Extreme Monthly Events in Southern South America

(1958-2001)

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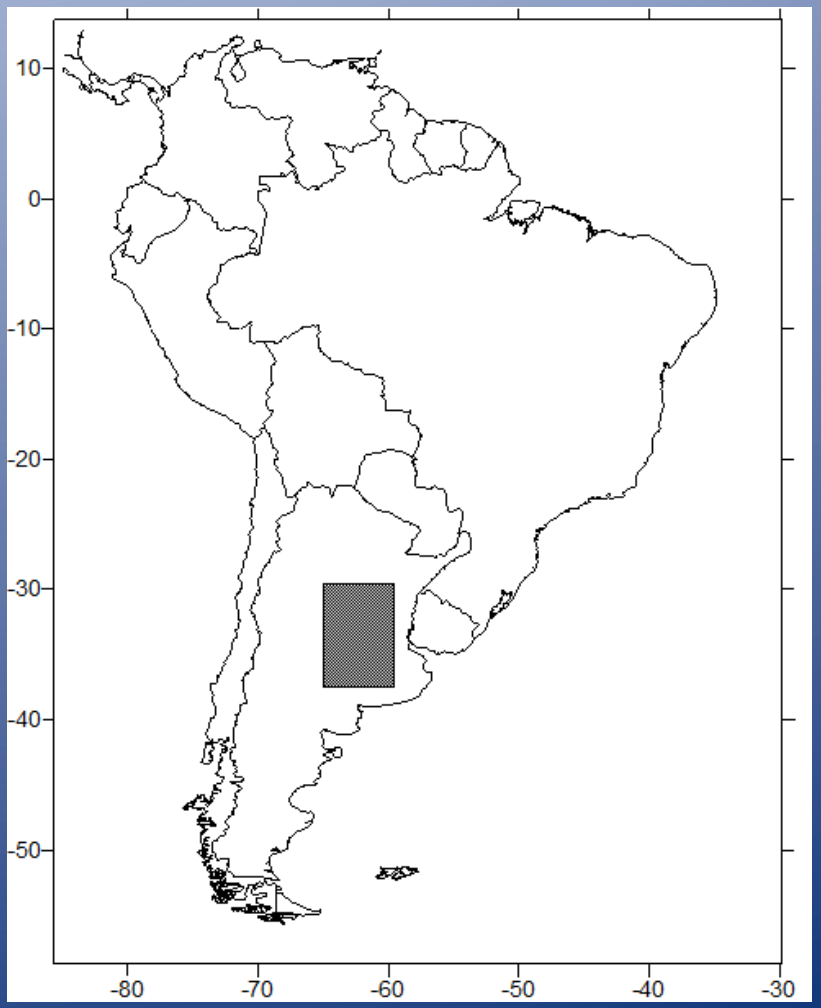
Warm January – Cold July

DATA:
Atmosphere: ECMWF 40 Year Re-analysis (ERA-40) Data (1957-2002)
Ocean (SST): GISS Surface Temperature Analysis

Central Argentina Area – Pampa húmeda

- Lat 30°-38° S
- Lon 65° - 60° W

- Highly populated region and important agricultural area.



Relationship between Temperature and Circulation in Southeastern South America and its Influence from El Niño and La Niña Events

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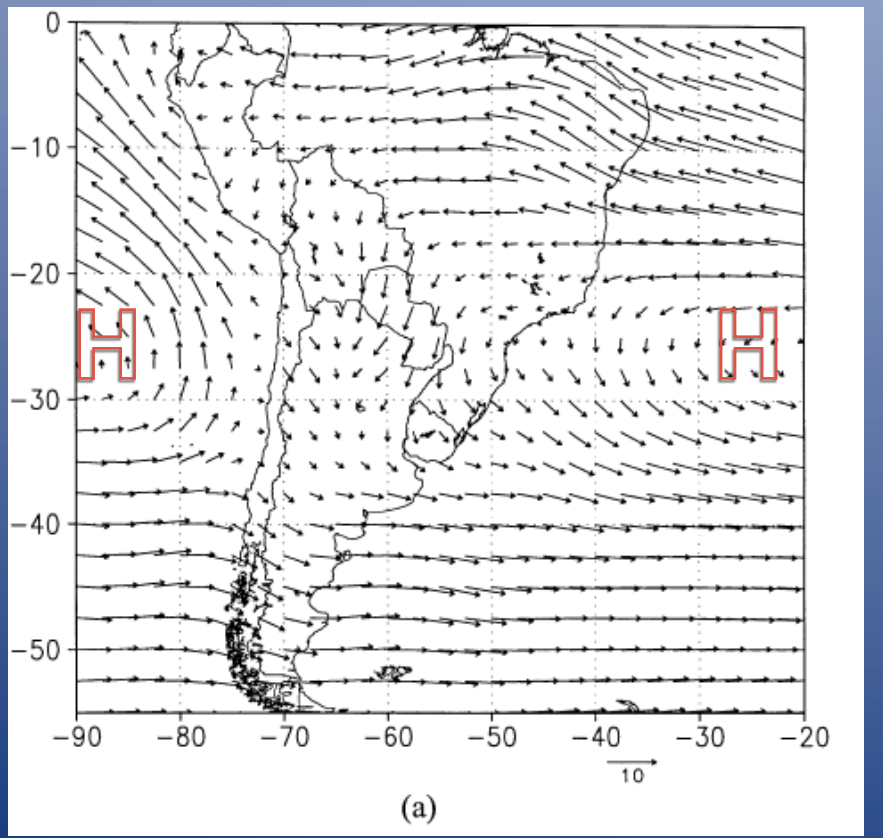
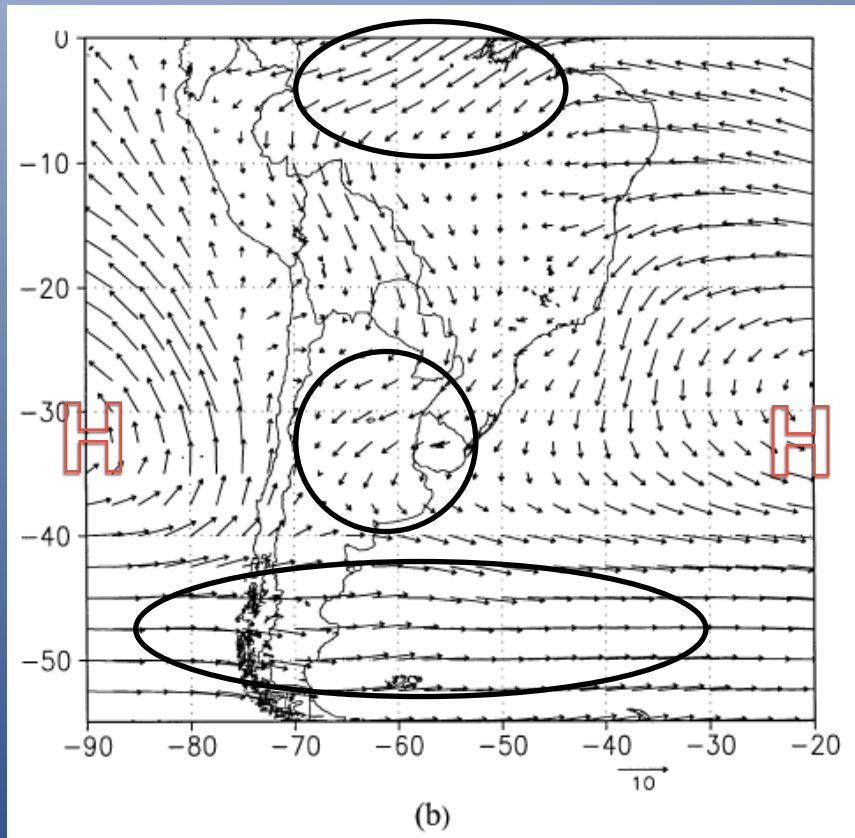


