

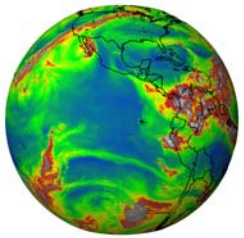

# Climate change along the extratropical Andes (25-45°S): Evidences and Projections

VICC2010 Valdivia, Chile
February 2010

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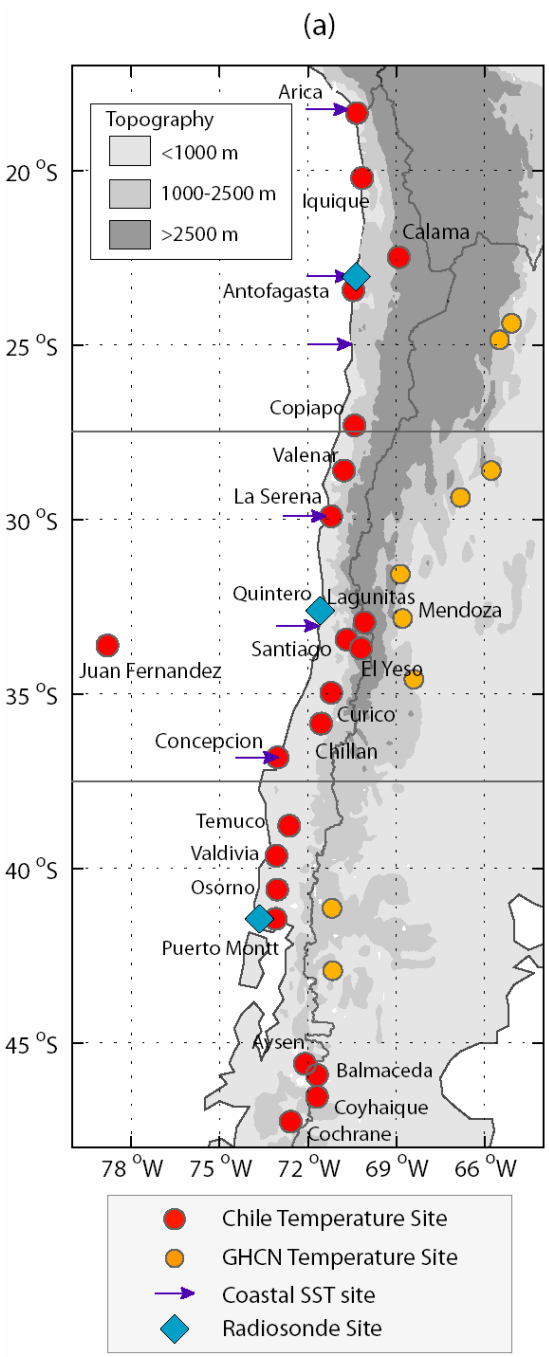
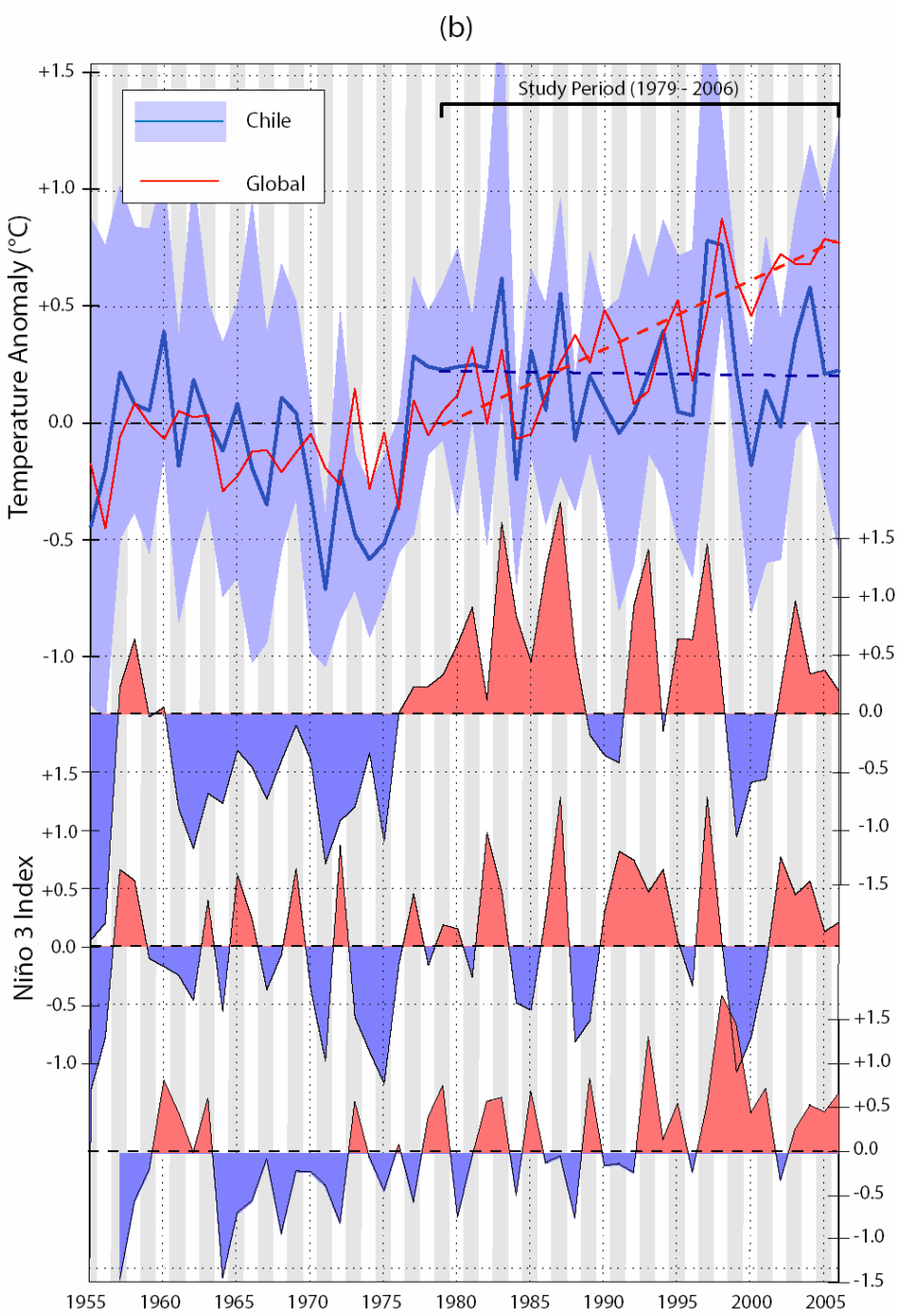
Universidad de Chile

http://www.dgf.uchile.cl/rene

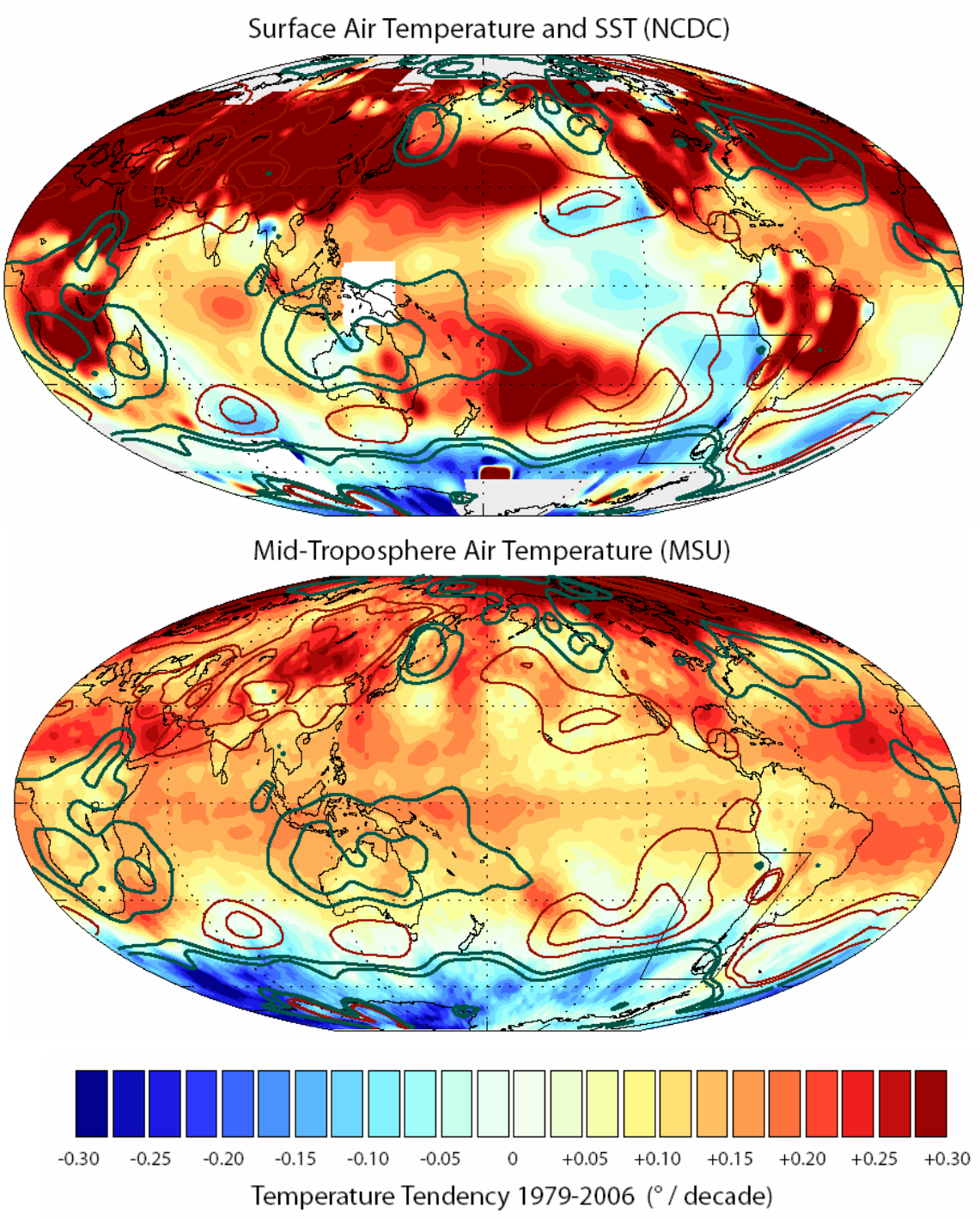
In collaboration with: M. Falvey, M. Rojas, P. Aceituno, H. Fuenzalida

