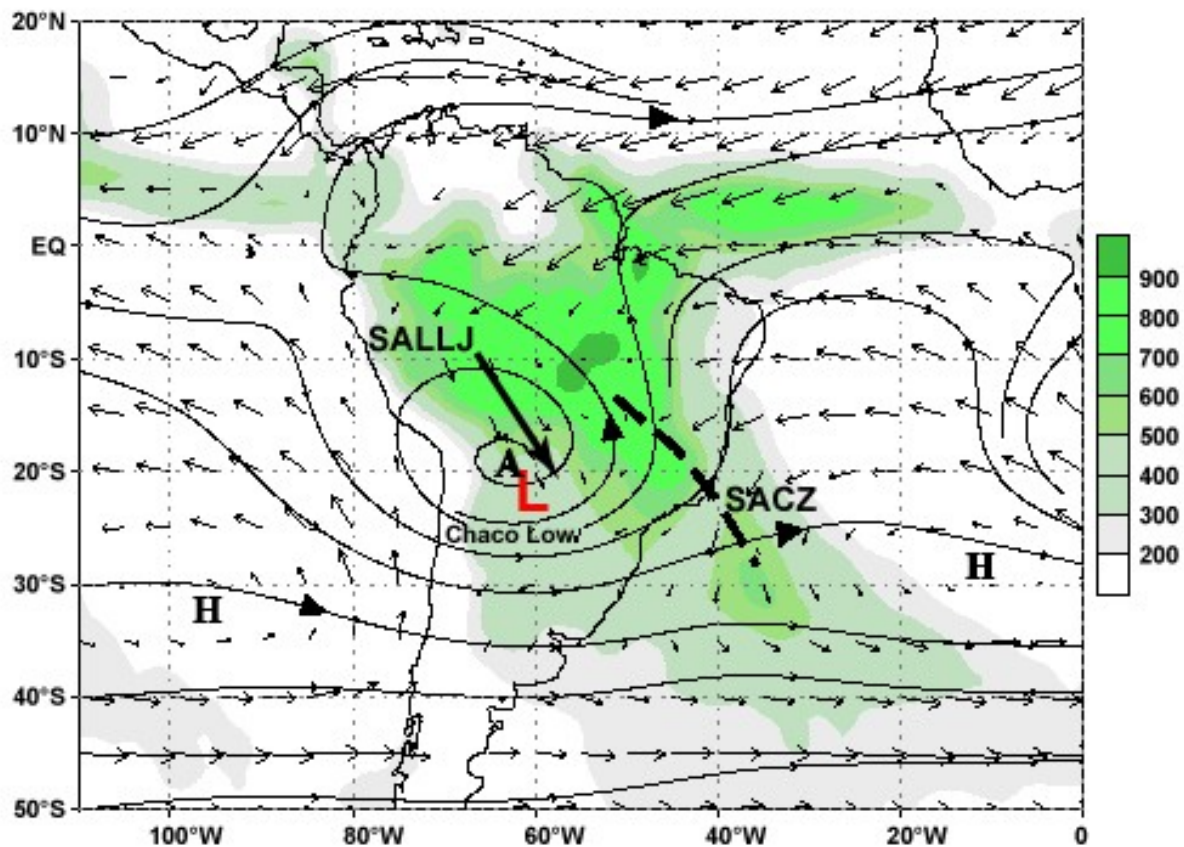


**Jet de Capas Bajas de Sudamérica  
(SALLJ)**

**ó**

**Corriente en Chorro de capas bajas  
(CCCB)**

**925 hPa Vector Wind, 200 hPa streamlines,  
and Merged Gauge and Satellite Estimated Precipitation  
December-February Mean (1979-1995)**



Courtesy of Vernon E. Kousky, NOAA/ Climate Prediction Center

# Jet Capas Bajas (ó CCCB)

- Introducción y definiciones
- Evidencias observacionales a escala regional y global
- Procesos físicos que explican este patrón de circulación en capas bajas
- Características medias de la CCCB de Sudamérica
- Análisis de situaciones particulares - Impacto de la CCCB sobre el tiempo significativo