(a)

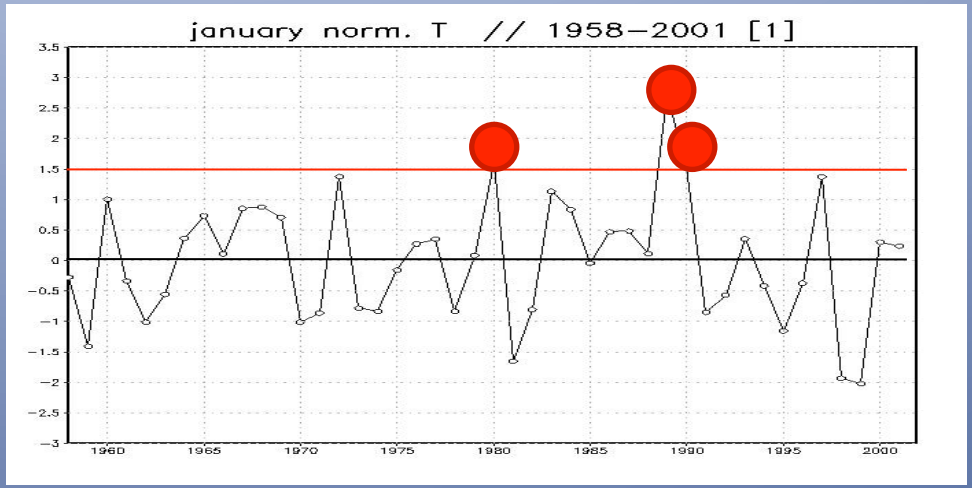


(b)

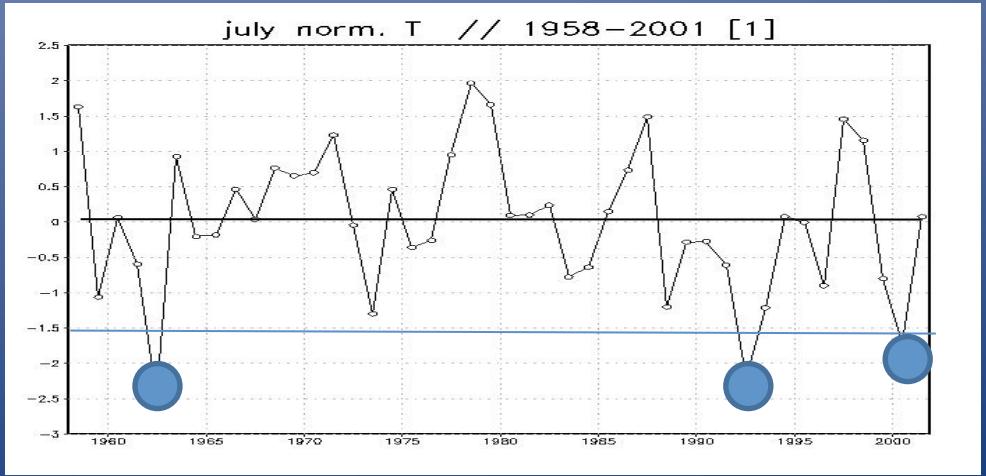
Fig. 2. Mean 925 hPa wind (m/s) field of the 1963–1990 period for (a) July and (b) January.

- Composites
  - 3 ‘extreme’ years in the area for each month

- Warm January:
  - » 1980
  - » 1989
  - » 1990



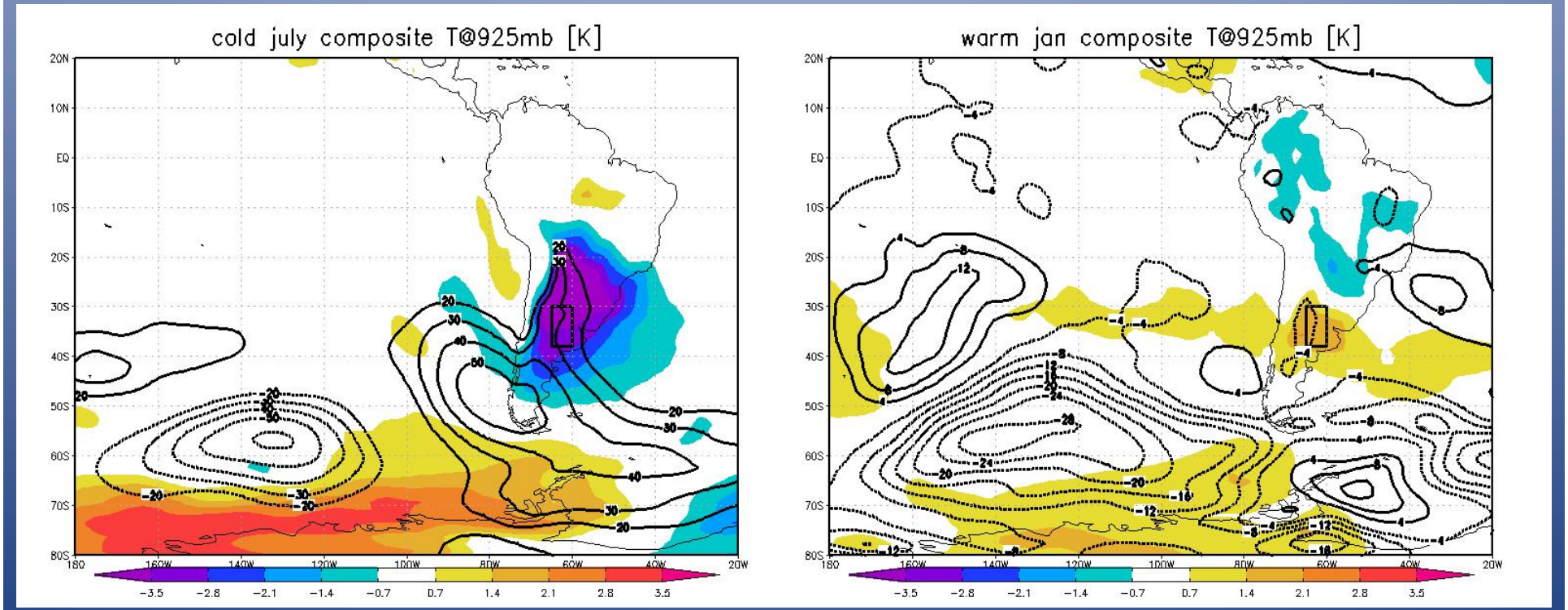
- Cold July:
  - » 1962
  - » 1992
  - » 2000



Temperature and GPH Anomalies (925 mb)