# Geographical setting and global context

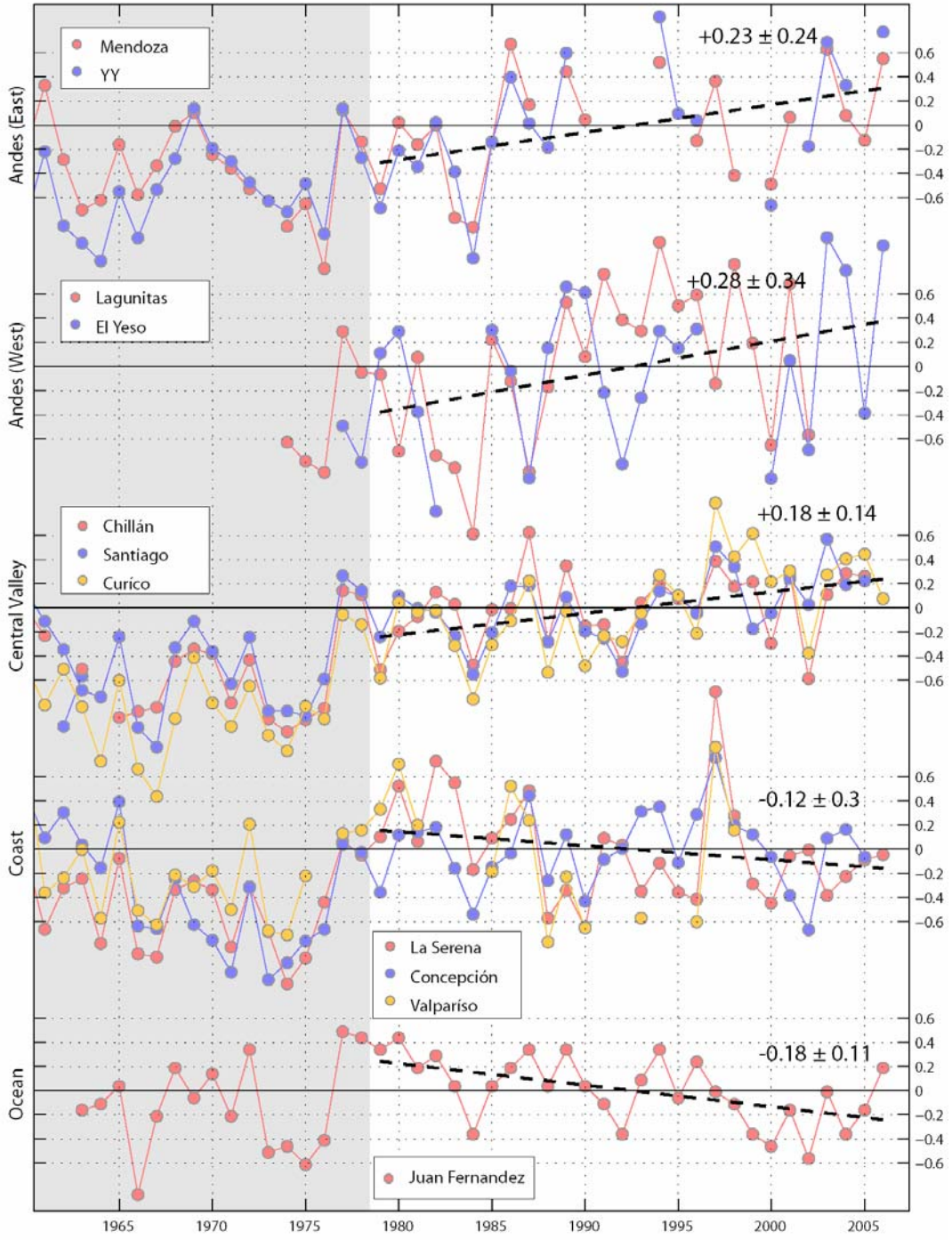


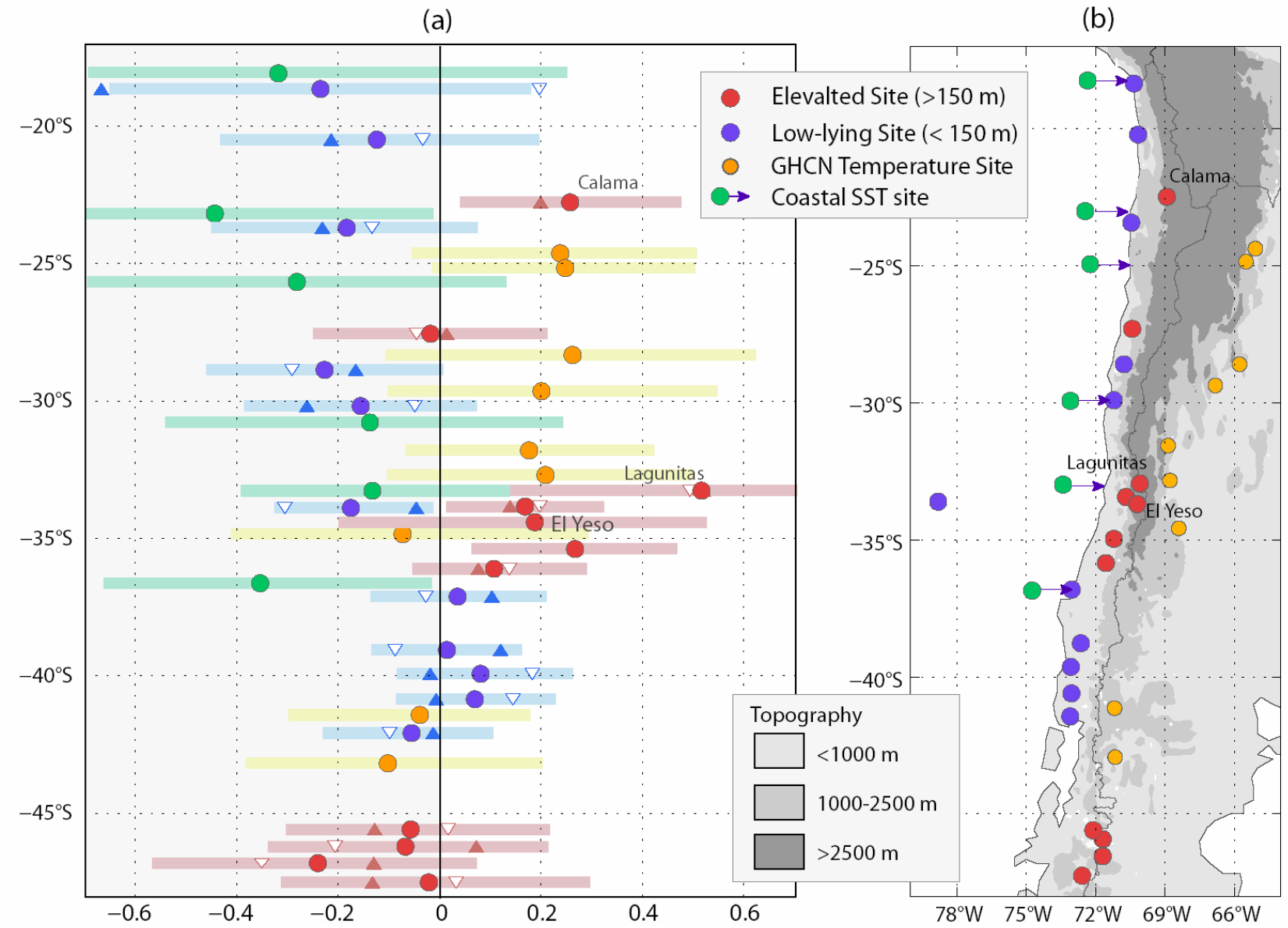
# Global Temperature Change 1979-2006



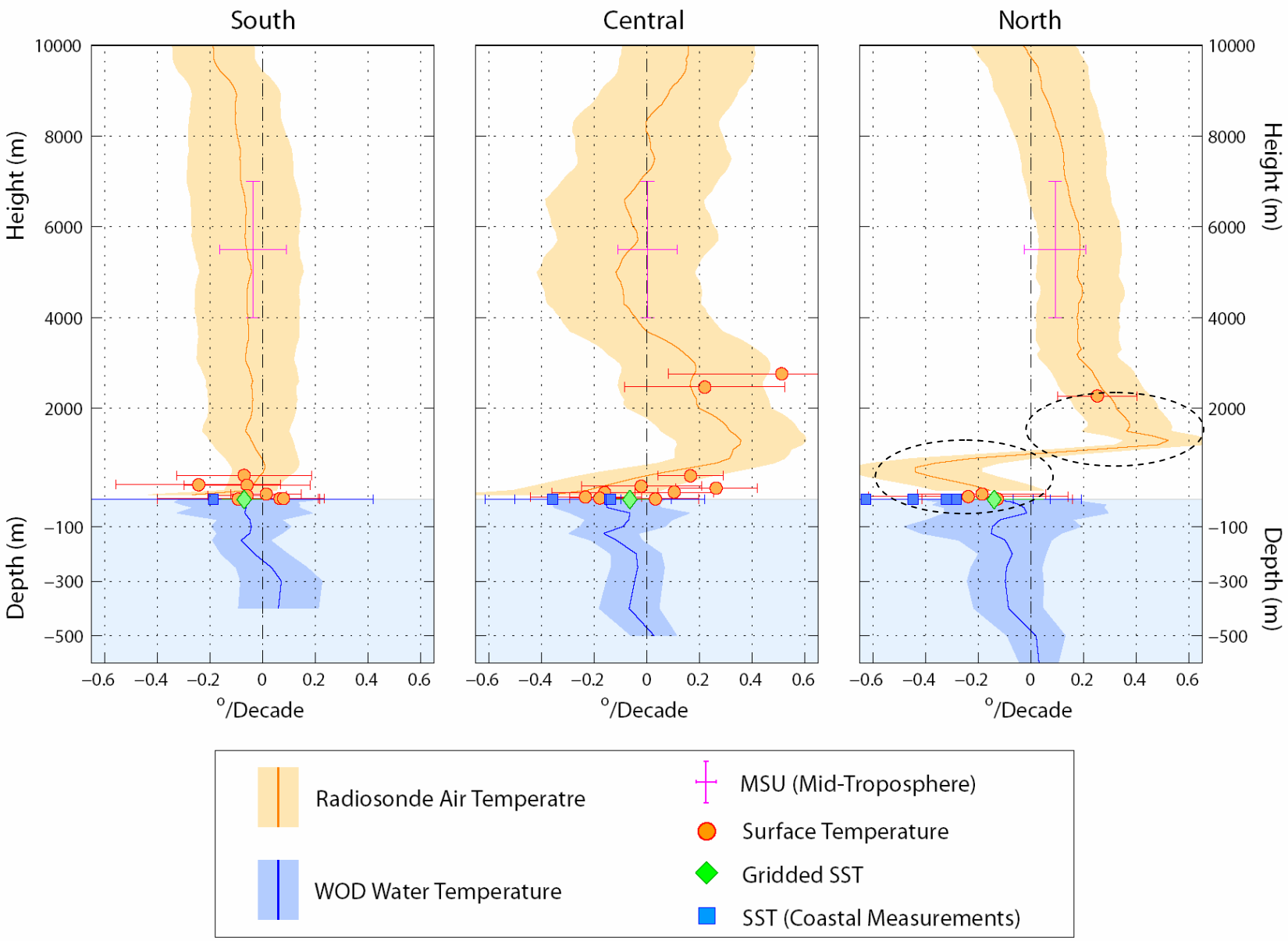
# Temperature Changes in Central Chile



# Ocean cooling – land warming along north-central Chile. Pattern reverses