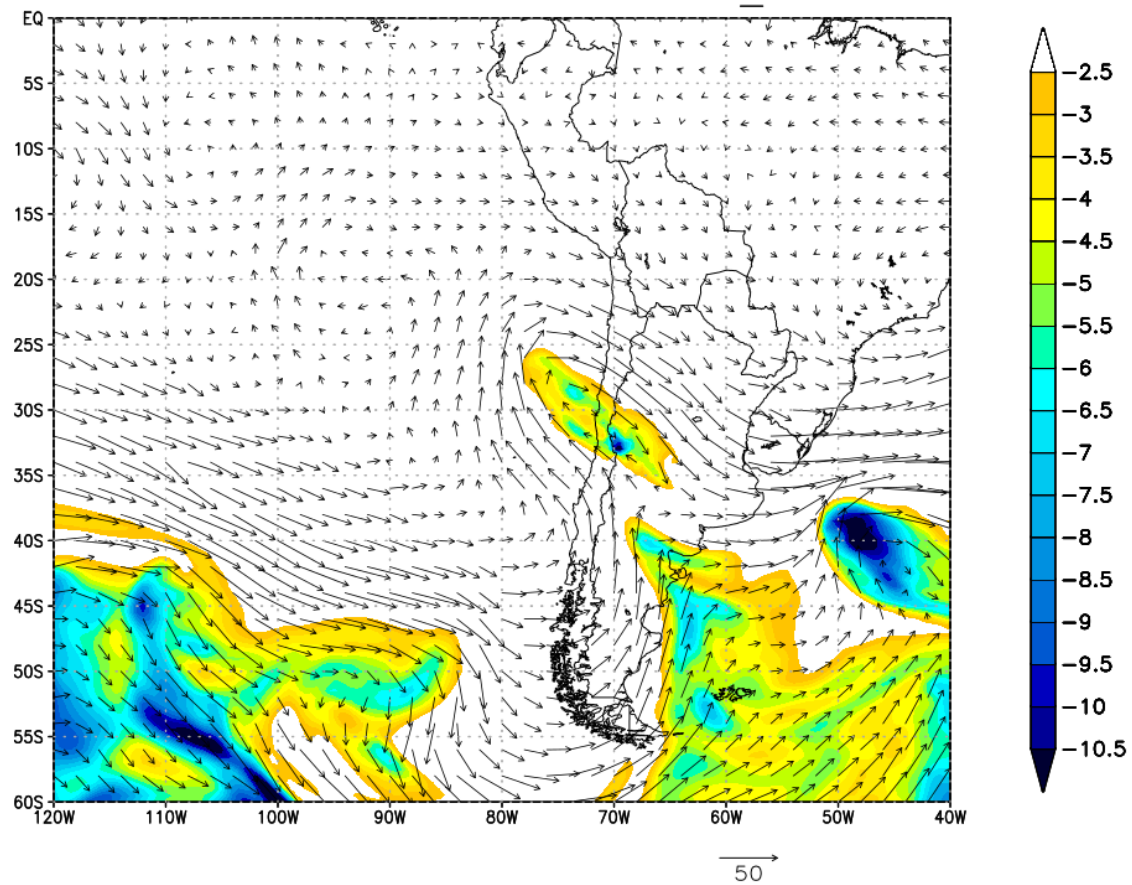
# PV Y VIENTO EN 330 K 20150325\_00 UTC



# PV Y VIENTO EN 330 K 20150325\_18 UTC

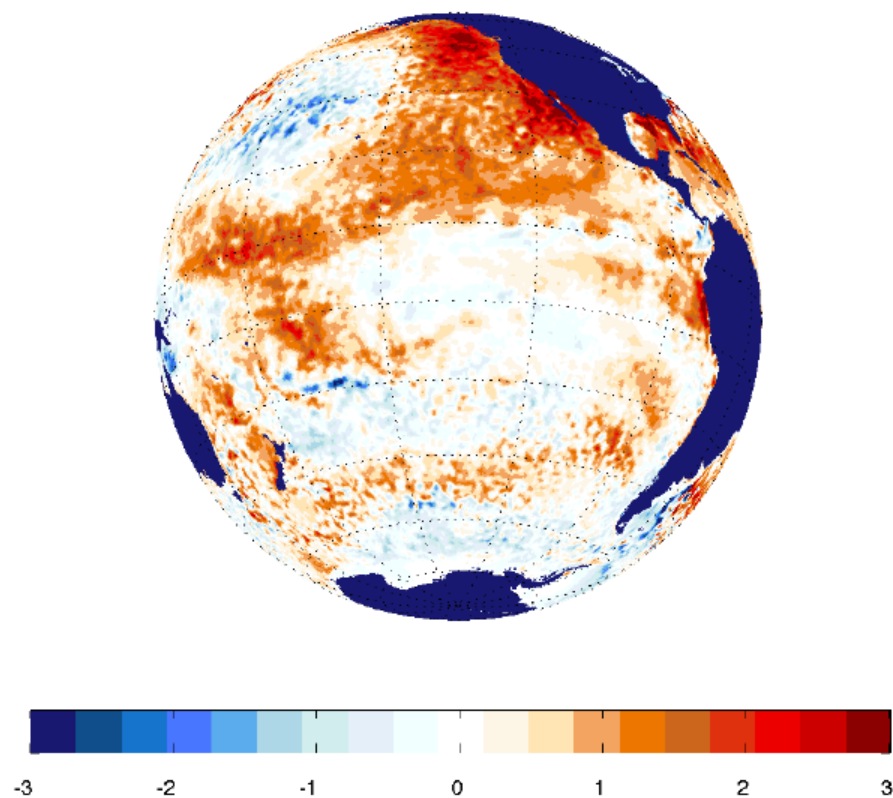


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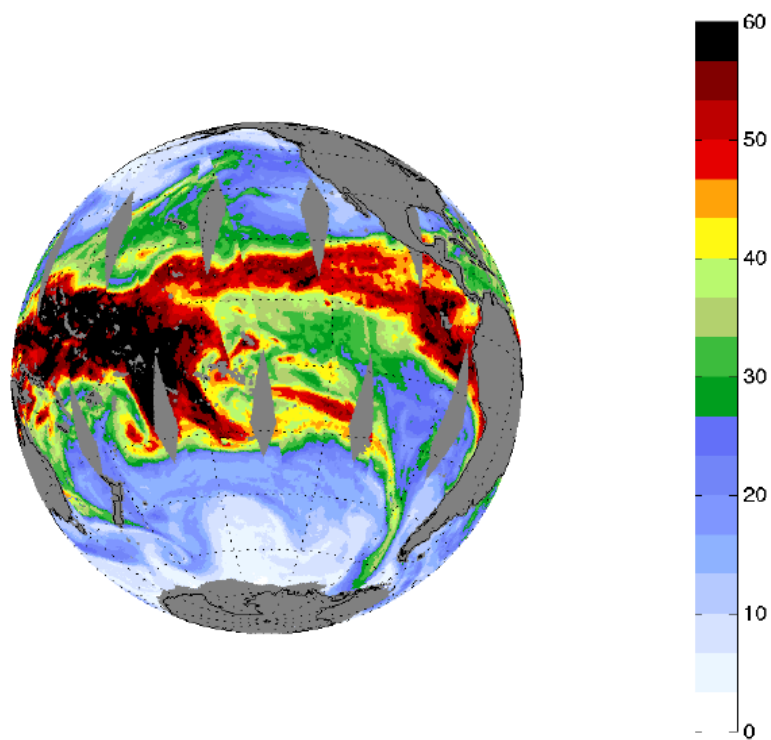