July

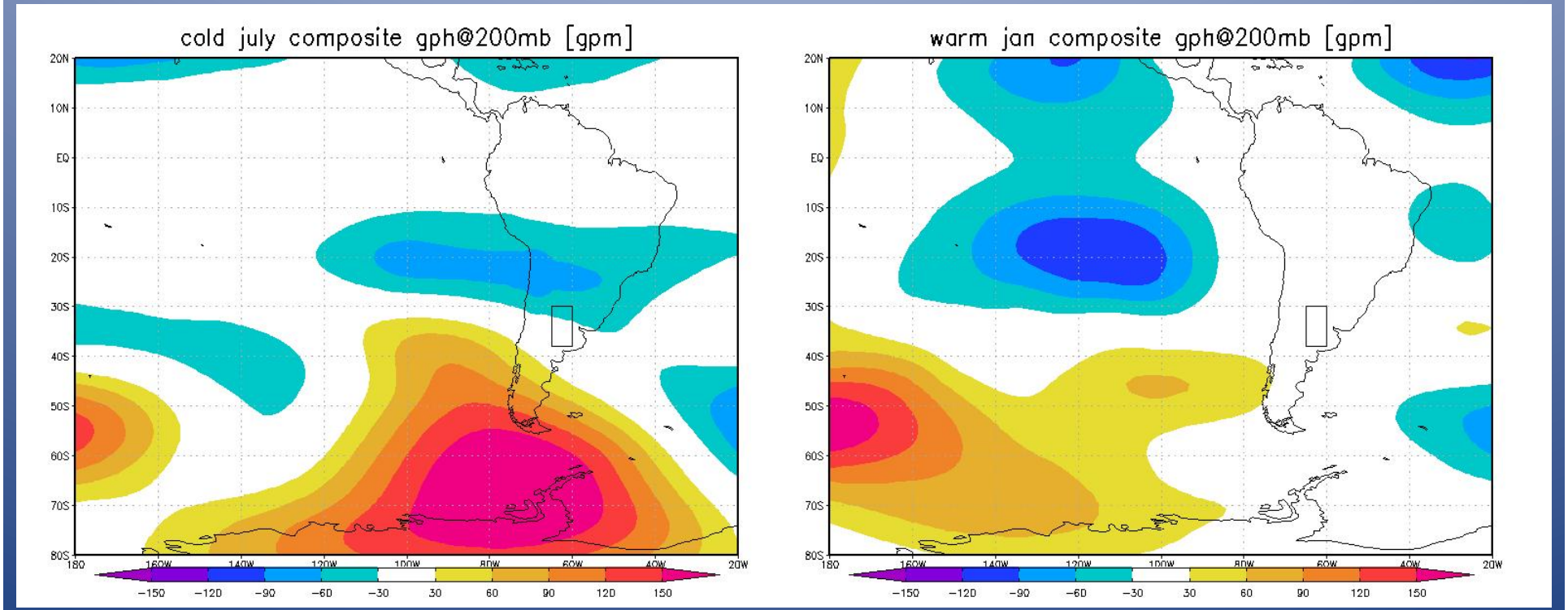
January



GPH Anomalies (200 mb)

July

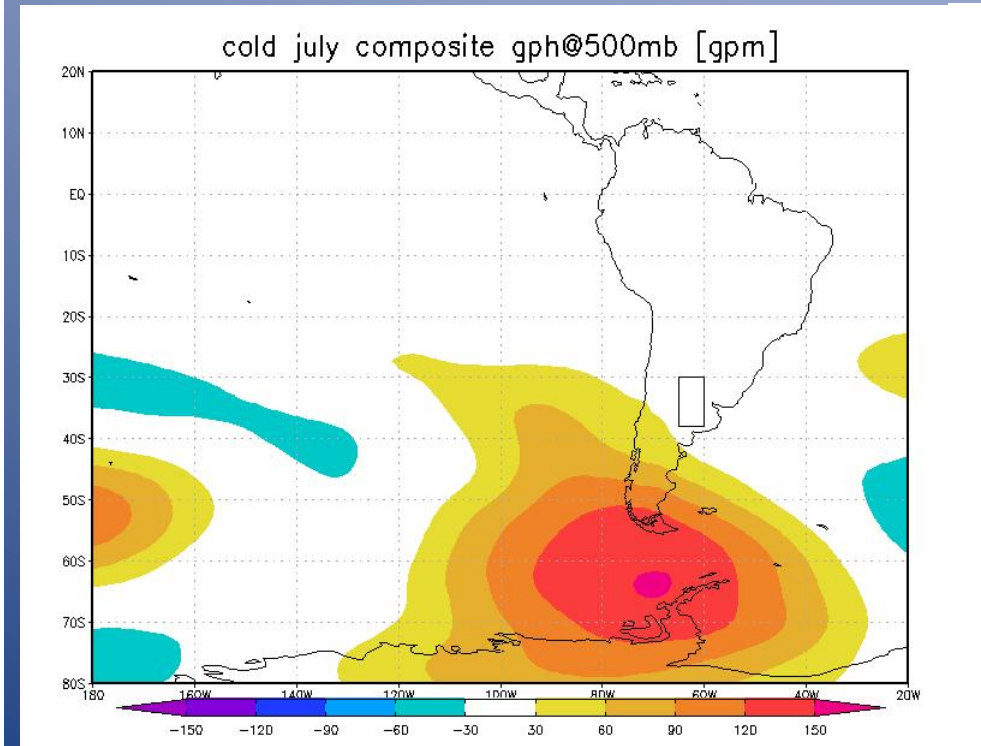
January

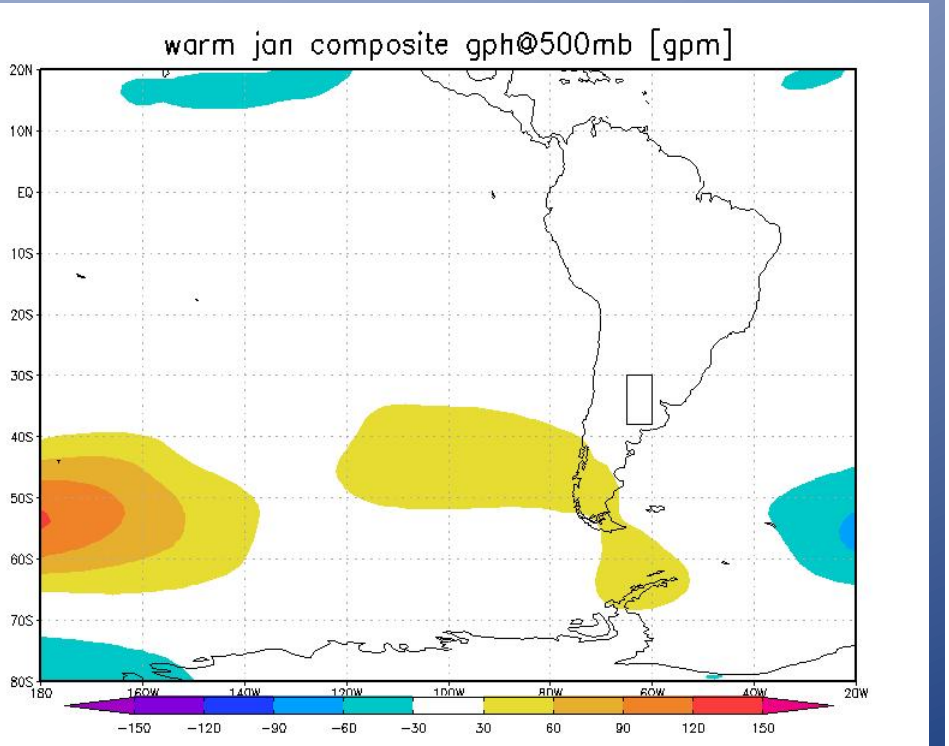


GPH Anomalies (500 mb)