farther south



# Temperature changes aloft (Radiosonde data)



# Global Temperature changes aloft

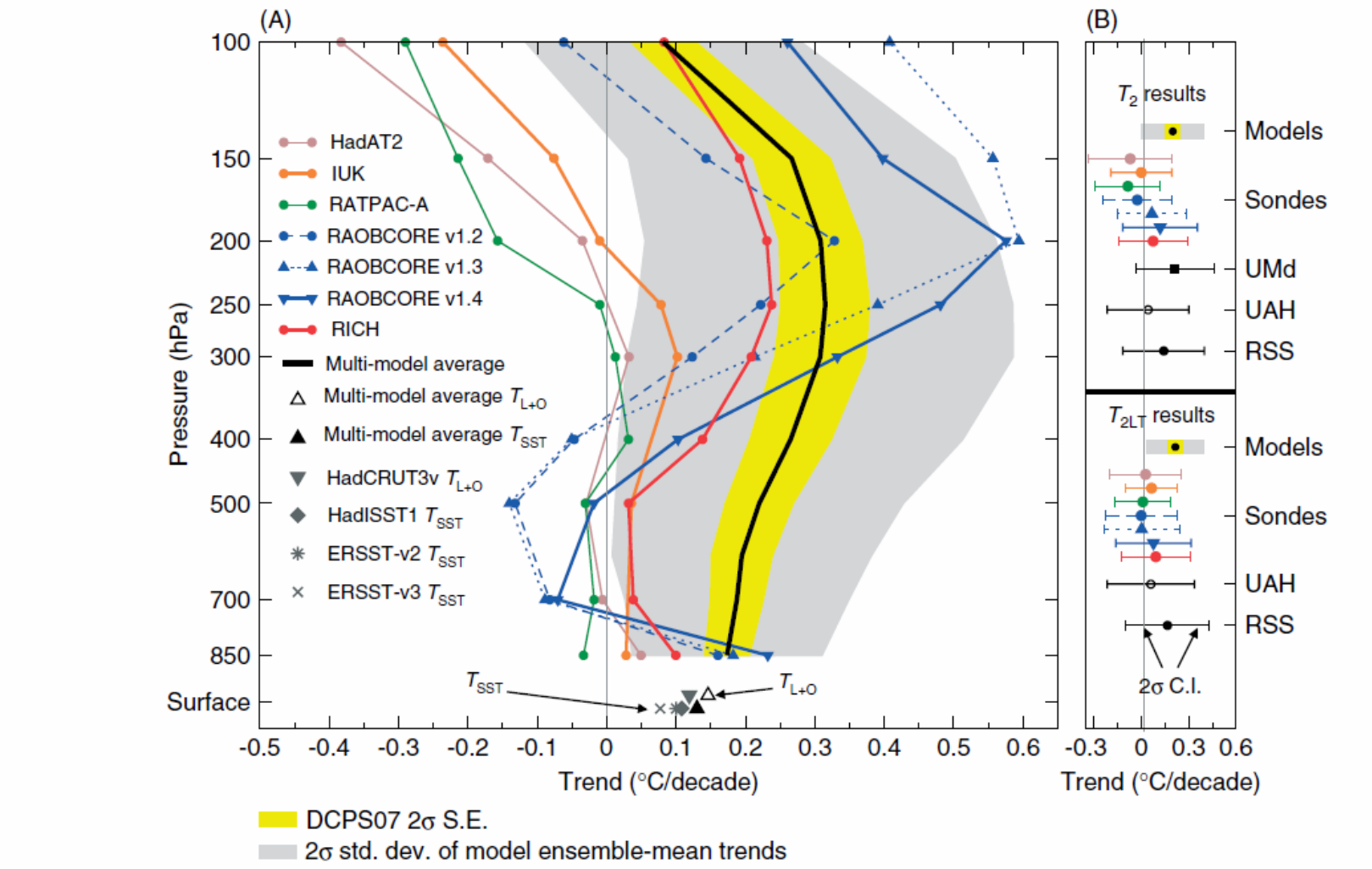
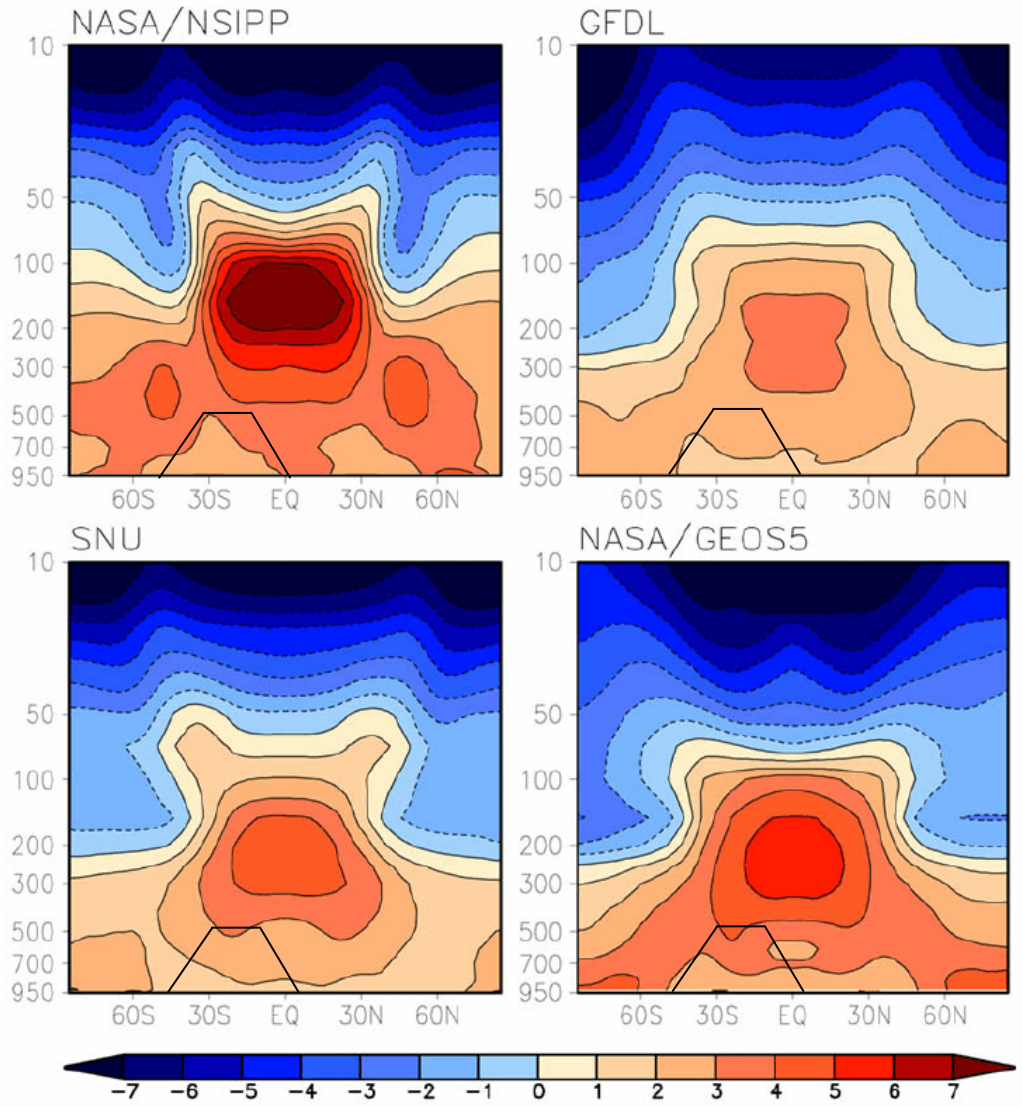



Figure 6. Vertical profiles of trends in atmospheric temperature (panel A) and in actual and synthetic MSU temperatures (panel B).