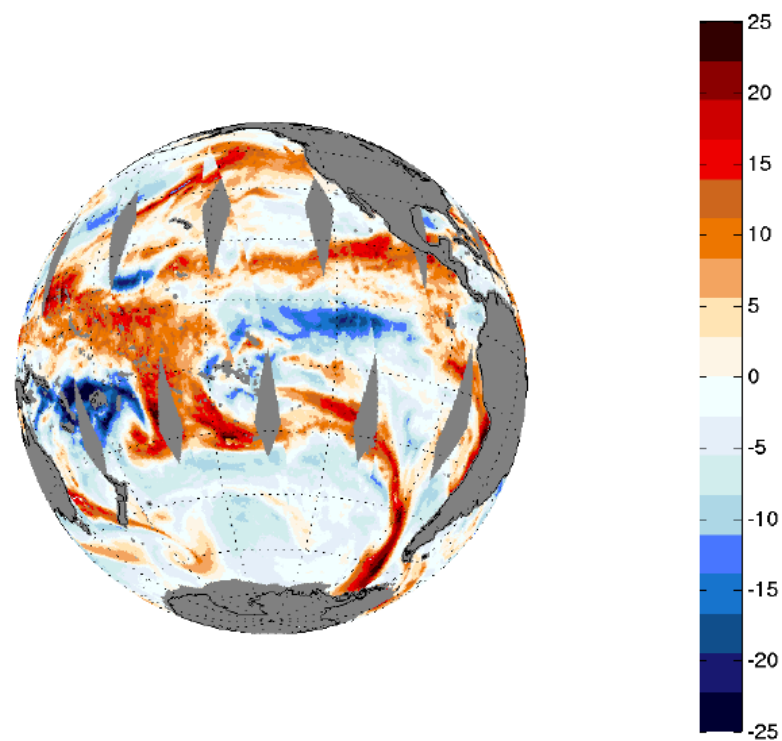
(b) Anomalia de TSM respecto de Marzo (1988-2011)



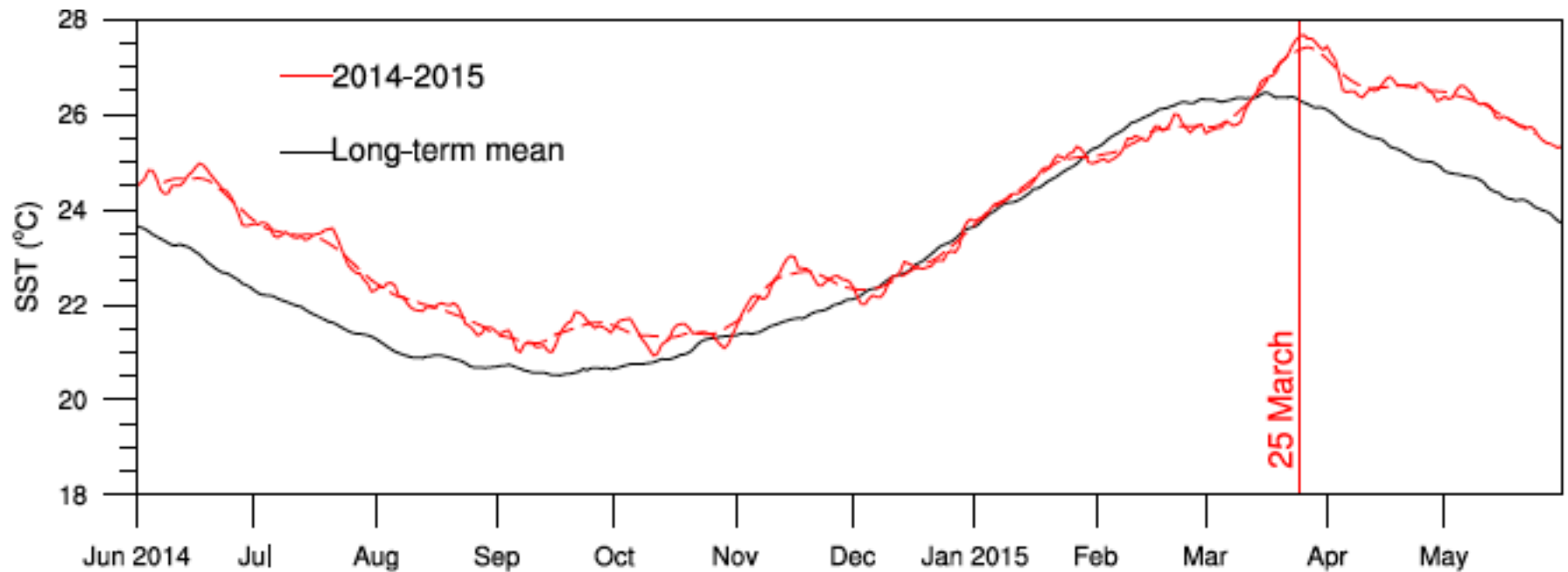
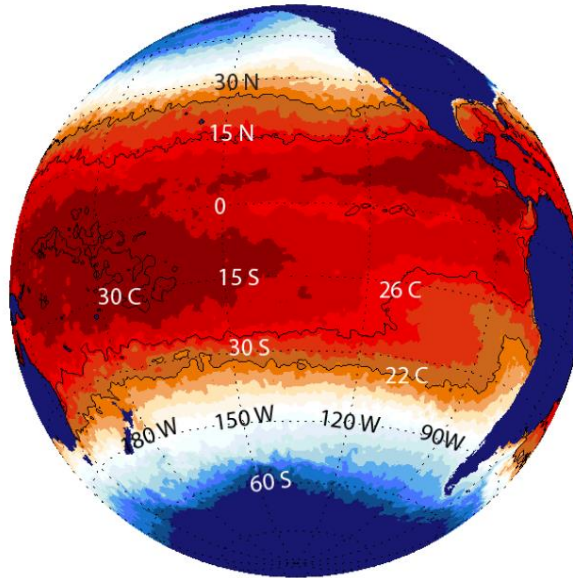
(a) Columna de Vapor de Agua [mm]  
23 de Marzo de 2015 SSM/I



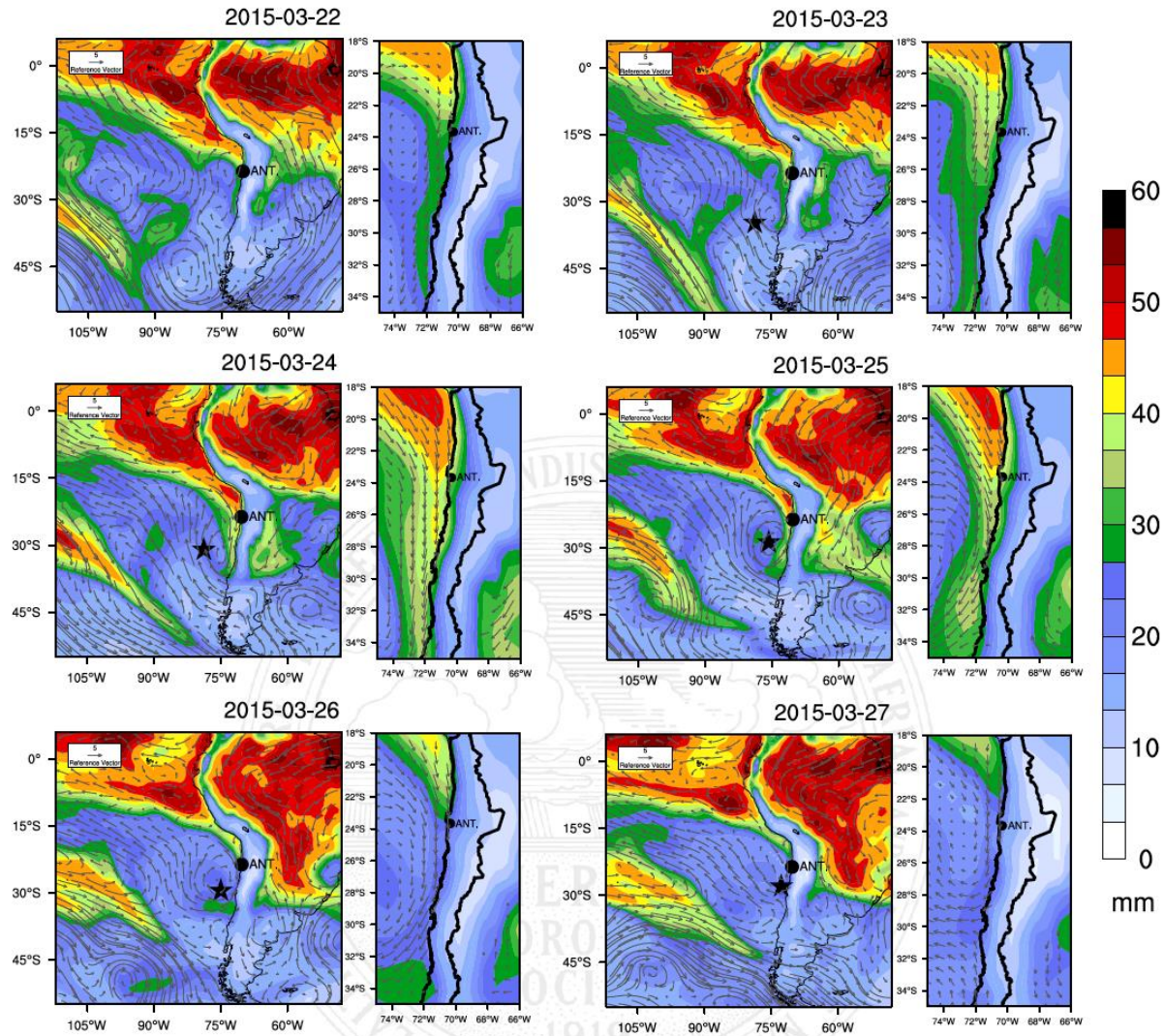
(b) Anomalia de la Columna de Vapor de Agua [mm]  
23 de Marzo de 2015 SSM/I