July

January

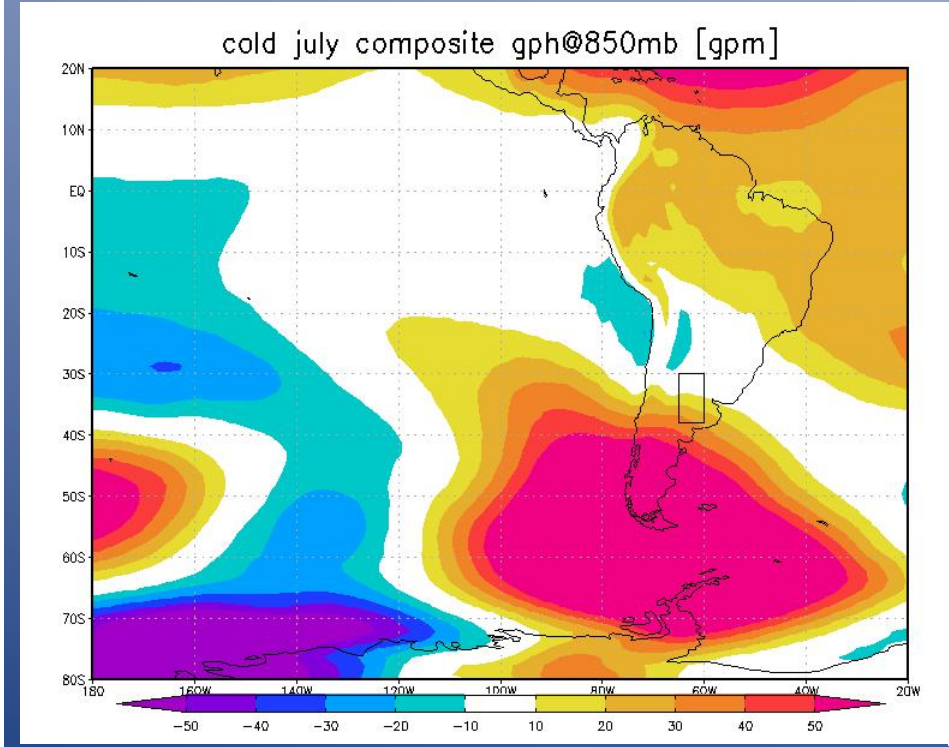


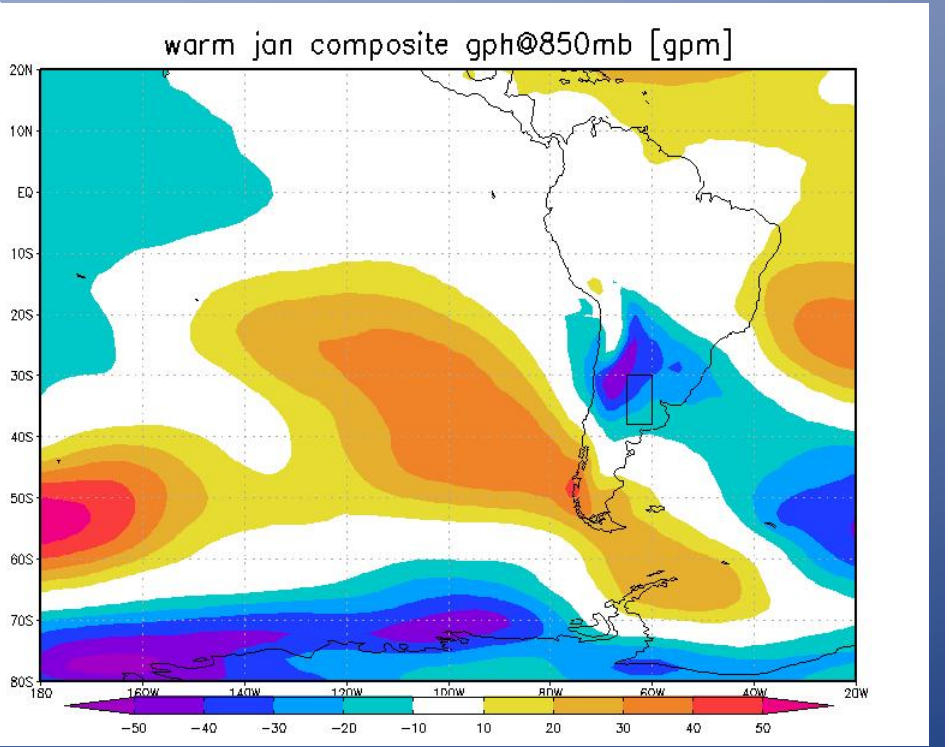


GPH Anomalies (850 mb)

July

January



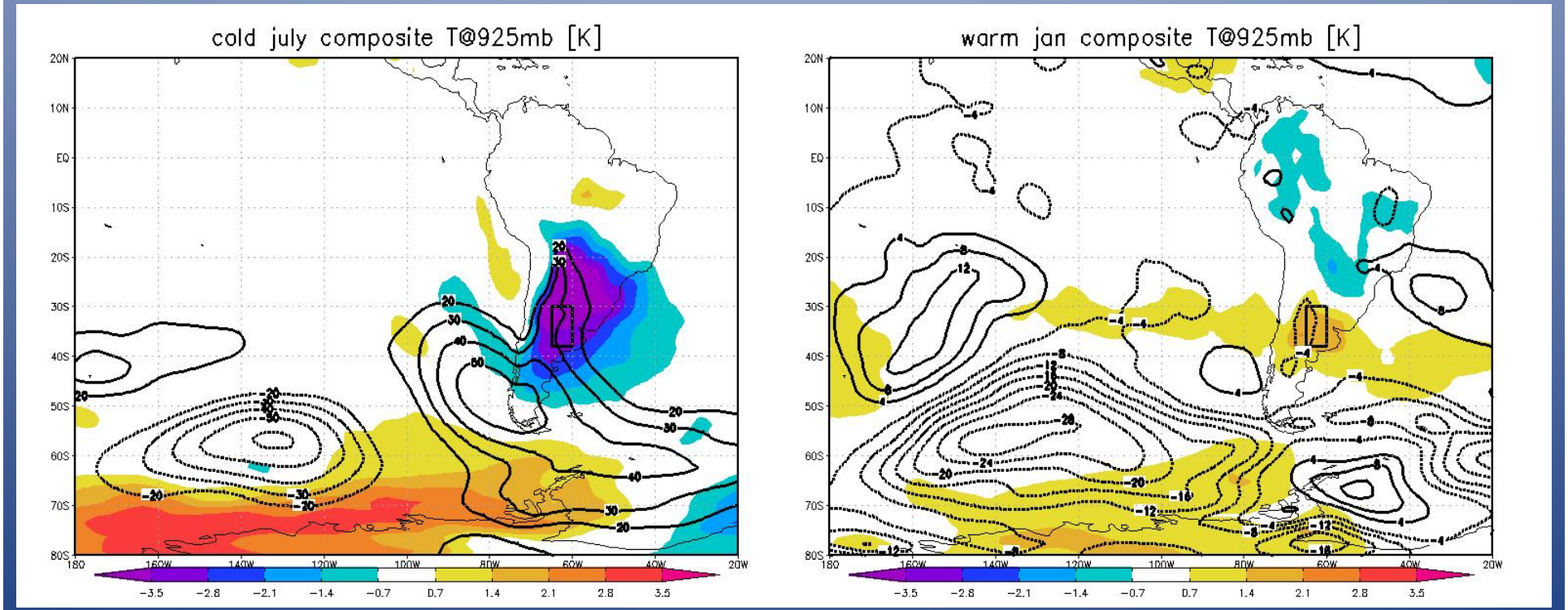


For the extratropical Chilean coast the most relevant anomalous winter feature [ENSO teleconnection pattern] is an anticyclonic circulation over the Bellingshausen Sea advecting cold polar air over the austral part of South America. [Rosemblueth et al., 1997]