Santer et al. 2008 (IJOC)

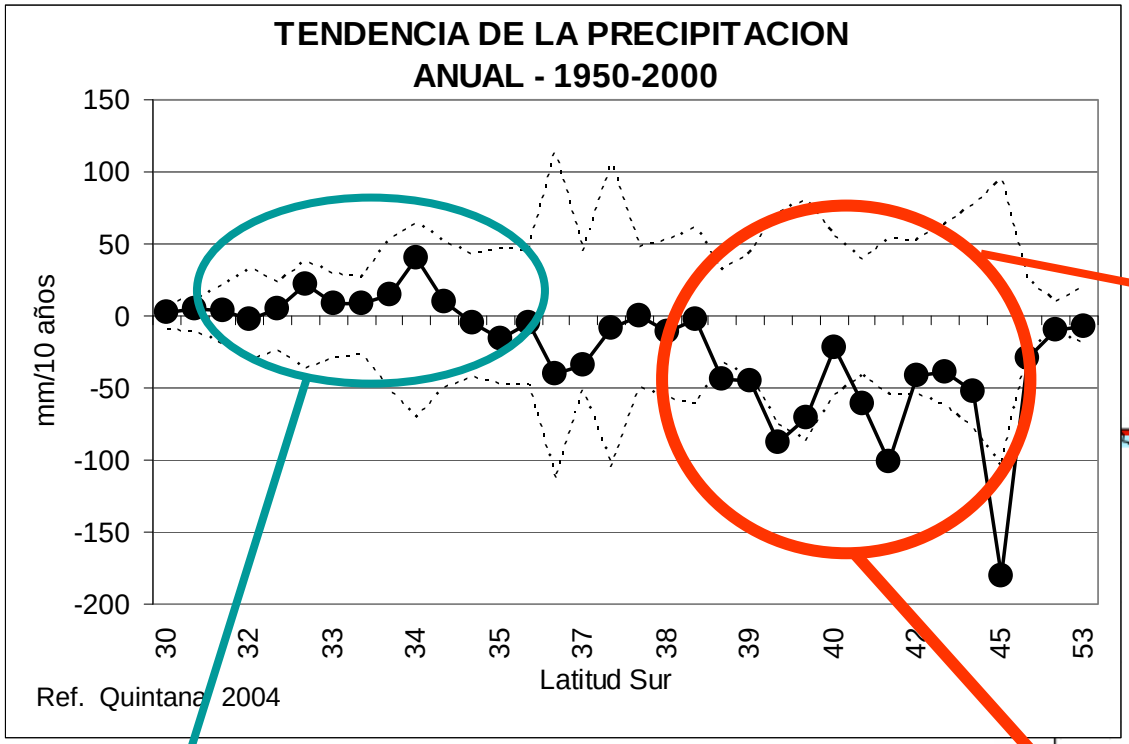
# Zonal mean distribution of temperature change (2xC02-Ctr)



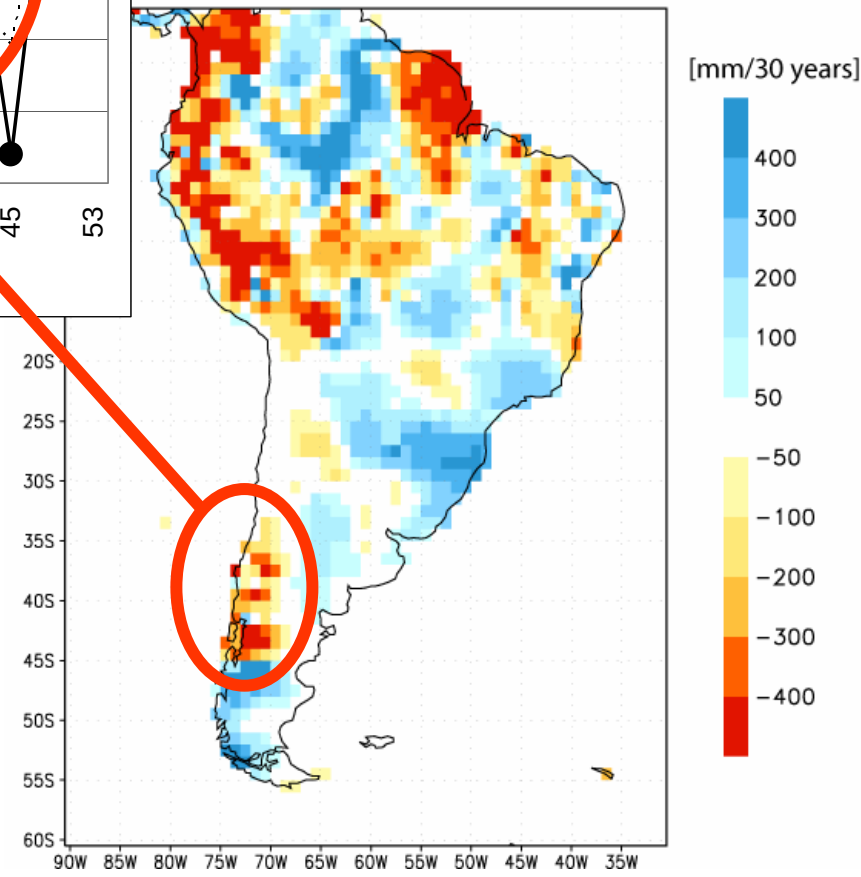

Zonal mean distributions of temperature change (2×CO2–Control). Units are Kelvin.

**Figure 4**: Zonally averaged, equilibrated temperature change associated with doubling $CO_2$ as a function of latitude and pressure for four different GCMs. From Lee et al, 2007.

# Precipitation Changes….warming, drying south

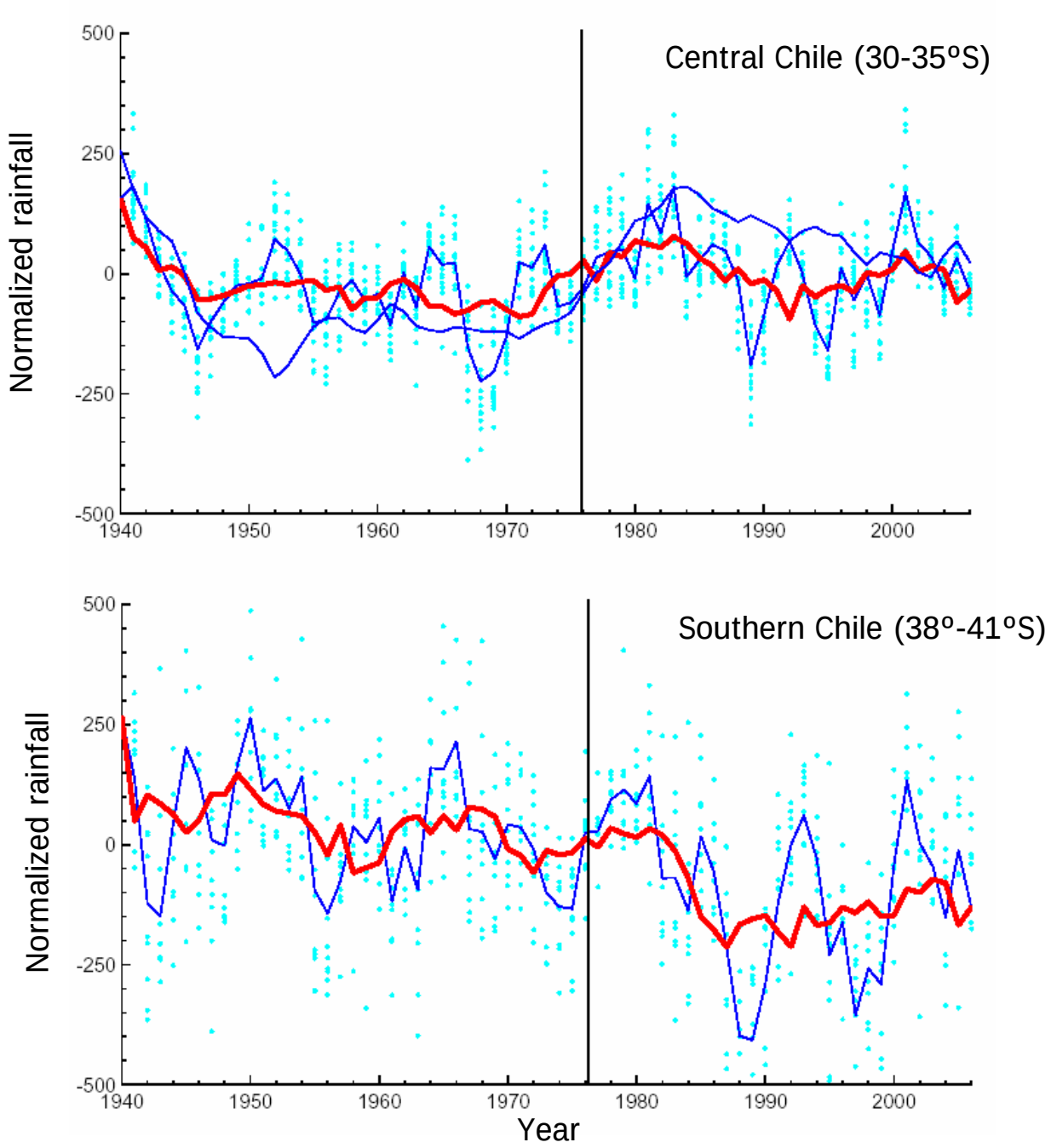



- Rainy climate
- MAP ~ 1000-3000 mm
- σ(IA)/MAP ~ 0.1
- Weak ENSO Impact
- Significant drying trend