# Introducción y definiciones

- En forma muy genérica puede considerarse que una corriente en chorro en capas bajas es un máximo del viento horizontal que debe darse por debajo de una cierta altura
- Para que sea “chorro” (jet) debe haber una importante cortante vertical, tanto por debajo como por arriba del máximo de viento
- De acuerdo con Ray (1986) es una corriente intensa, estrecha y cuasi-horizontal:
  - $V > 12$  m/s
  - Relación ancho/largo  $> \frac{1}{2}$
  - Cortantes verticales entre 5 y 10  $\text{ms}^{-1}$  por km



# Definiciones

Según Stensrud (1996) se distinguen:

- Los jets identificables a partir del perfil vertical local del viento y que pueden o no presentar cortantes horizontales importantes
- Los jets identificables en los campos de circulación en capas bajas, que se extienden entre cientos y/o miles de kms y presentan cortantes horizontales importantes, pero pueden no estar limitados a la CLP, es decir están asociados con forzantes de escala sinóptica

# Evidencias observacionales de Corrientes en chorro en el mundo

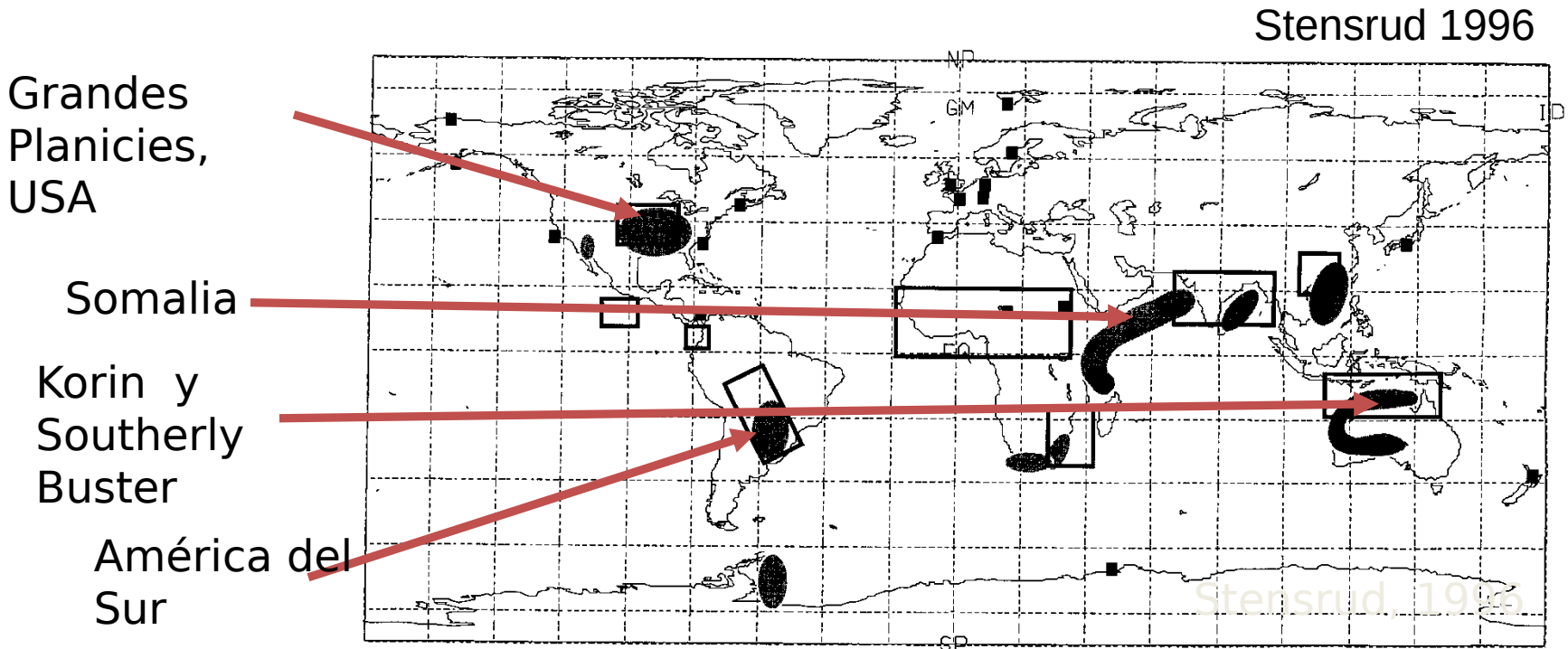
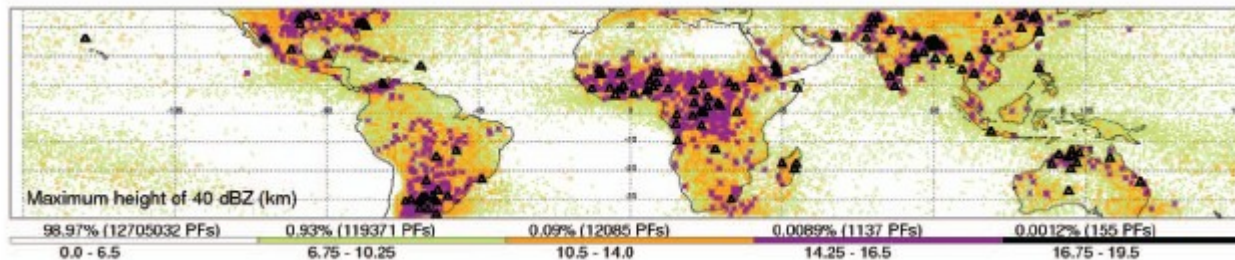