Temperature and GPH Anomalies (925 mb)

July

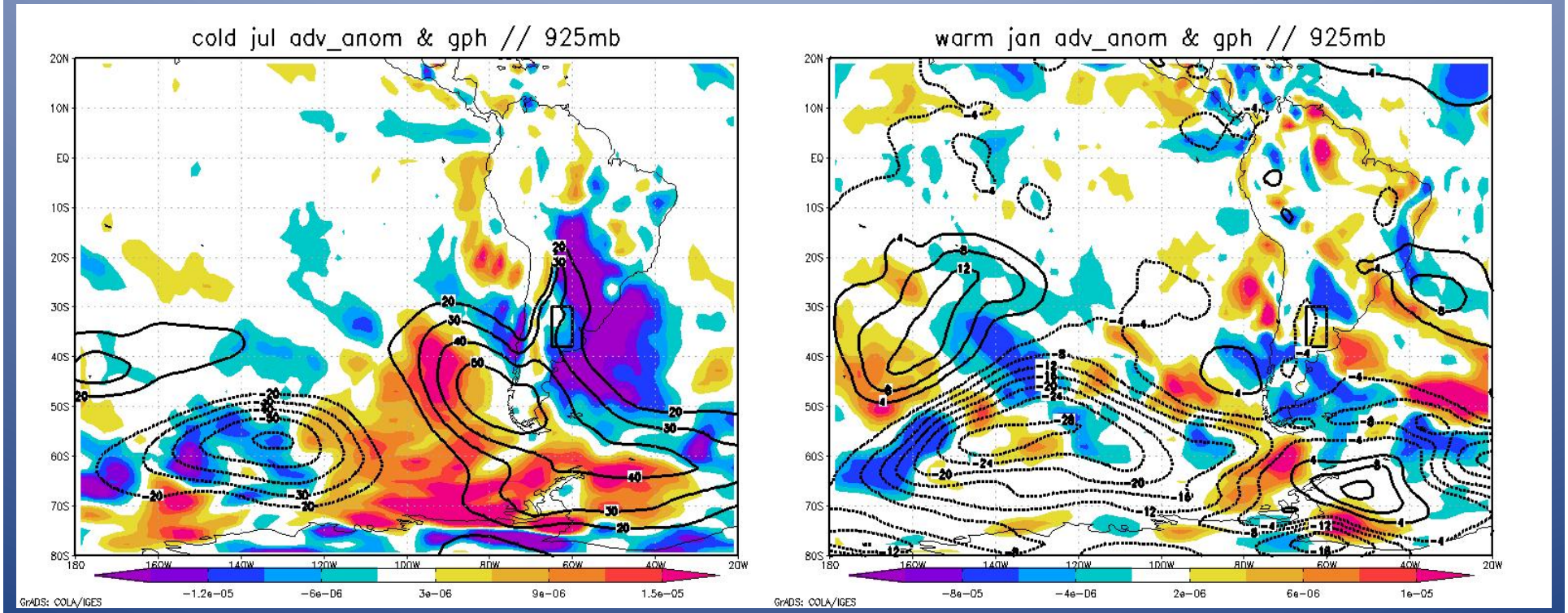
January



Temperature Advection Anomalies and GPH (925 mb)

July

January

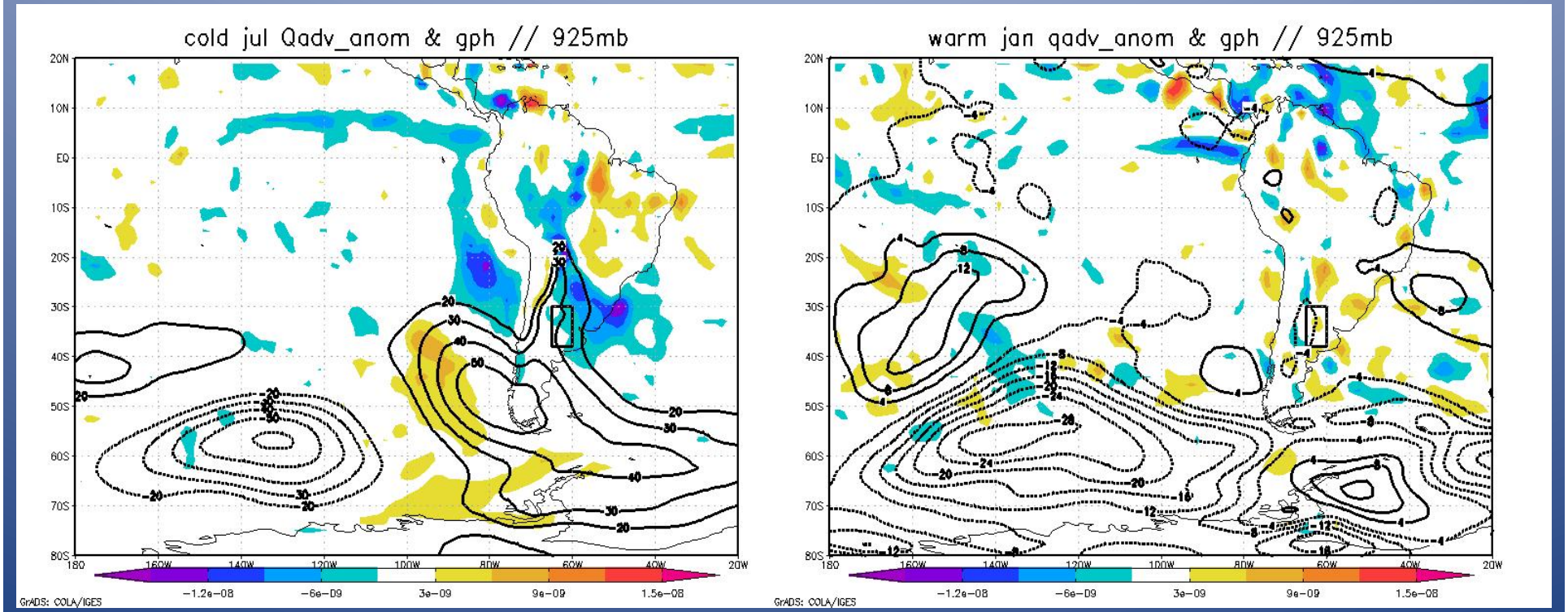


[Barros, Grimm & Doyle, 2002] The mean low-level flow over subtropical South America has a northern meridional component that contributes to the balance of heat. This meridional component, roughly estimated by the zonal geopotential gradient between the western border of the South Atlantic high and the Chaco Low, is associated with positive (negative) surface temperature anomalies Argentina and southern Brazil, especially in winter. **This relationship does not hold in central Argentina in summer**, when the cooling due to precipitation may offset the warming caused by the enhanced northern component of the flow.