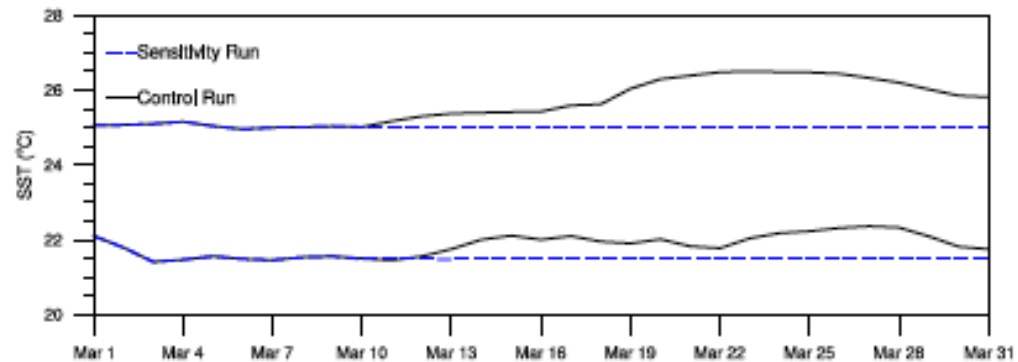
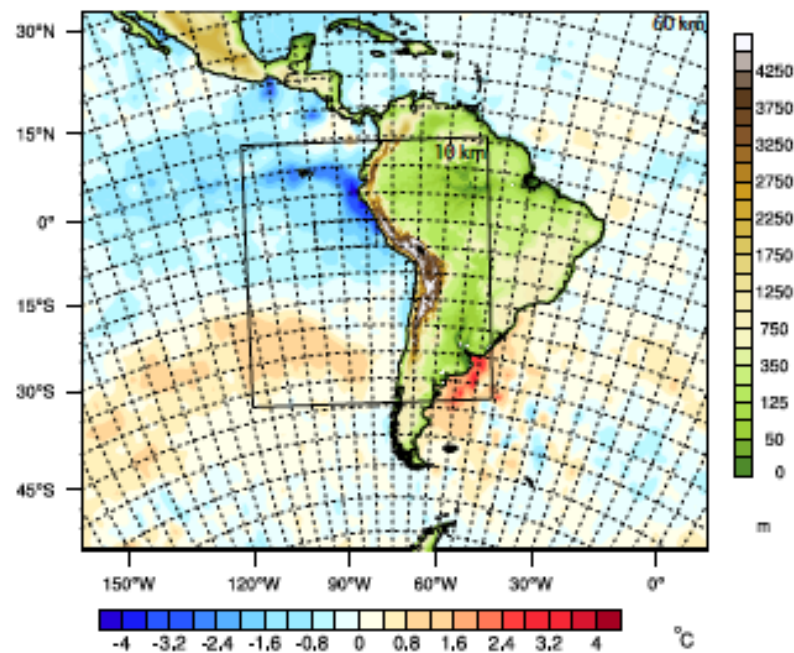
(a) Temperatura superficial del Mar 23 Marzo, 201.