FIG. 1. Regions where low-level jets are known or suspected to occur with some regularity (shaded) and where mesoscale convective complexes are known to occur frequently during the summer (open boxes). Squares denote locations where low-level jets have been observed.



Zipser y otros  
2006

# Criterio de identificación Bonner 1968

*“El máximo de viento en capas bajas debe encontrarse por debajo de los 2000 metros de altura. La cortante superior se estimará a partir de la diferencia en el módulo del viento entre el nivel del viento máximo y el mínimo subsiguiente o el nivel de 3000 metros (lo que ocurra primero)”.*

<i>Criterio</i>	<i>Viento máximo por debajo de los 2000 metros</i>	<i>Diferencia entre el máximo y el mínimo subsiguiente o el nivel de 3000 metros</i>
I	12 m s <sup>-1</sup>	6 m s <sup>-1</sup>
II	16 m s <sup>-1</sup>	8 m s <sup>-1</sup>
III	20 m s <sup>-1</sup>	10 m s <sup>-1</sup>



Este criterio modificado se usa para S.Am.

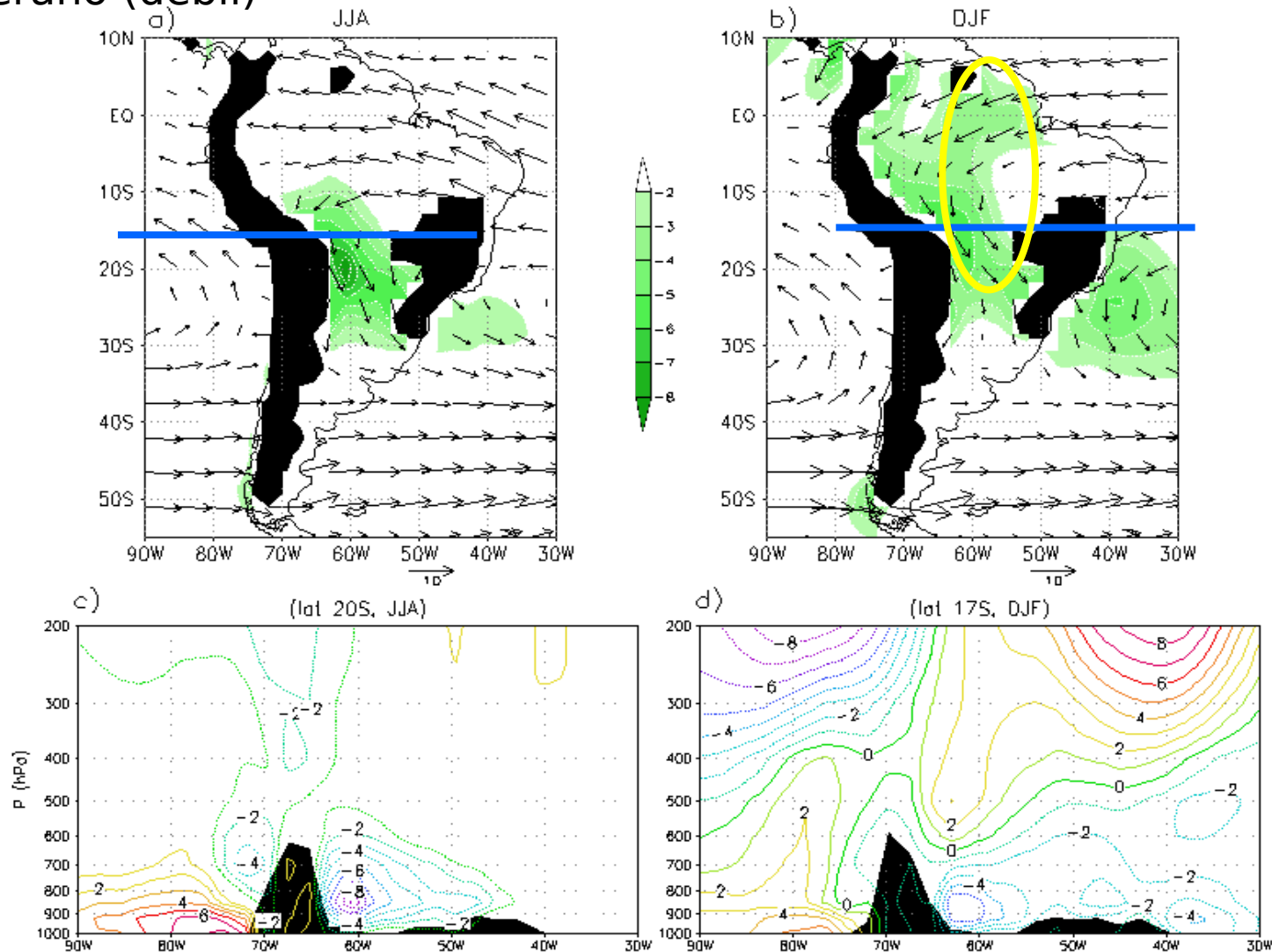
# Criterios de Bonner adaptados para su utilización en campos analizados sobre Sudamérica

- El máximo de la intensidad del viento ( $V$ ) en 850 hPa al este de los Andes debe ser mayor o igual a 12 m/s.
- La componente meridional debe ser del norte.
- La diferencia de las velocidades del viento entre 850 y 700 hPa debe ser mayor o igual a 6 m/s en algún lugar de la región abarcada por la isotaca de 12 m/s.
- Viento Meridional  $>$  Viento Zonal

# Evidencias observacionales

Viento medio en 850 hPa para invierno y verano (sombreado: mag. viento meridional)