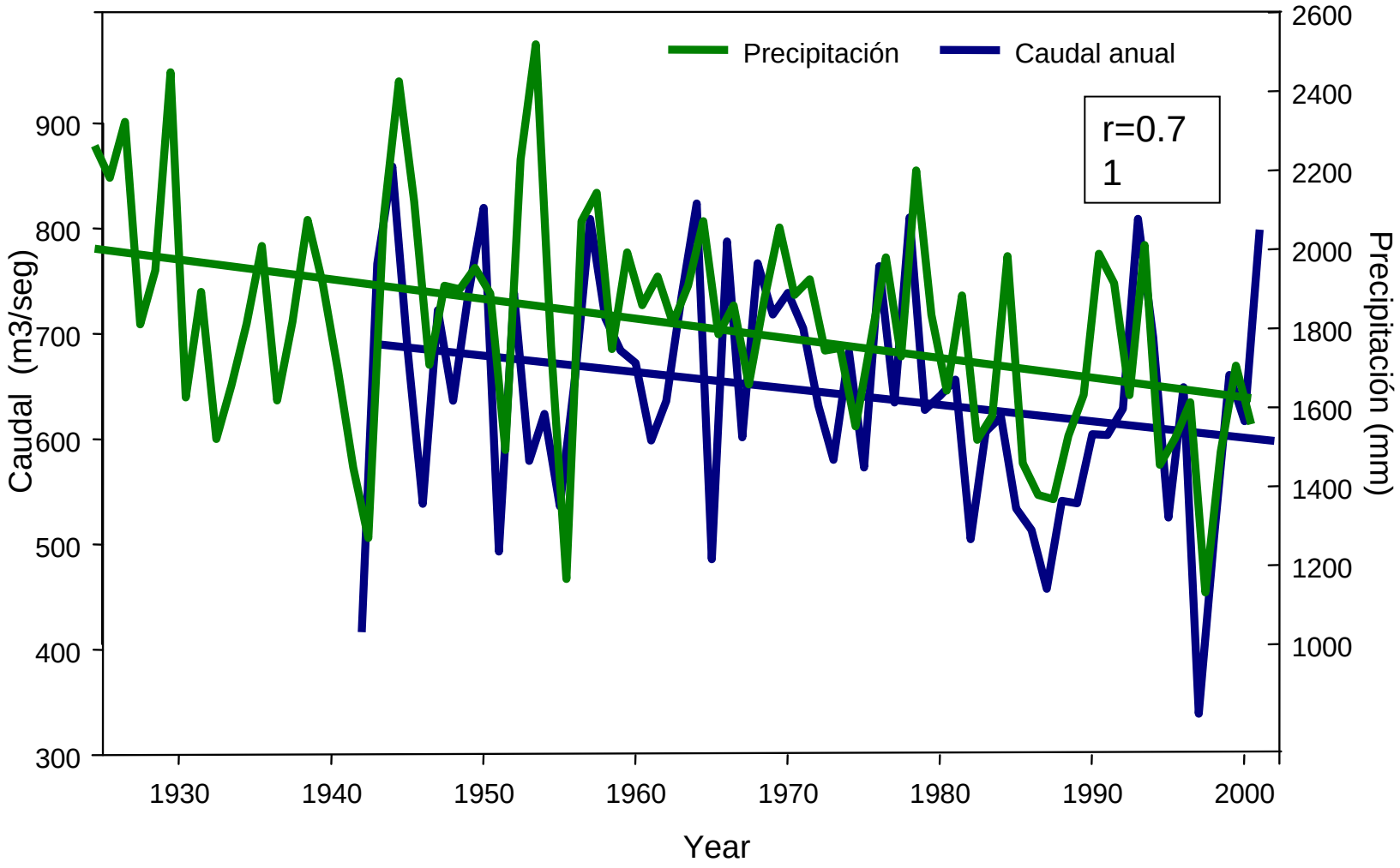



- Semiarid climate
- MAP ~ 30-500 mm
- σ(IA)/MAP ~ 0.3 – 0.5
- Strong ENSO Impact
- No significant trend