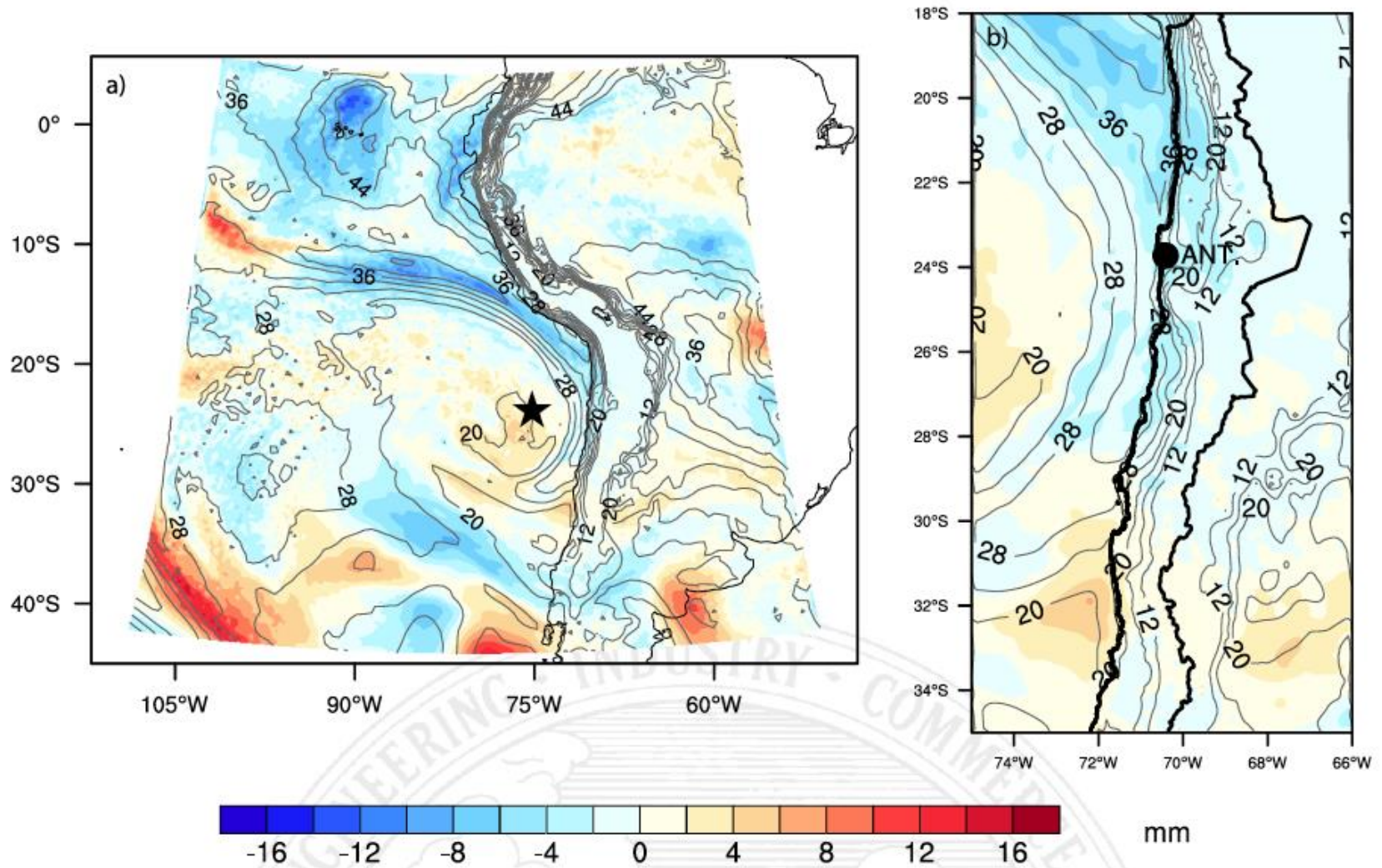


# ERA-Int PW and Wind 850hPa



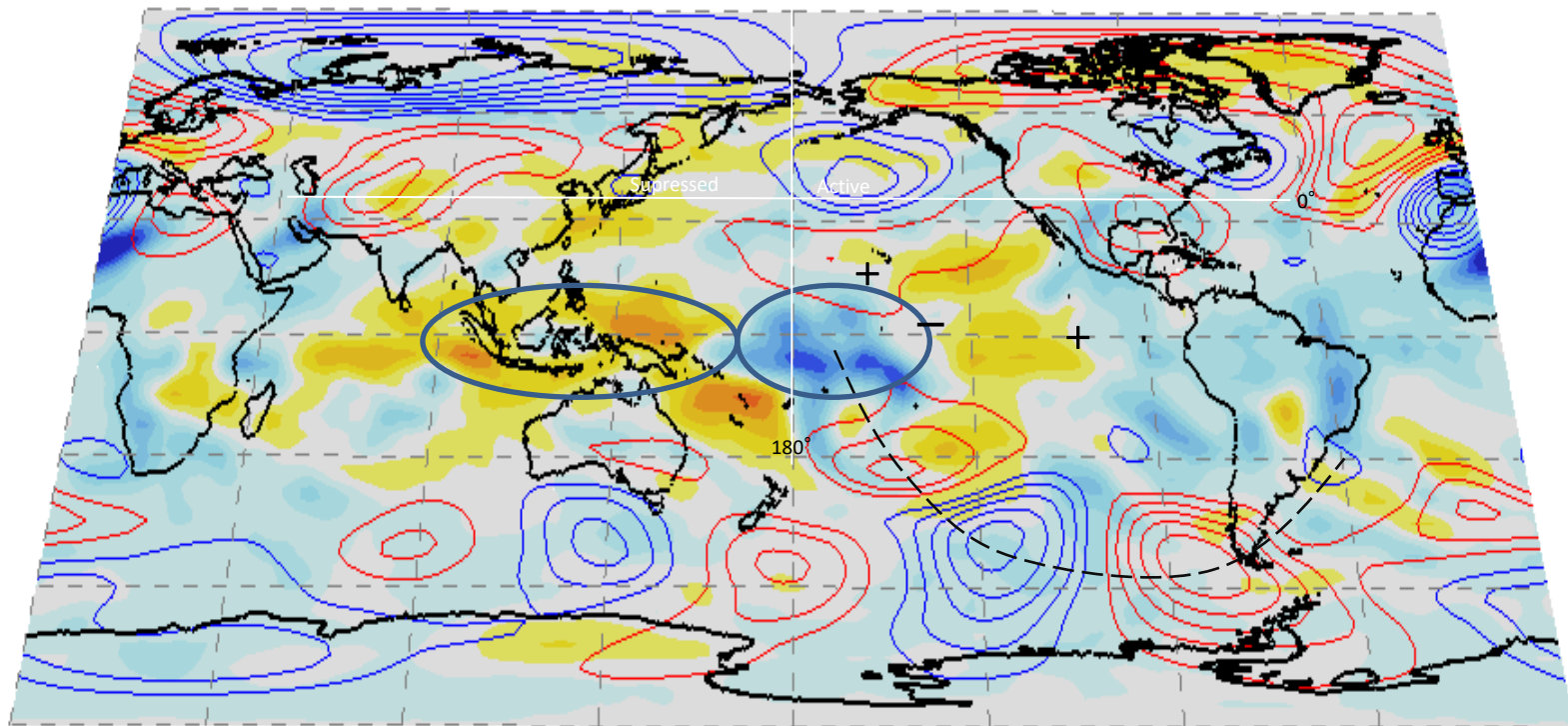






Bozkurt et al, 2016, Monthly Weather Review

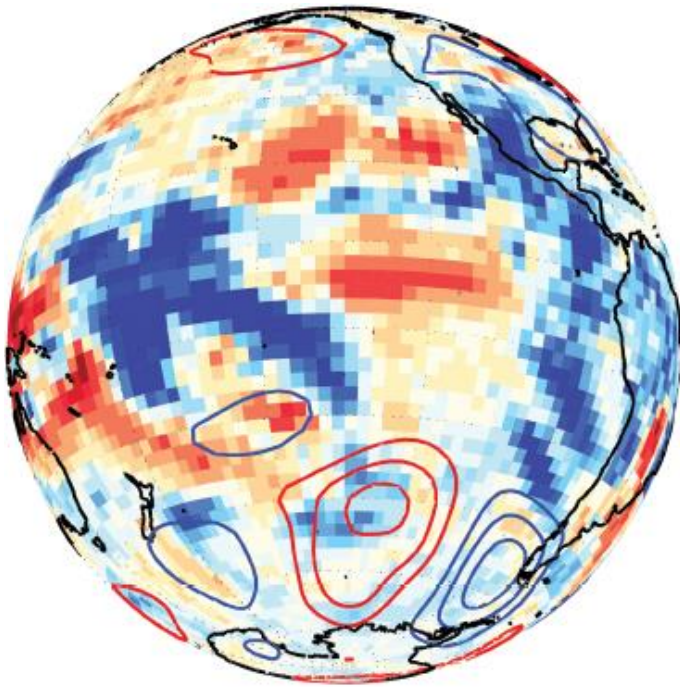
## OLR & H250 19-22 Mar 2015



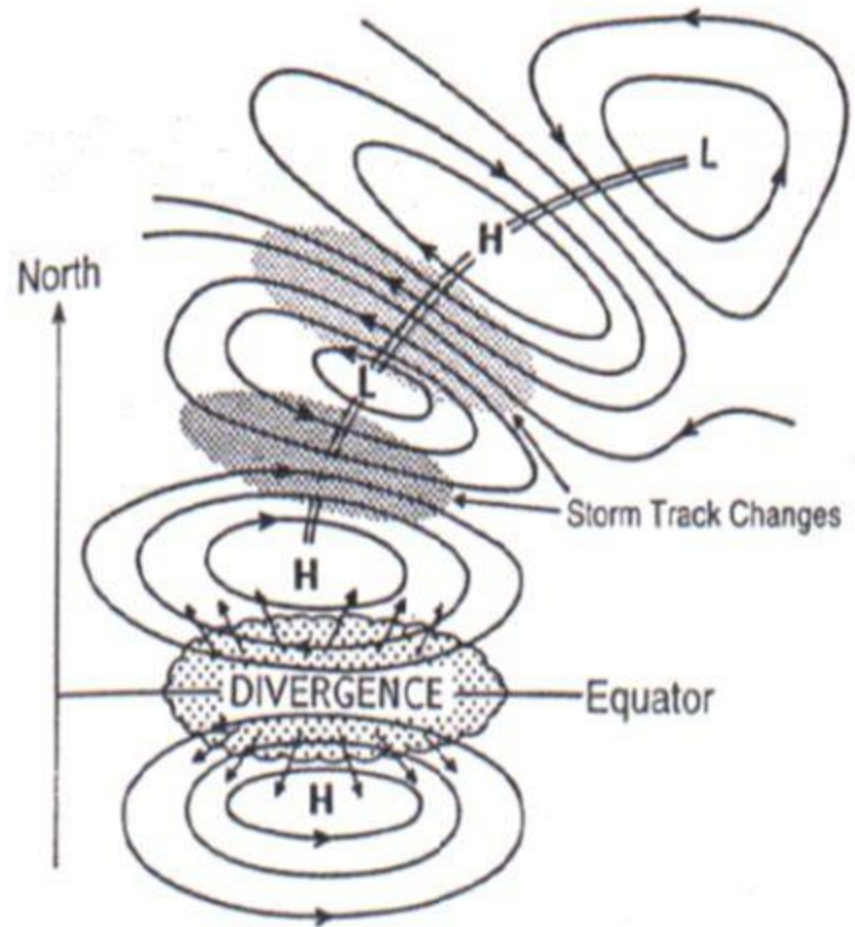


# Propagation of Rossby waves

from a region of tropical convection (schematic)