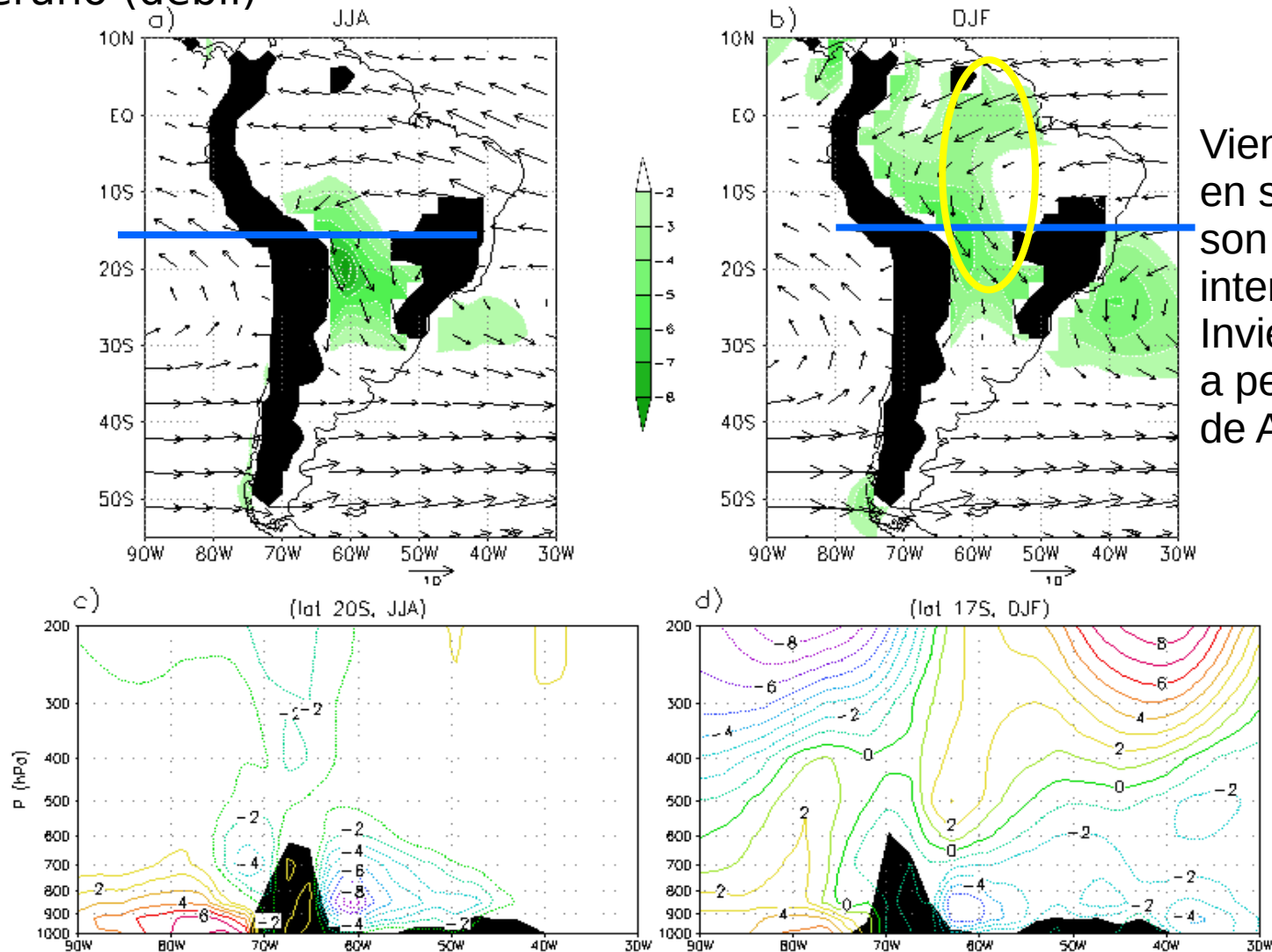
Máximo de viento del norte en Sta Cruz de la Sierra en Invierno y verano (débil)



# Evidencias observacionales

Viento medio en 850 hPa para invierno y verano (sombreado: mag. viento meridional)