Specific Humidity Advection Anomalies and GPH (925 mb)

July

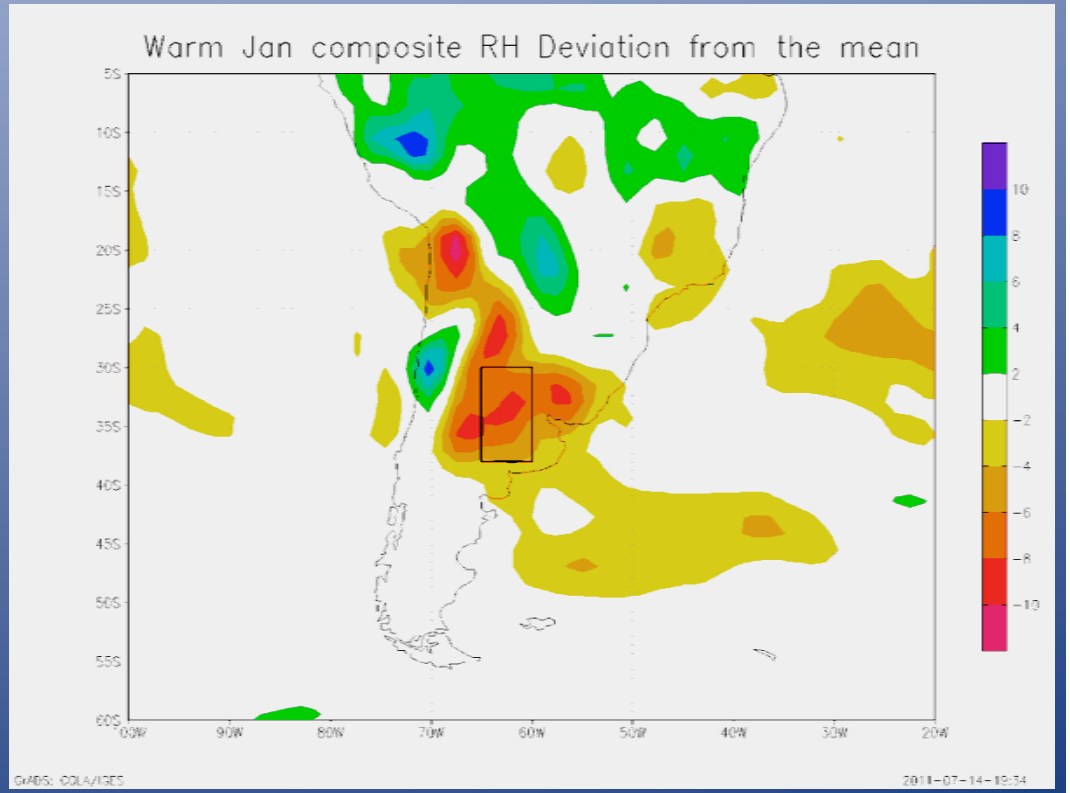
January



Relative Humidity Anomalies (lower levels)

January

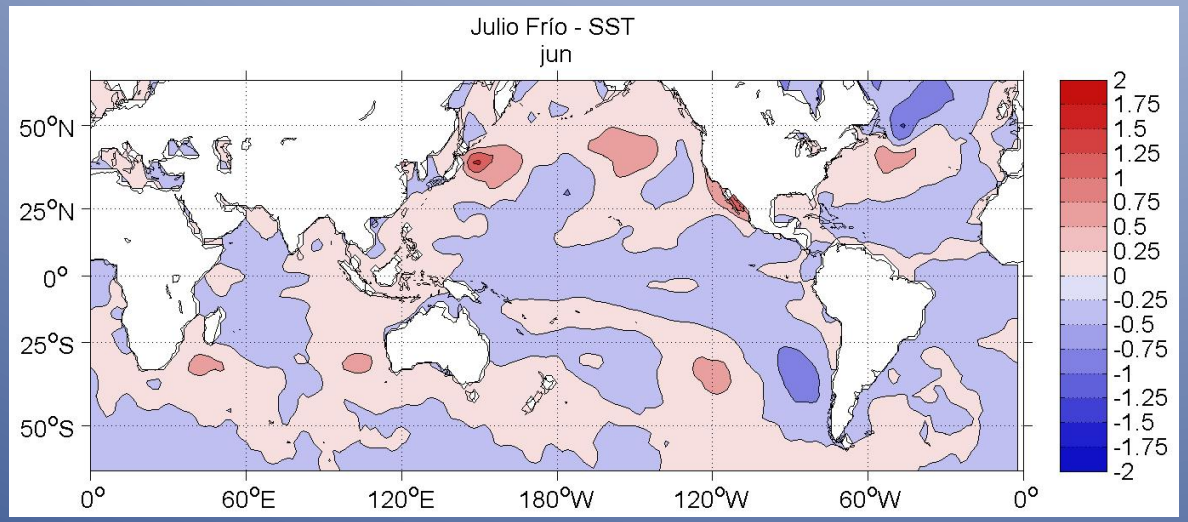
But RH is T-dependent!