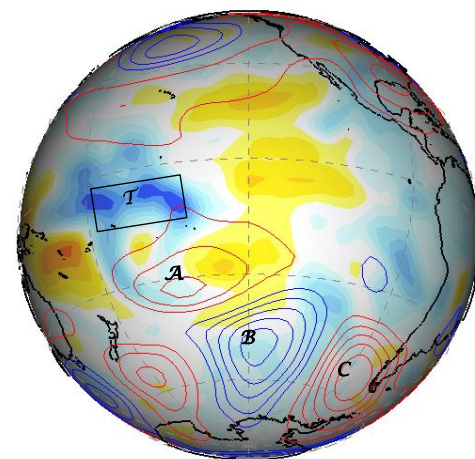
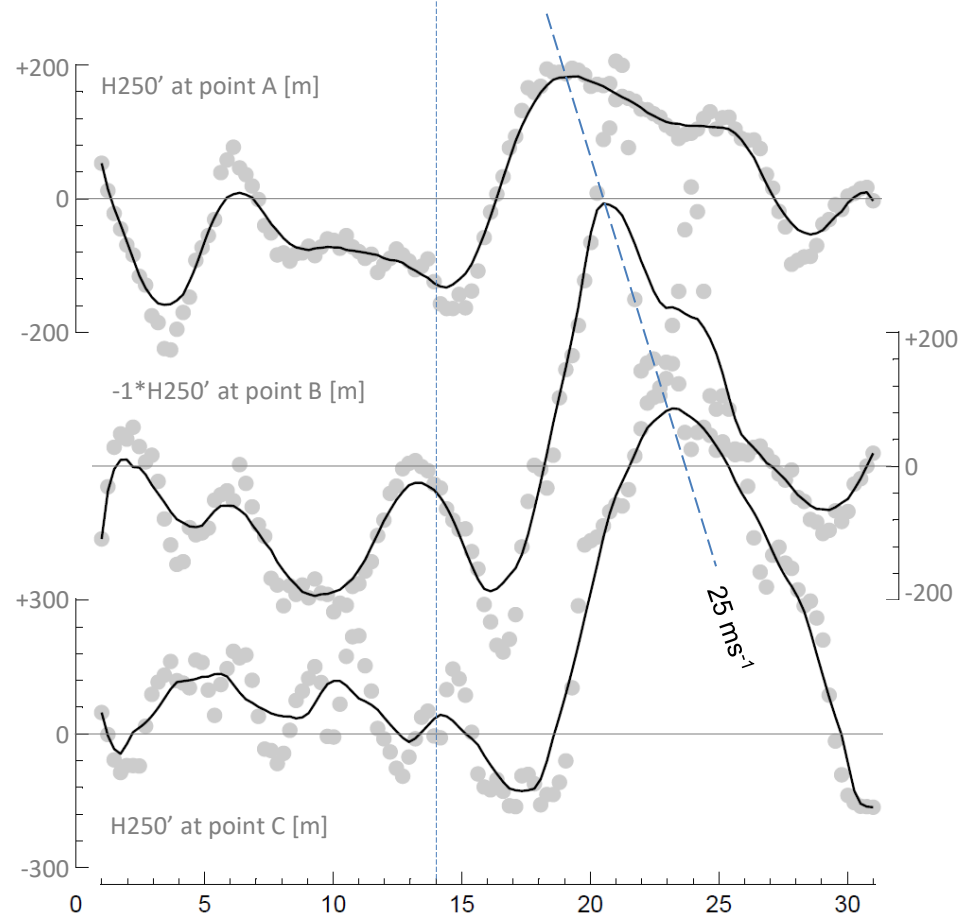
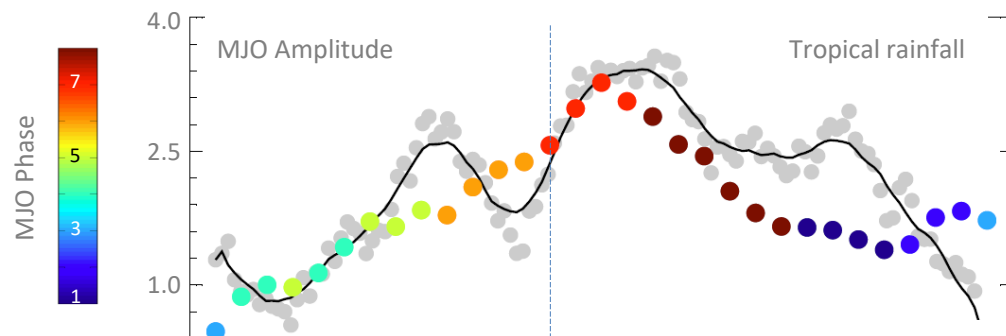


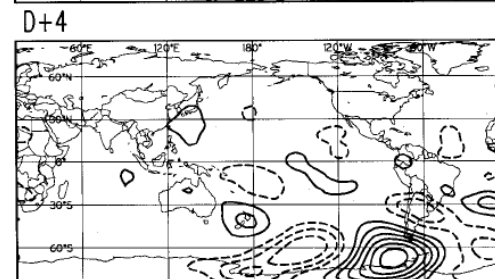
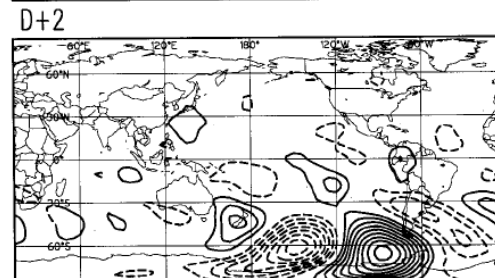
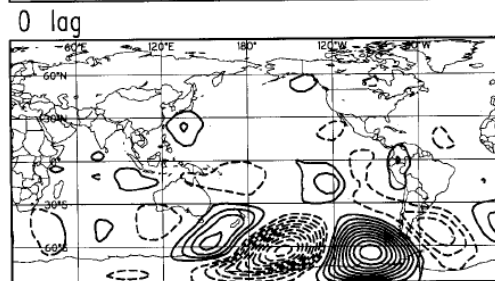
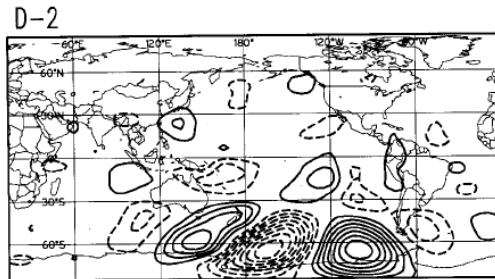
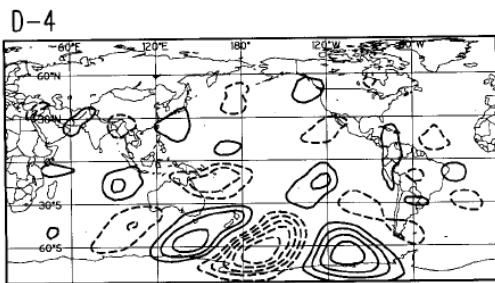
*Horel and Wallace (1981)*