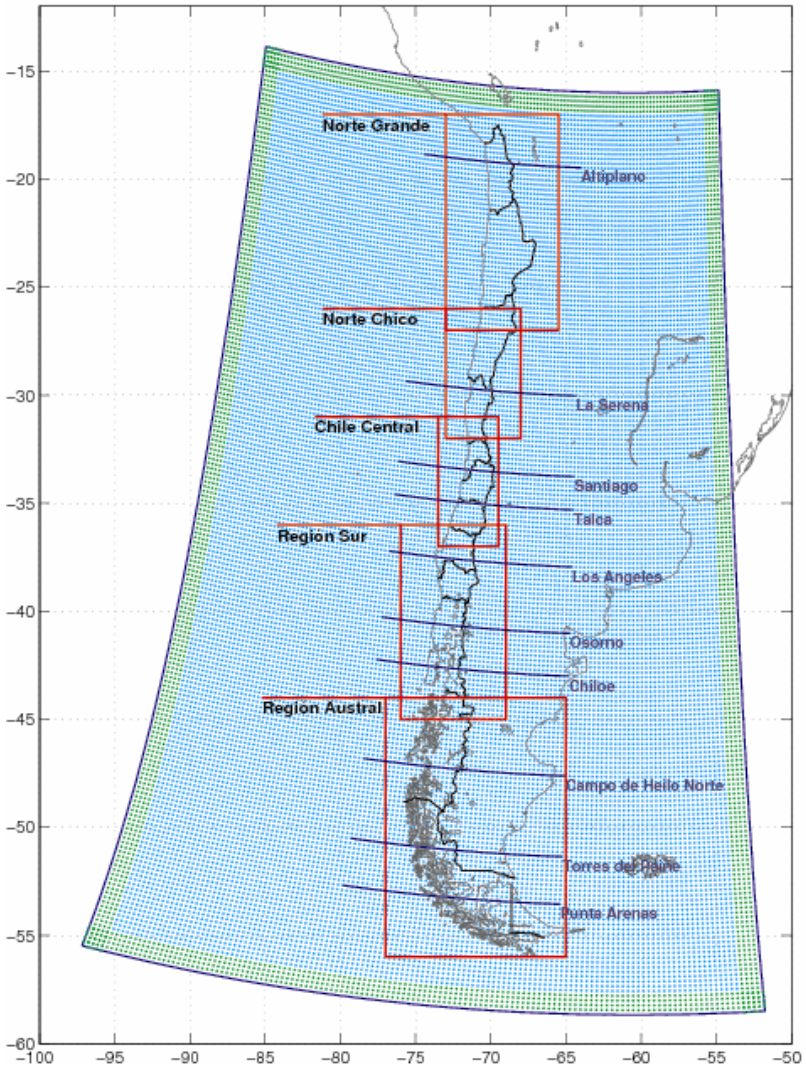
# Evolución de las Precipitaciones



# Comparación entre la precipitación de Pto. Montt y el caudal del Río Puelo (Fuente: Antonio Lara, UACH)



# Regional Simulations of the Future




**Model:**

- PRECIS – UK

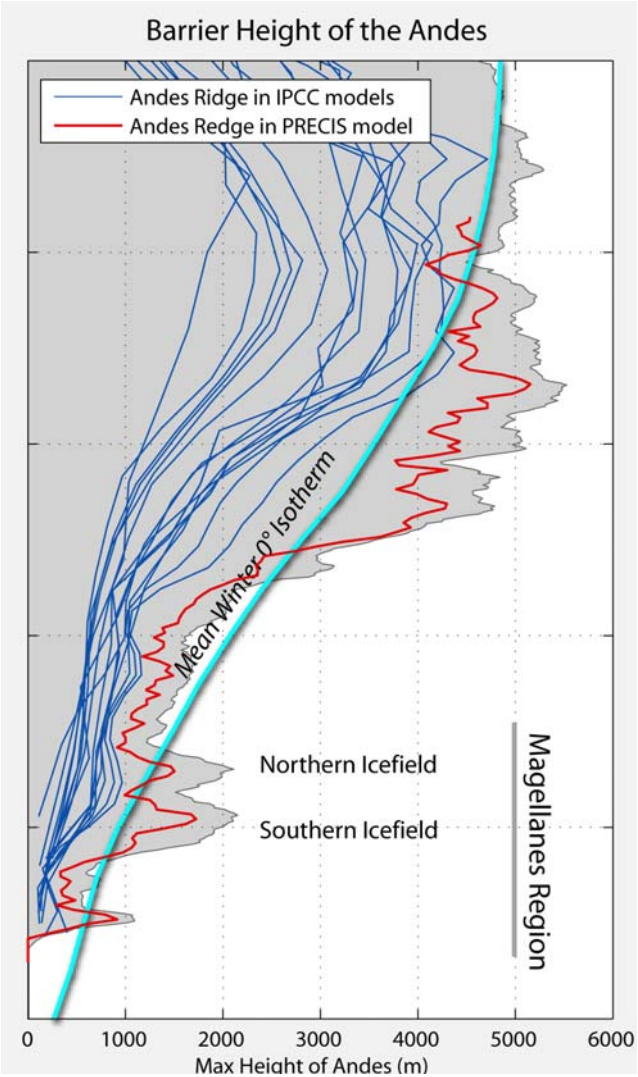
**Single domain**

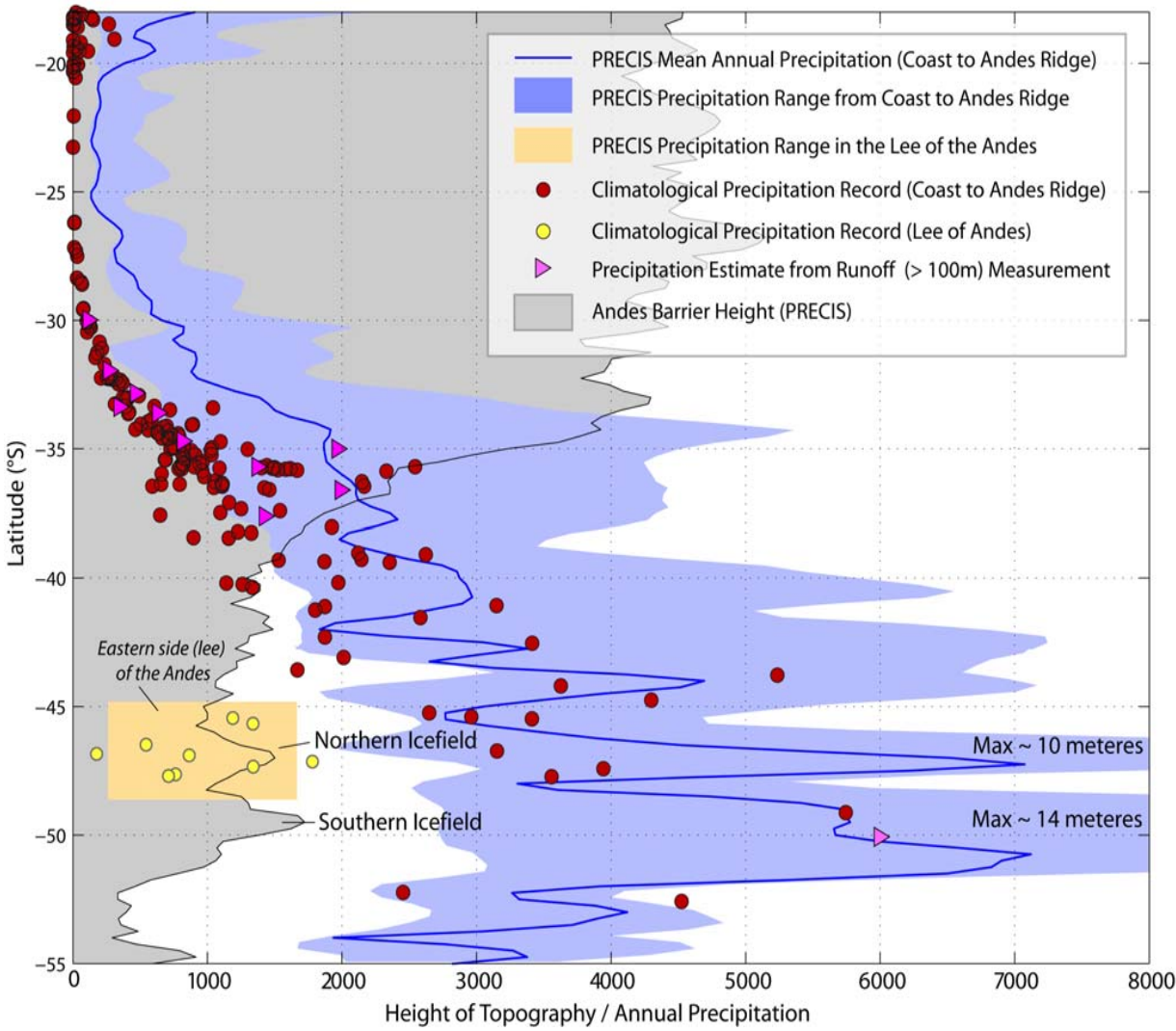
- Horiz. grid spacing. 25 km
- 19 vertical levels
- Lateral BC: HadAM every 6h
- Sfc. BC: HadISST1 + Linear trend

**Simulations**

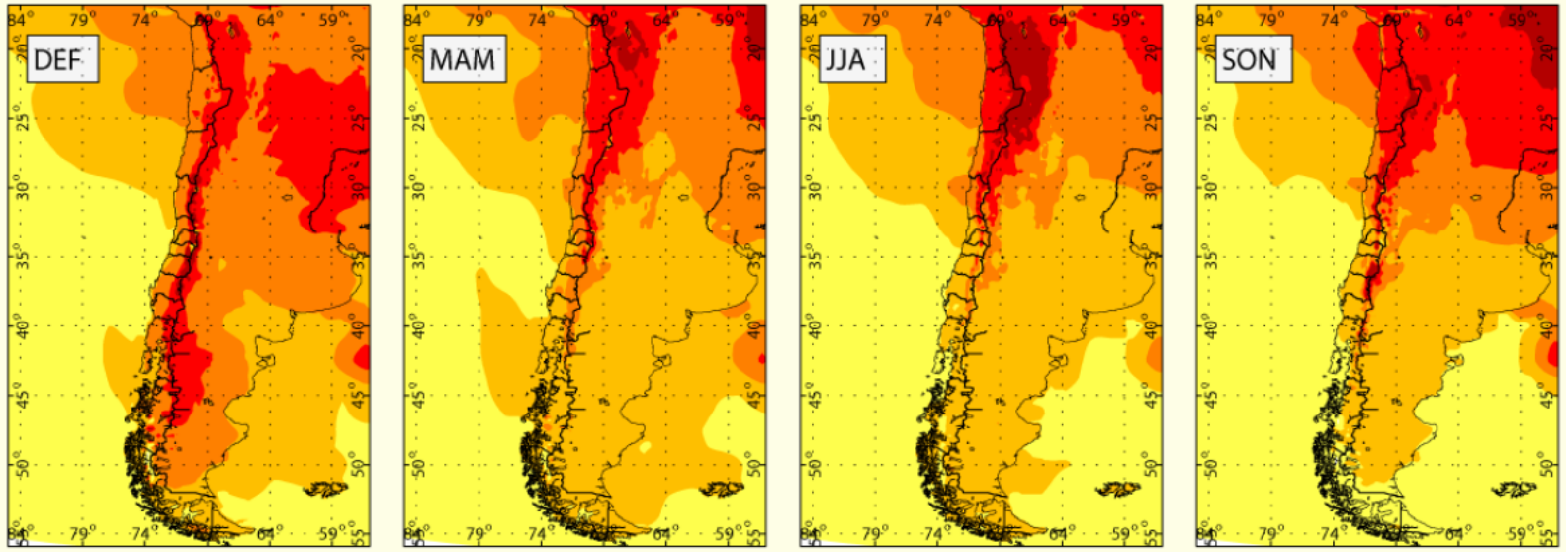
- **1961-1990 Baseline**
- **2071-2100 SRES A2 y B2**
- 30 years @ 3 min → 4 months per simulation in fast PC