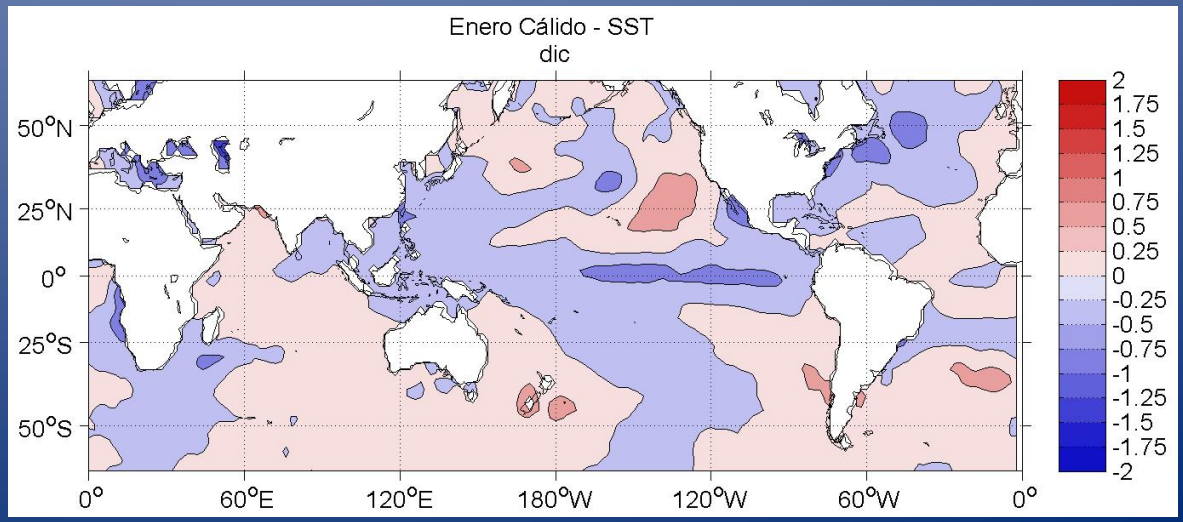


SST Anomalies m -1

July

January

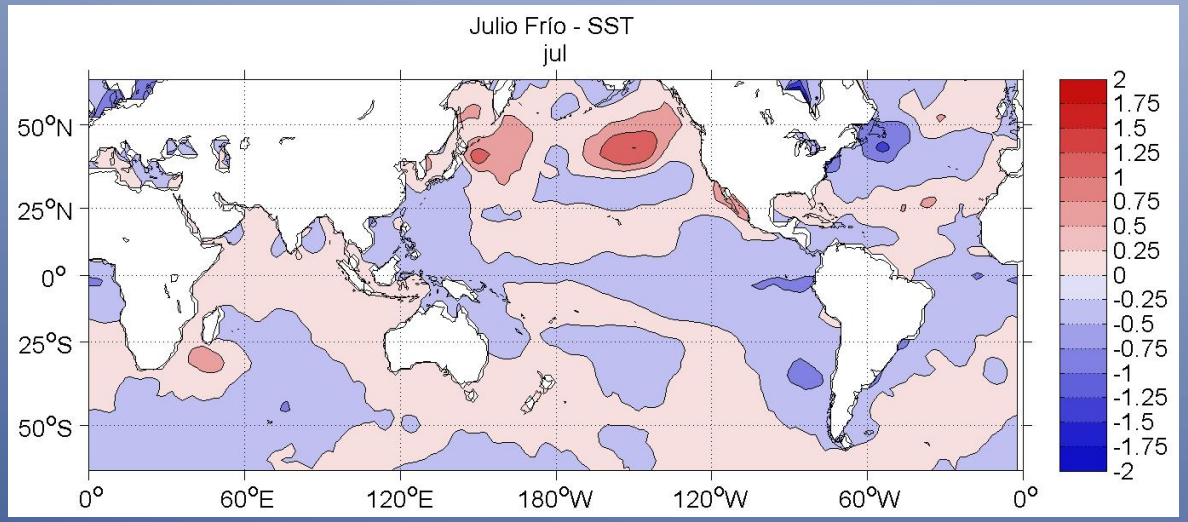


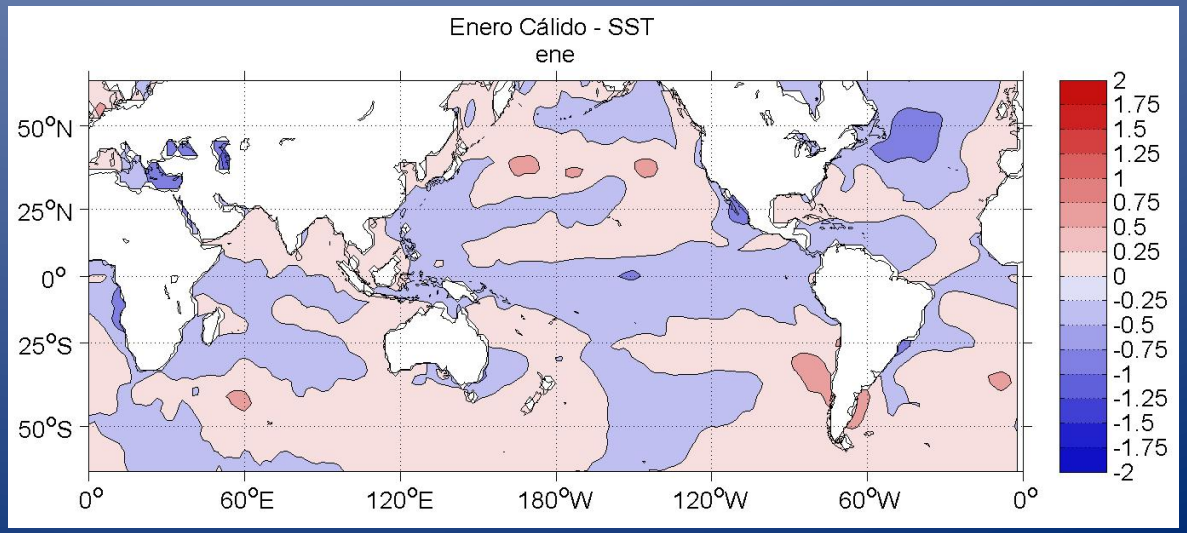


SST Anomalies m 0

July

January





Some conclusions…

- Extreme cold July events seem to be linked to marked barotropic circulation anomalies that induce cold and dry advection from the SE.
- Extreme warm January events don't show clear advection anomalies, but a notorious RH anomaly could be related to less cloudiness and more incoming radiation in SSA.
- However, we are considering *only* mean values! => we should also take 'turbulent' fluxes into account
- SST anomalies are consistent with the observed patterns.
- *Further research is needed!*

References:

- **Grimm AM, V.R. Barros, M.E. Doyle, 2000: Climate variability in southern South America associated with El Nino and La Nina events. Journal of climate.13: (1) 35-58 JAN 1 .**

- **Rosenbluth B.,H.A. Fuenzalida and P. Aceituno, 1997: Recent Temperature variations in southern south America. Int. J. Climatol., 17, 67–85.**

Muchas gracias!!!
Grazie mille!

REFERENCES

- For the extratropical Chilean coast the most relevant anomalous winter feature [ENSO teleconnection pattern] is an anticyclonic circulation over the Bellingshausen Sea advecting cold polar air over the austral part of South America. [Rosemblueth et al., 1997]

- [Barros, Grimm & Doyle, 2002]An intermittent low-pressure centerknown as the Chaco low appears most of thetime in western and central Argentina, andsouthern Bolivia. This low results from the sur-face heating and from the influence of the Andeson the westerly flow. It is observed throughoutthe year, but it is less intense in winter.

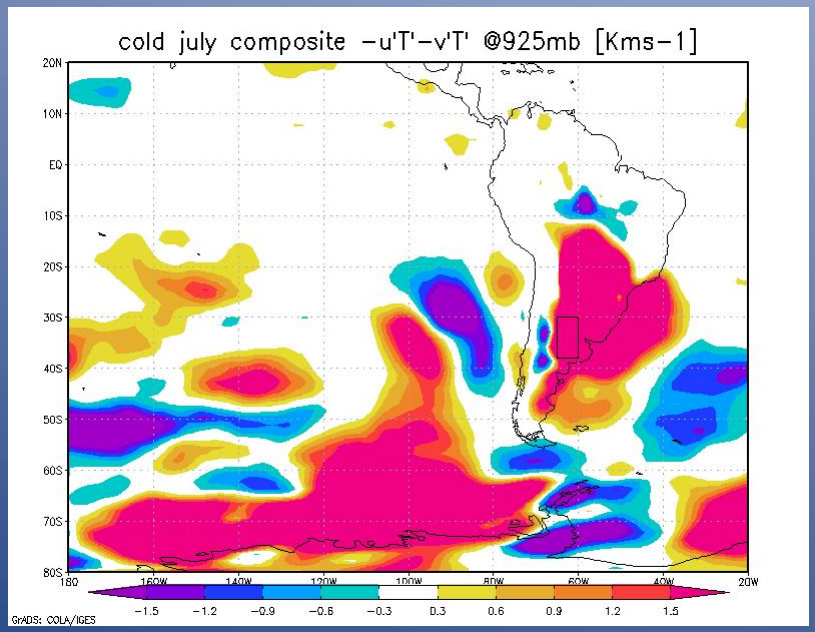
- [Barros, Grimm & Doyle, 2002] The mean low-level flow over subtropical South America has a northern meridional component that contributes to the balance of heat. This meridional component, roughly estimated by the zonal geopotential gradient between the western border of the South Atlantic high and the Chaco Low, is associated with positive(negative) surface temperature anomalies Argentina and southern Brazil, especially in winter. This relationship does not hold in central Argentina in summer, when the cooling due to precipitation may offset the warming caused by the enhanced northern component of the flow.