*Trenberth et al. (1998)*





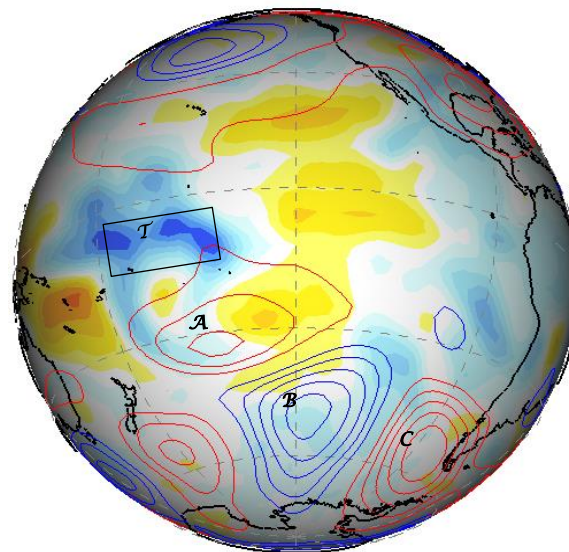
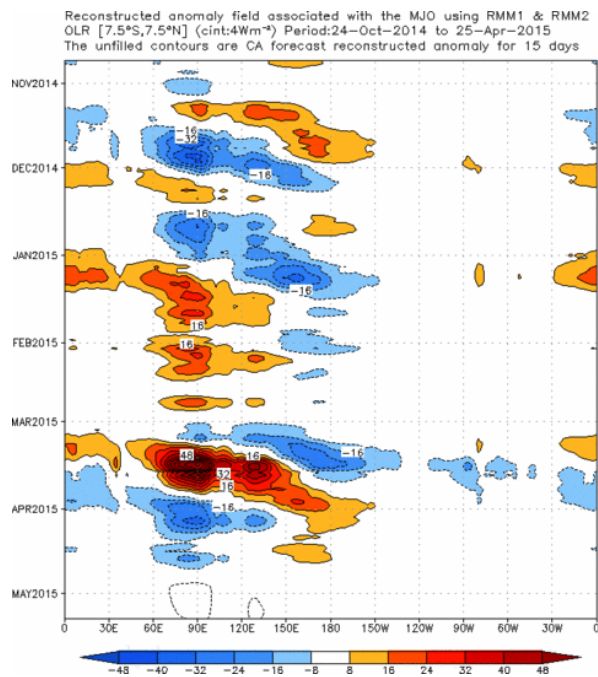
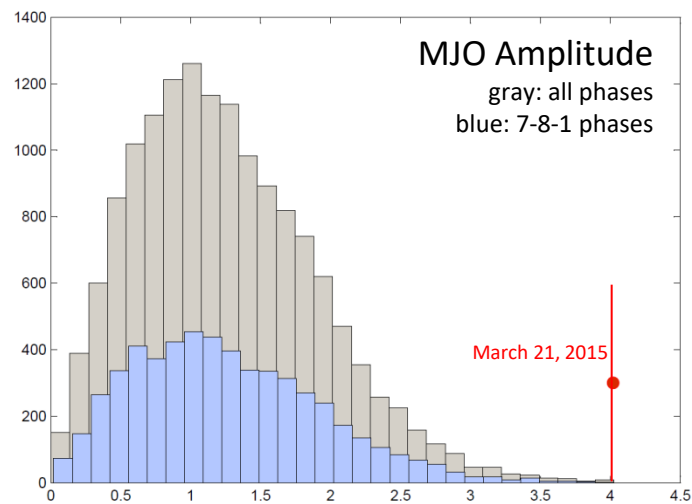


Major southern winter storms in central Chile during the developing phase of ENSO events seem to be mainly associated with blocking or slowly moving highs embedded in high latitude hemispheric circulation patterns where wavenumbers 3 and 4 prevail. The blocking area is located to the south-west of the continent, around the Bellingshausen Sea (90°W).

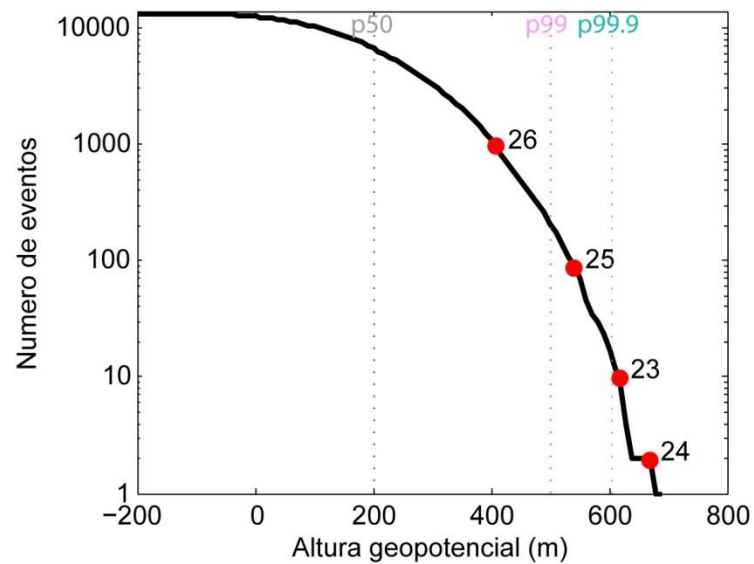
These features seem to be consistent with the observed hemispheric teleconnection patterns described in Karoly's (1989) 200-hPa ENSO geopotential anomaly composites. The system behaves as if the blocking ridge amplifies and stays longer than normal in the Bellingshausen Sea area owing to a resonance effect with a wavetrain emerging from the central equatorial Pacific, similar to the patterns described by Horel and Wallace (1981) for the Northern Hemisphere.

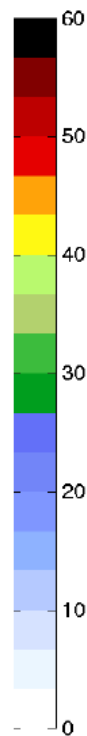
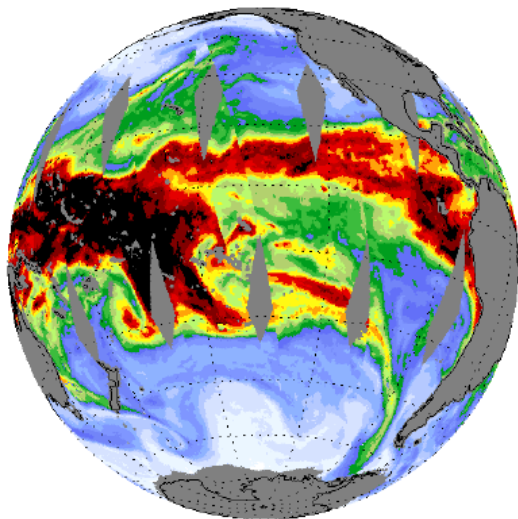
Rutllant and Fuenzalida, 1991