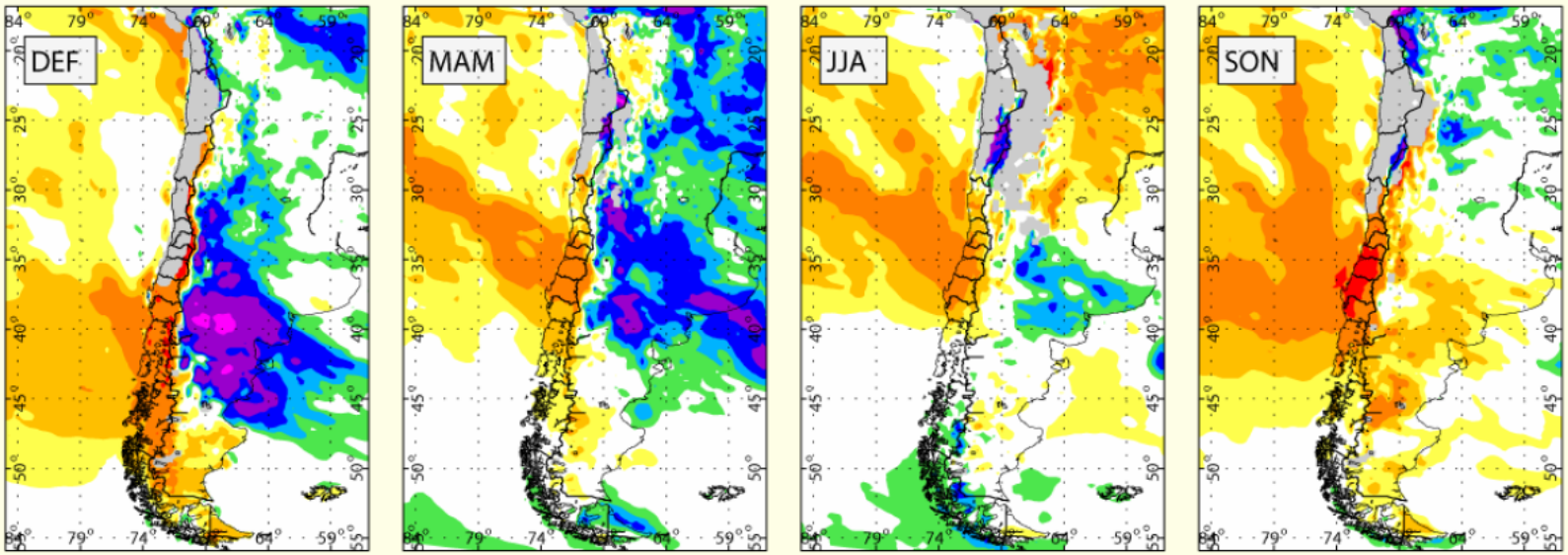
# Regional Simulations of the Future



# Projected Changes PRECIS-DGF

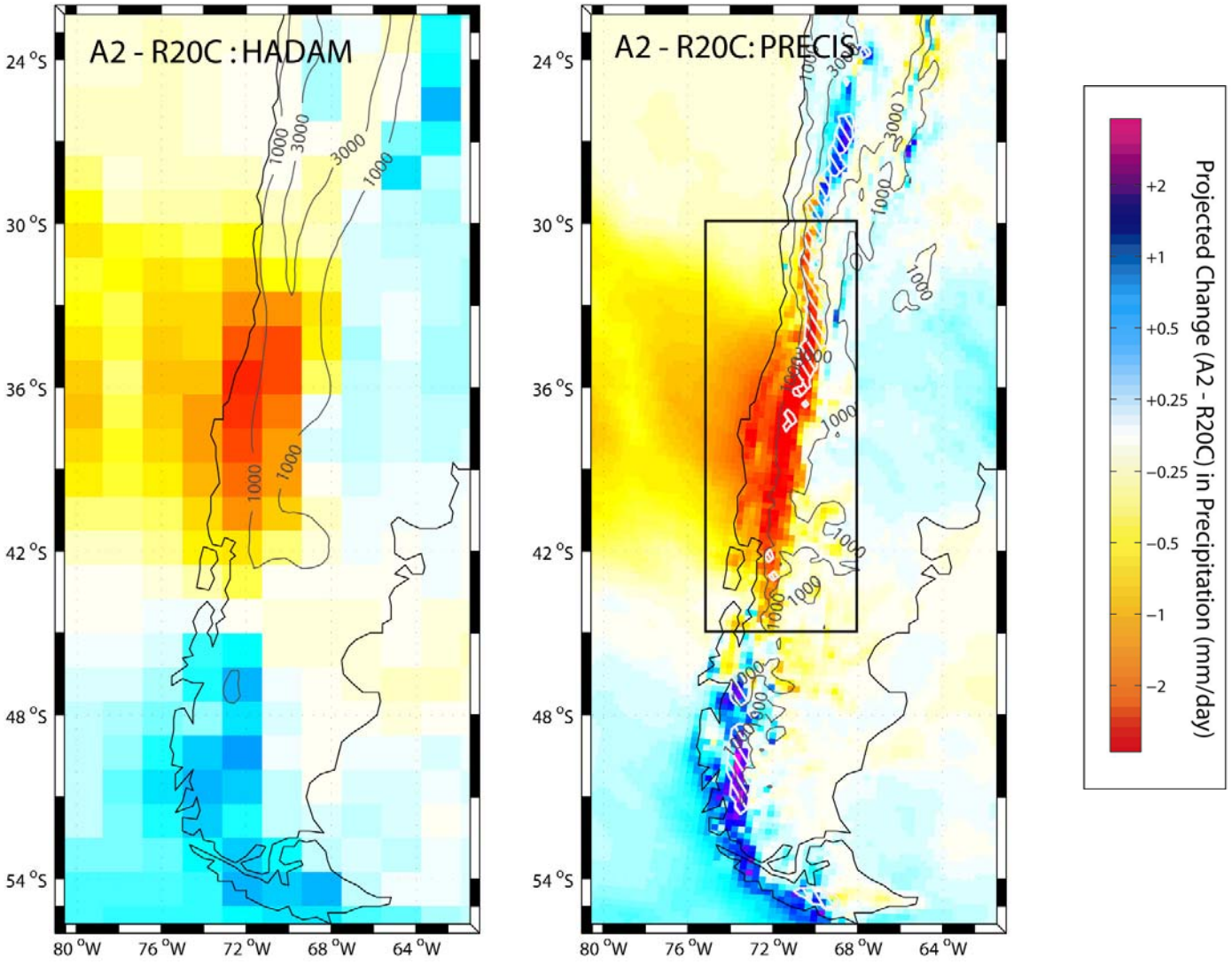


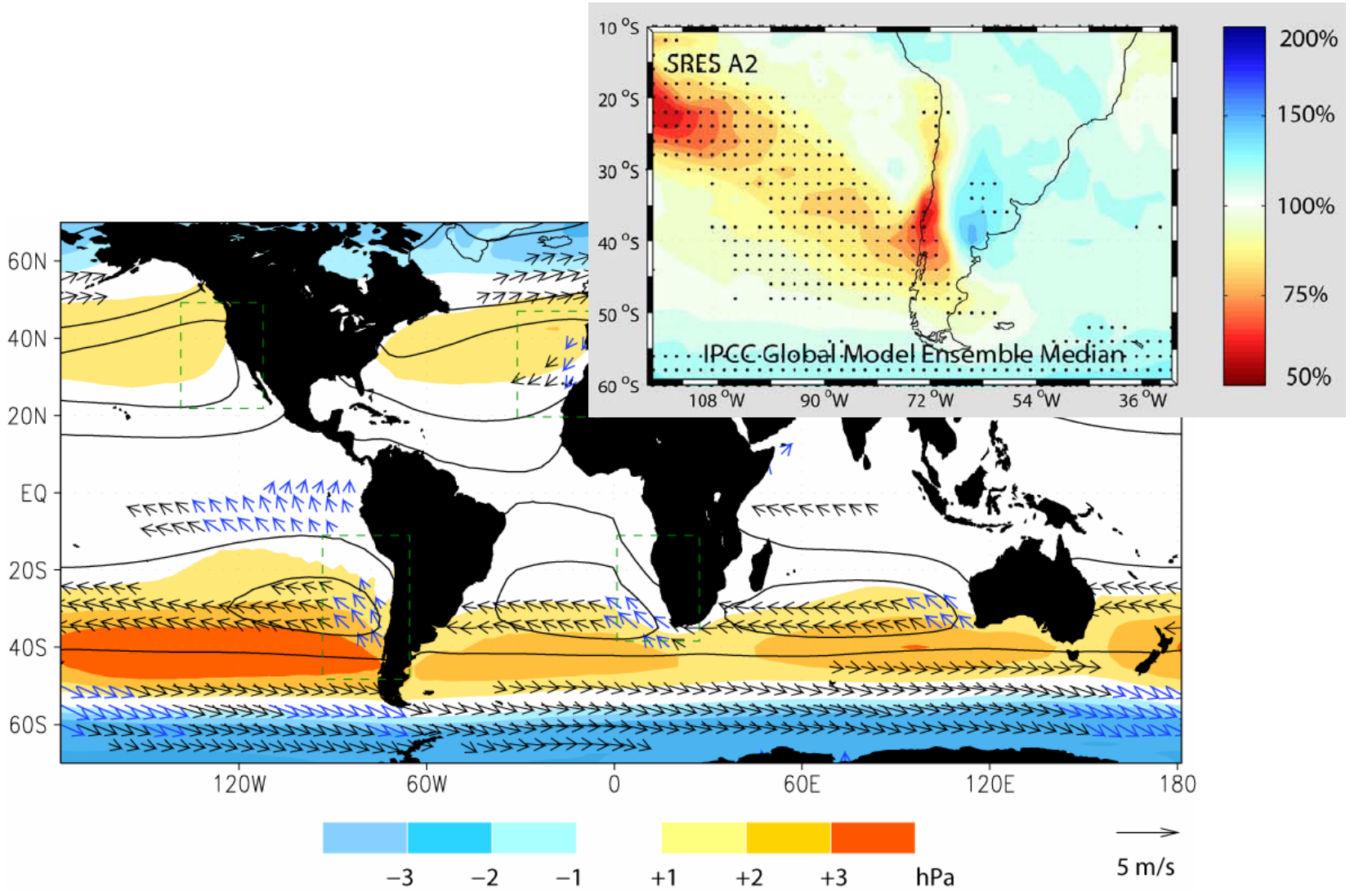

Futuro: 2071-2100 / Presente: 1960-1990

# Projected Changes PRECIS-DGF

Large scale precipitation changes also similar to parent model. Changes (both positive and negative) are strongest on the western (upwind) side of the Andes.