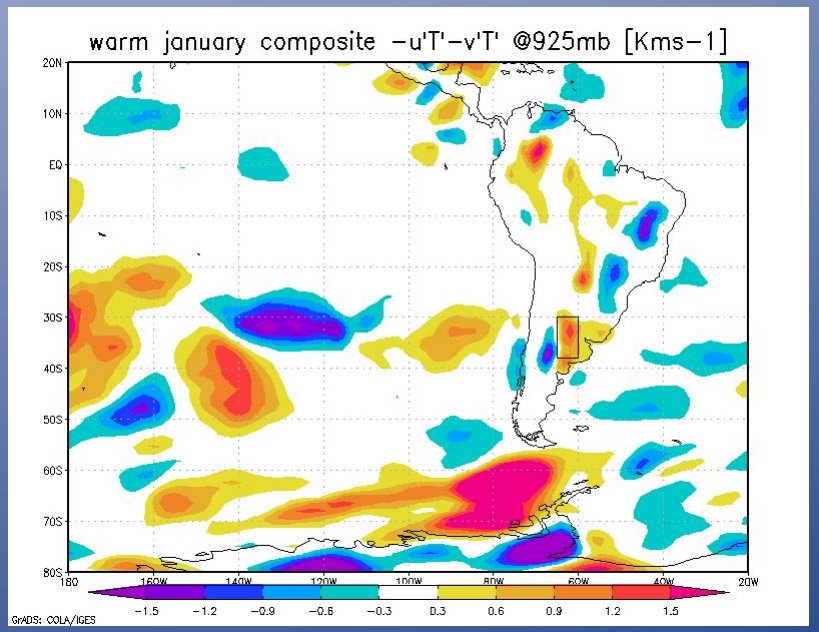
- In summer time, the incursion of tropical air into mid latitudes seem to be linked to the presence of the Chaco Low (Lichtenstein 1989), located approximately at 25°S and 65°W,and the subtropical Atlantic high. The intensification of the Chaco Low usually leads towarm episodes over southern Brazil, Uruguay and central and northern Argentina, and to the occurrence of convective events. [Seluchi & Marengo, XXXX]

Advection AnomaliesTemperature and gph (925 mb)

July

January

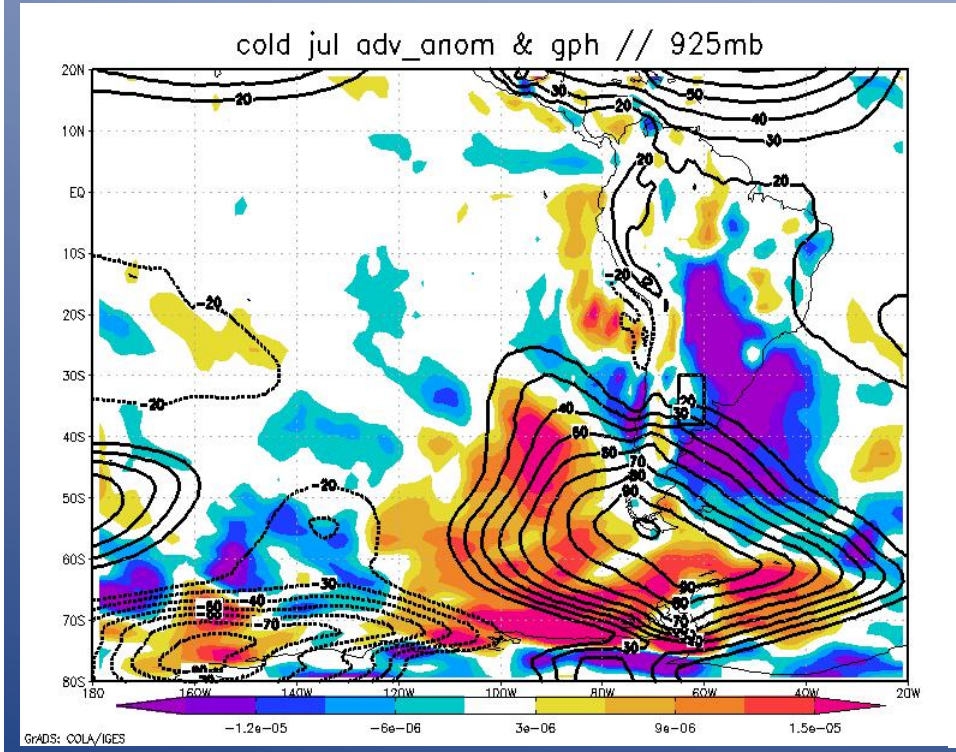


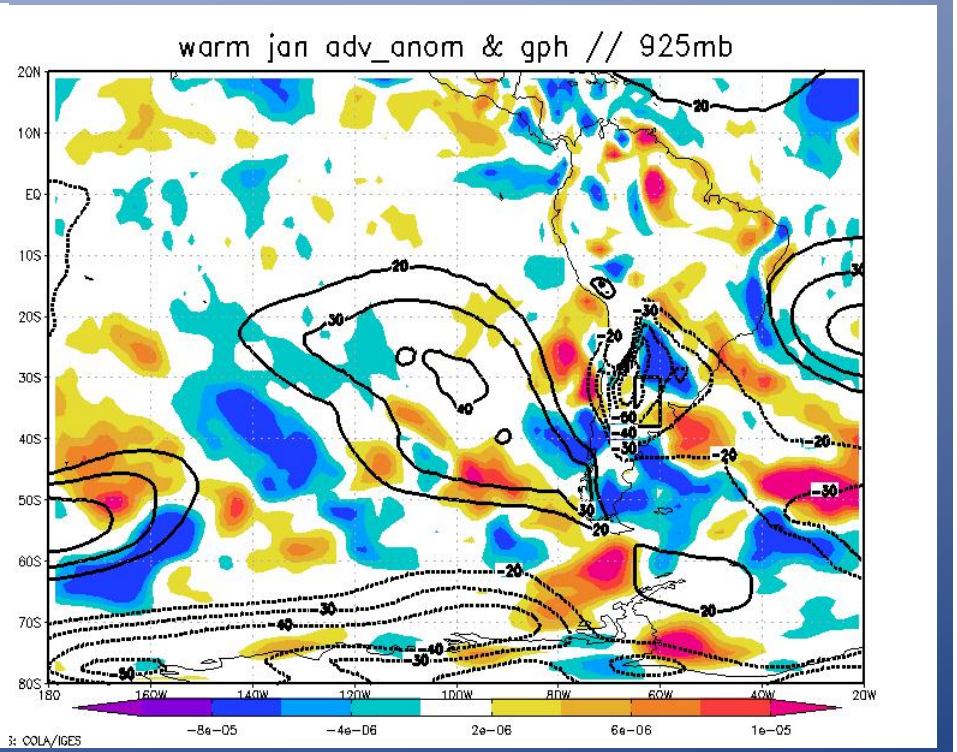


Temperature Advection Anomalies and GPH (925 mb)

July

January





Stream Function (850 mb)

July

January