Renwick and Revell, 1999

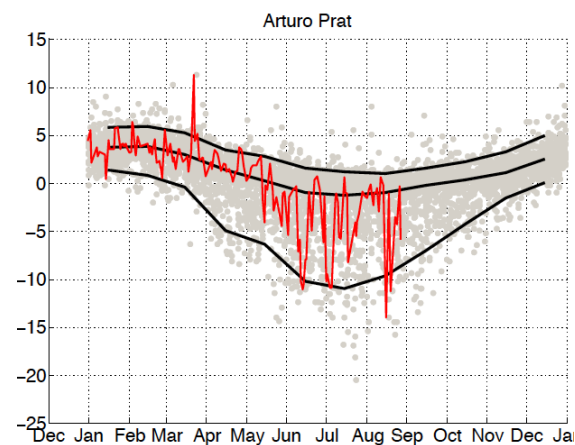
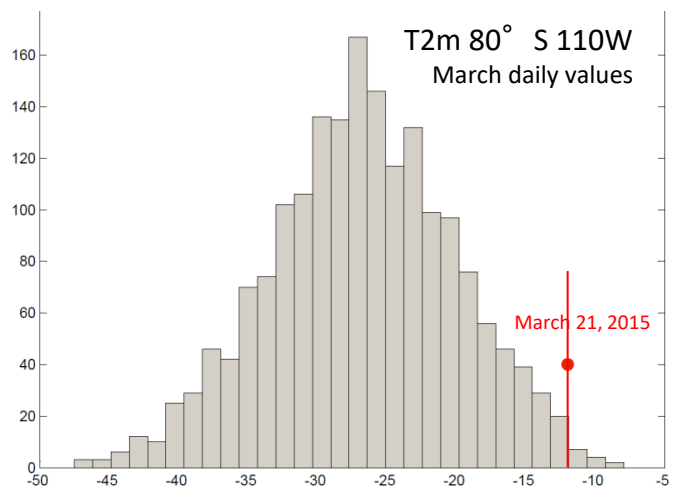
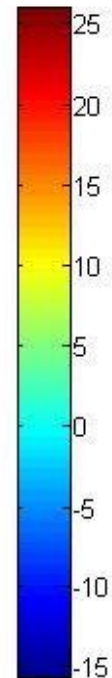
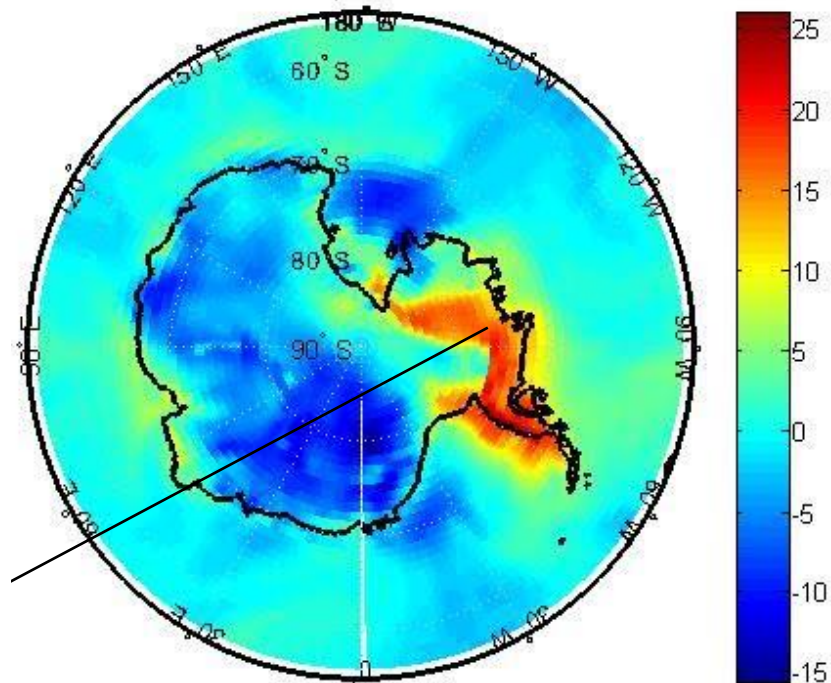