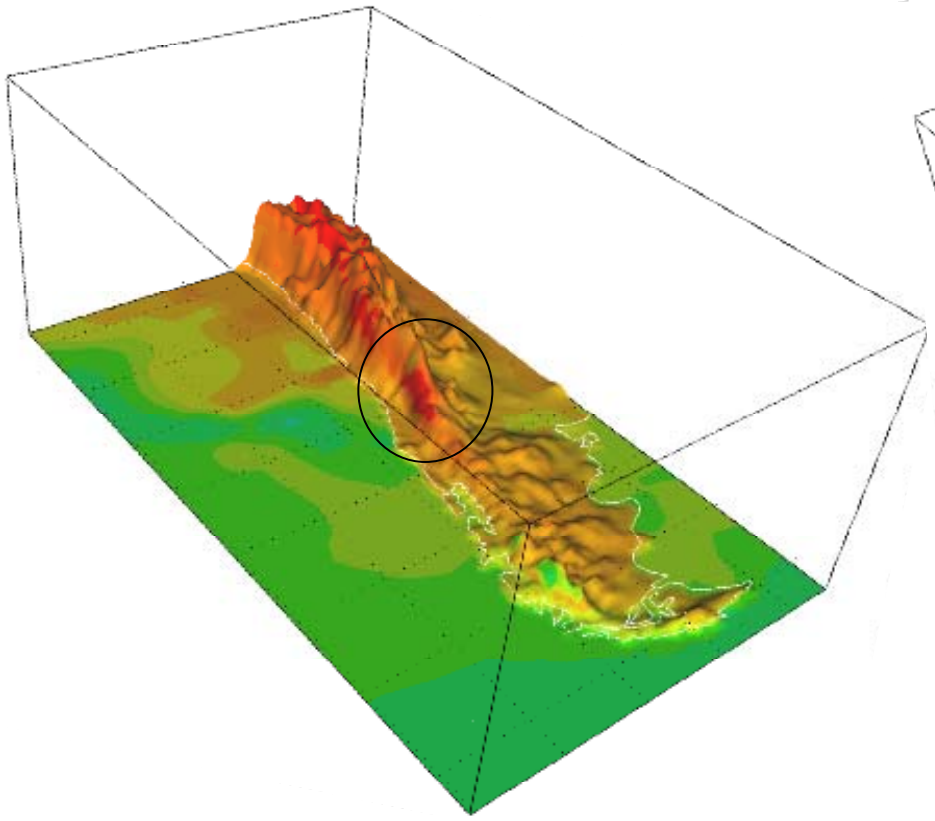
# Projected Changes PRECIS-DGF




**Strengthening of the poleward flank of subtropical anticyclones and poleward shift of the midlatitude storm track is very consistent among GCMs**

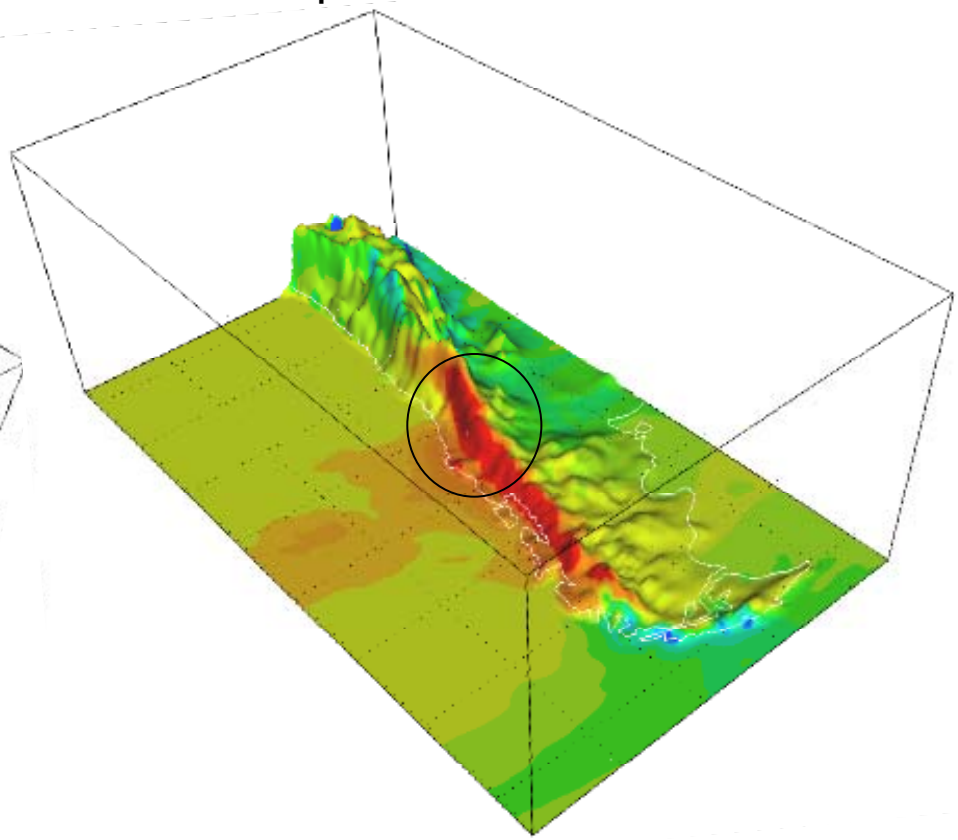
# Diferencias A2(2100-2070) – BL(1960-1990)

Temperatura Superficial



-1° 0° 1° 2° 3° 4° 5° C

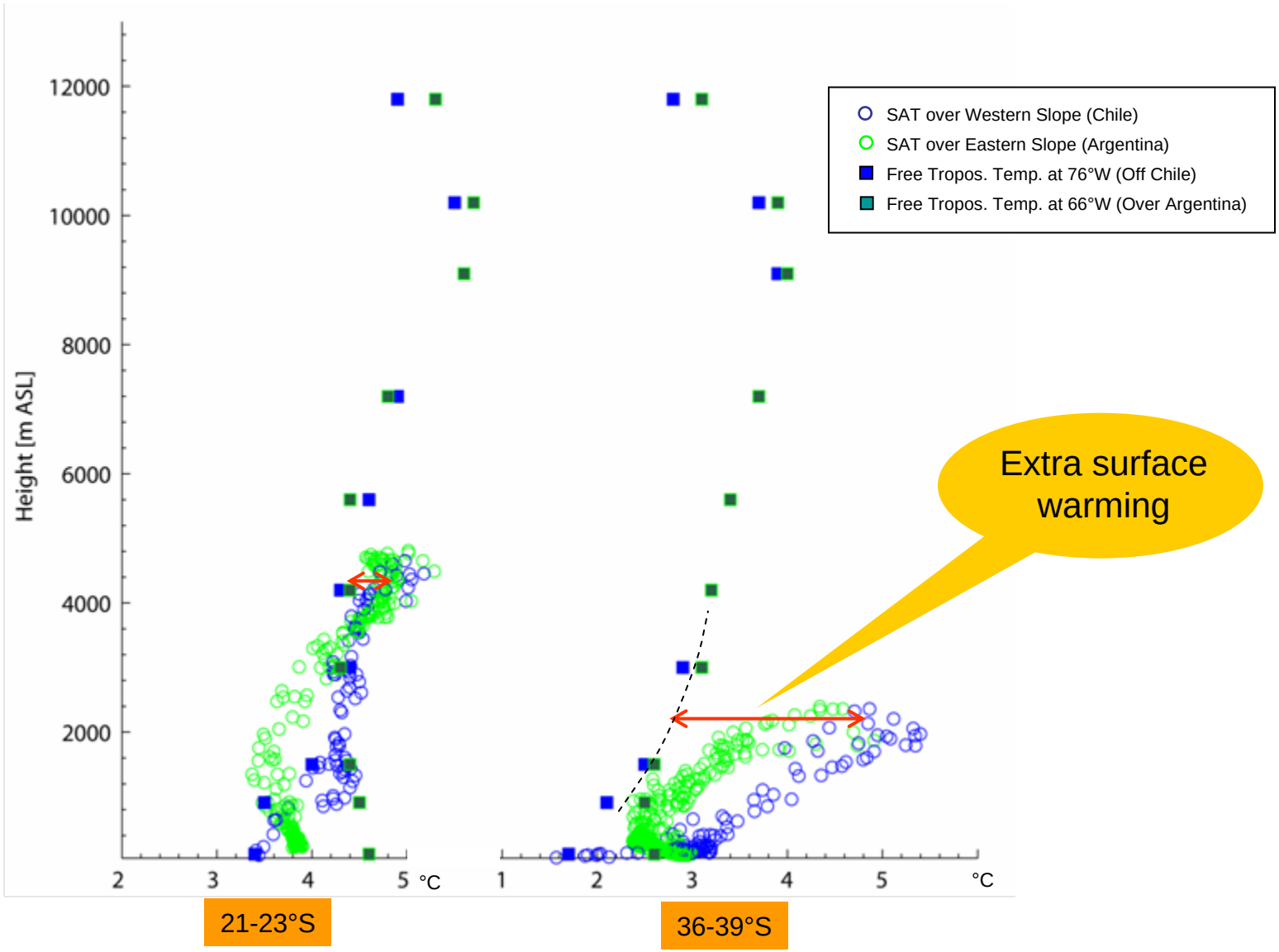
Precipitación



-50 0 +50 mm/mes

PRECIS-DGF-UCH

# ΔT (A2-BL) versus Height



# Conclusions

- Meteorological data in south-central Chile is (marginally) enough to resolve current climate trends…mostly in agreement with ACC expectations (land warming, coastal cooling).
- In contrast, climate records in southern Patagonia not enough to evaluate trends.
- GCMs and RCMs indicate a few robust climate changes in southern Chile: southward expansion of the semi-arid climate, warming in the Andes.
- RCMs outputs reliable enough to evaluate changes in cryosphere using intermediate models