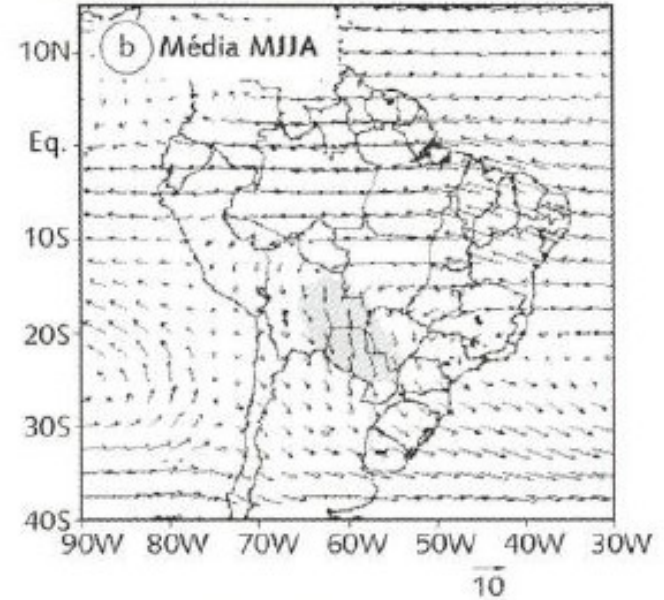
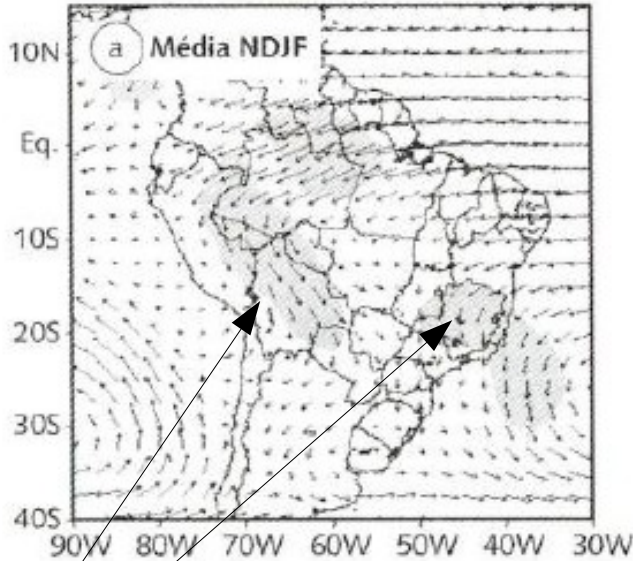
Máximo de viento del norte en Sta Cruz de la Sierra en Invierno y verano (débil)



Vientos medios en subtrópicos son más intensos en Invierno debido a penetración de ASAS

Maximo cerca de 850 hPa





A veces se los denomina “aerial rivers”

(Arraut and Satyamurty 2009)

Cuando el flujo al este de los Andes desarrolla un núcleo de alta velocidad se denomina CCCB.