Histograma acumulativo Anomalia altura geopotencial 300hPa  
Sector Sur



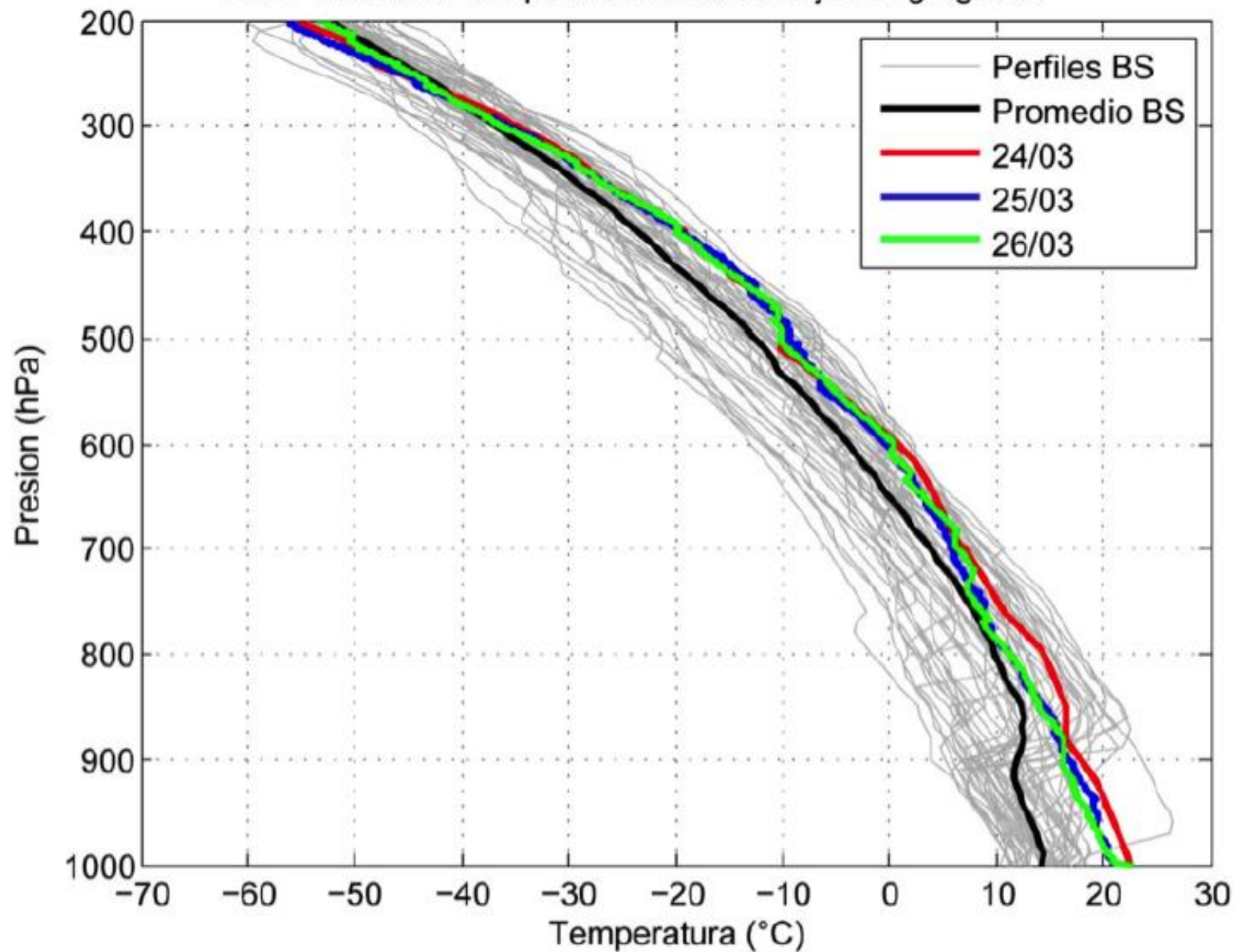


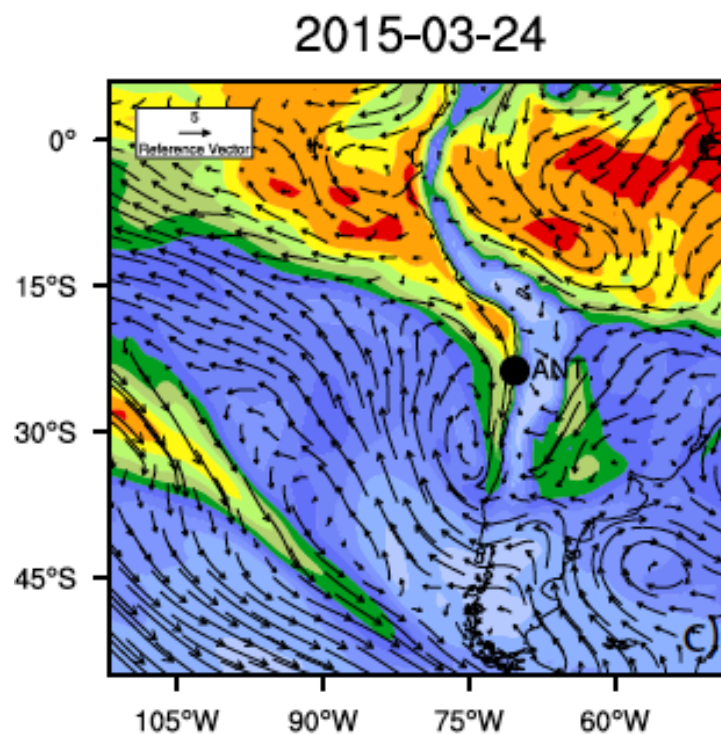
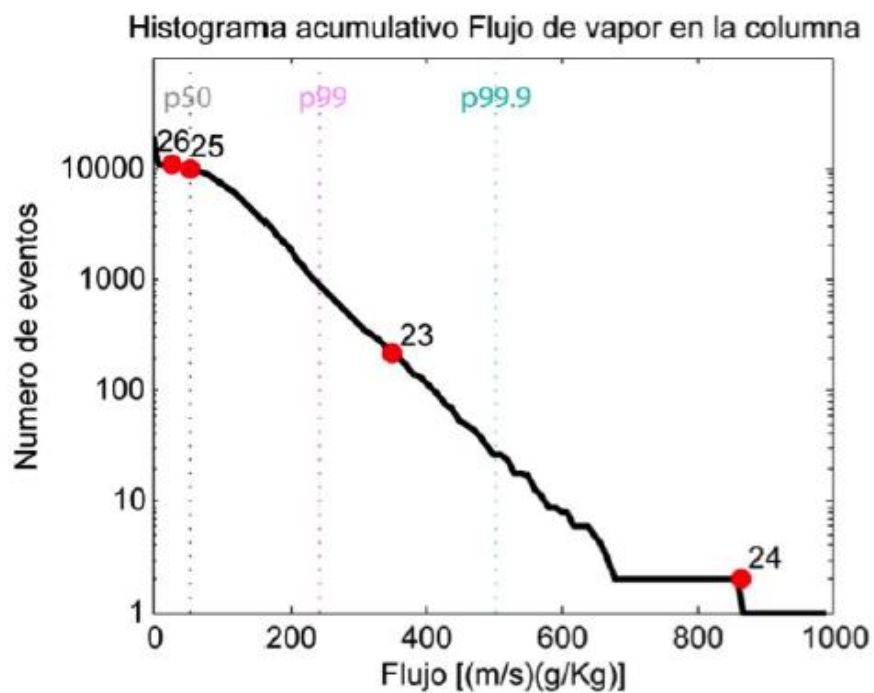
Anomalia de temperatura 24-Mar-2015



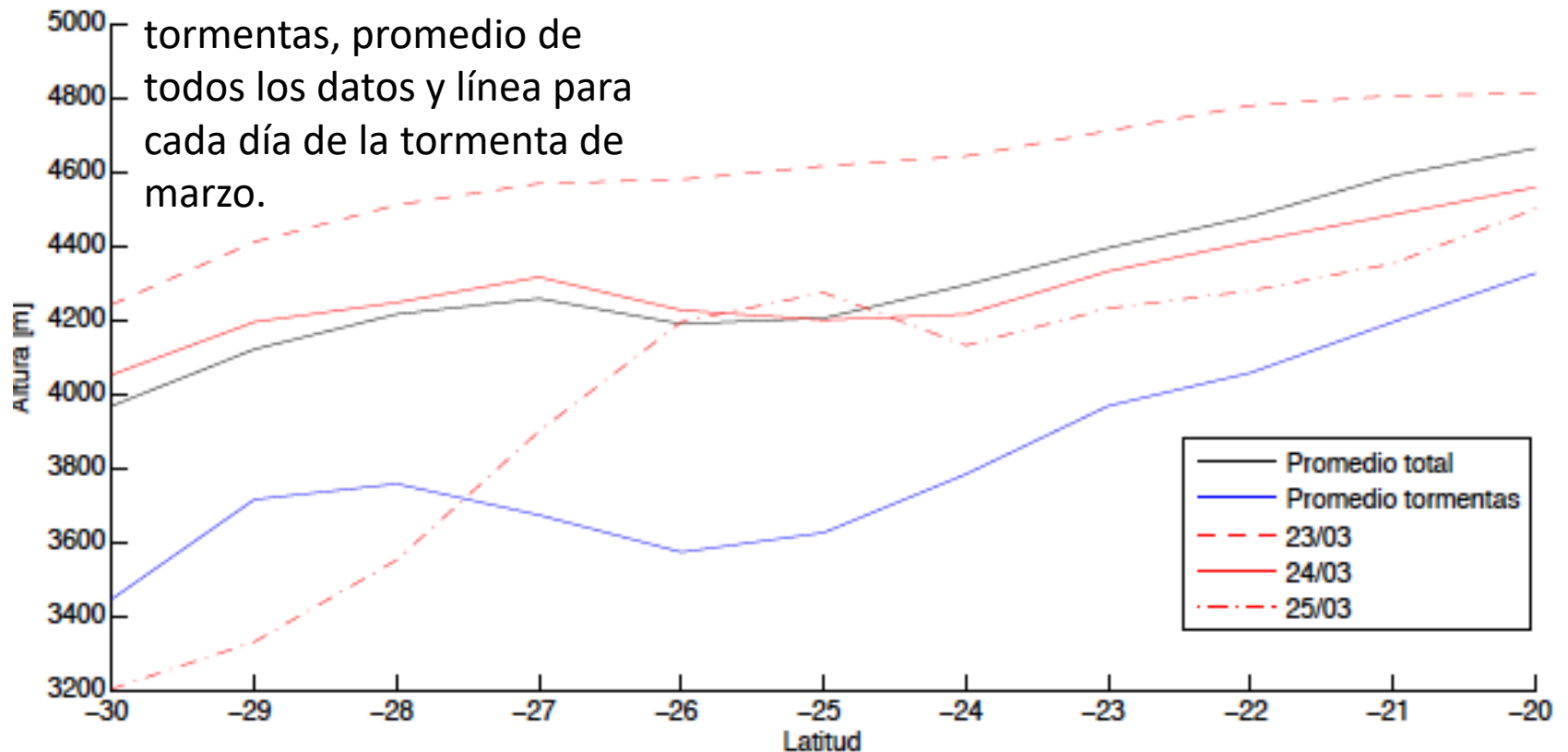


Perfil vertical de temperatura durante Bajas Segregadas





Altura isoterma cero: altura de la isoterma cero en la longitud 68, para distintas latitudes, con reanálisis ERA. Promedio de todas las tormentas, promedio de todos los datos y línea para cada día de la tormenta de marzo.



## Benjamín Vicuña Mackenna, El Clima de Chile, Julio, 1877

Pero lo que constituye la más notable peculiaridad del aguacero del 10 de julio en Atacama, no es que lloviese en esas regiones cuando en el sur había escampado totalmente, ni que durase más de doce horas cada uno de sus aguaceros, sino que su marcha fuera inversa, de norte a sur, como si su núcleo generador hubiese estado en el desierto, es decir, en latitudes donde jamás llueve. He aquí, en efecto, cómo daba cuenta de esa extraña anomalía en las leyes de nuestro clima el intendente de Coquimbo en un telegrama al ministro del interior.

*Serena, julio 11 de 1877.*

Señor Ministro:

Ayer ha tenido lugar una lluvia, no tan grande como benéfica, la que parece ha sido *mayor hacia el norte*, pues por los telegramas que he recibido del sur de la provincia, esa lluvia ha sido *menos* en Illapel que en Ovalle, y en Ovalle *menos* que en La Serena.

En Elqui el aguacero ha sido mayor que en La Serena y la nevada caída parece abundante.

Dios guarde a V. S.

*Antonio Alfonso.*