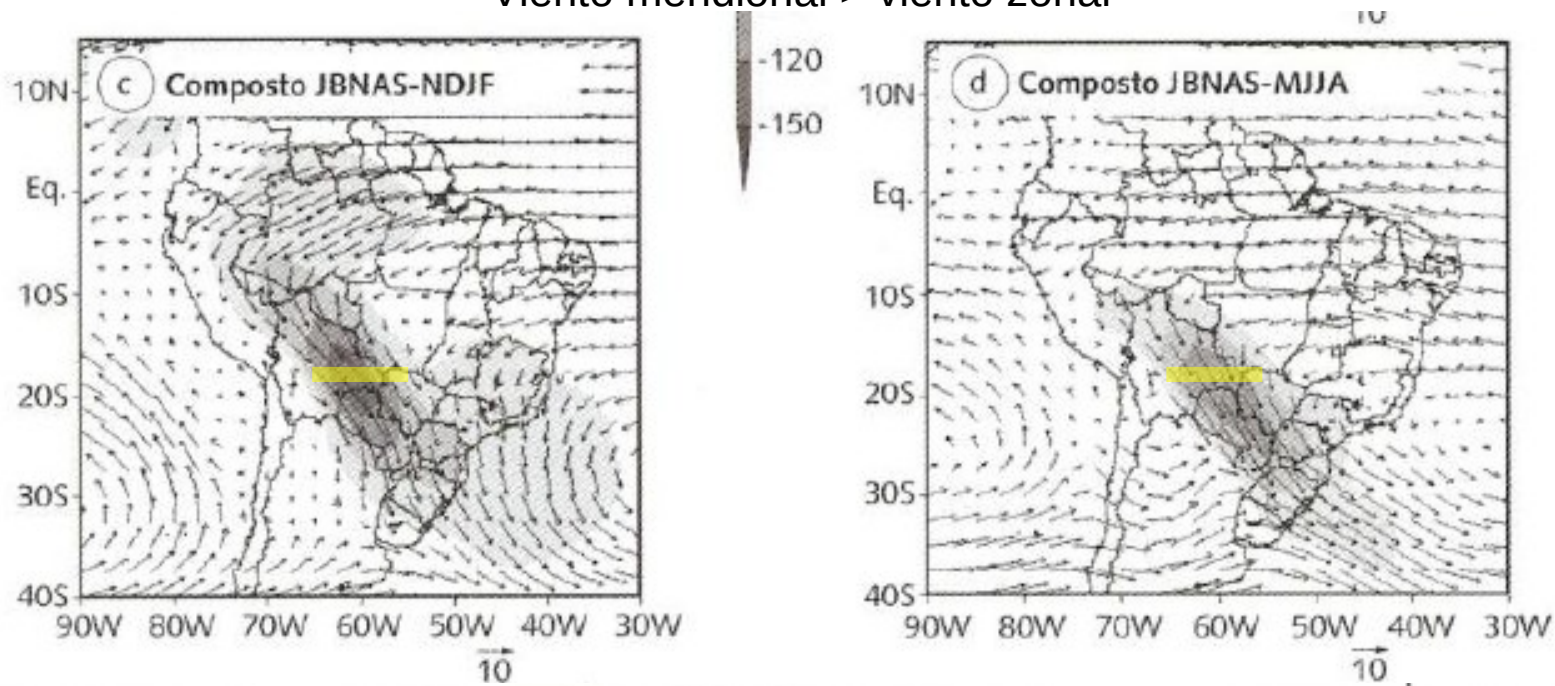
A CIRCULAÇÃO atmosférica regional em níveis baixos (Fig. 11.1) mostra, durante o verão (novembro a fevereiro), uma maior intensidade dos ventos alísios que vêm do Atlântico Tropical Norte e que viram para o sudeste ao encontrarem a barreira dos Andes, sendo o fluxo da ASAS mais fraco (Fig. 11.1a). No inverno (Fig. 11.1b), o fluxo caracteriza-se pelo enfraquecimento dos alísios e pela intensificação do fluxo do noroeste associado à ASAS, que está mais intensa e próxima do continente. O transporte de umidade integrado vertical-

$$Q(\lambda, \phi, t) = \int_0^{p_0} qV \frac{dp}{g}$$

## Eventos del Jet

Criterio de Bonner (1986)

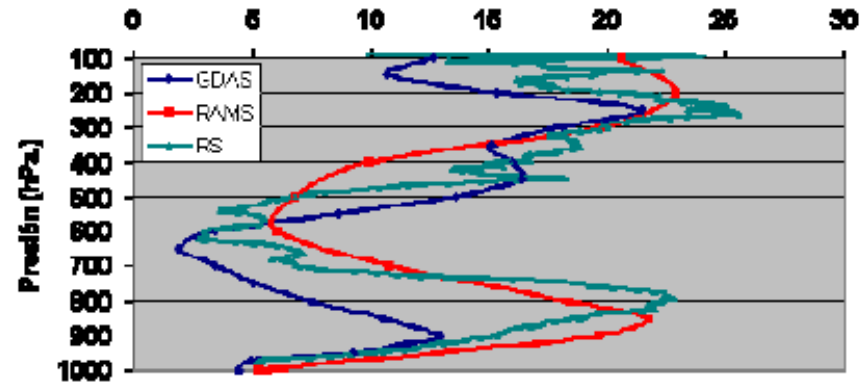
- Vientos mayores a 12 m/s en 850 hPa
- Cortante vertical 6 m/s entre 700 y 850 hPa
  - Vientos del norte
- Viento meridional > viento zonal



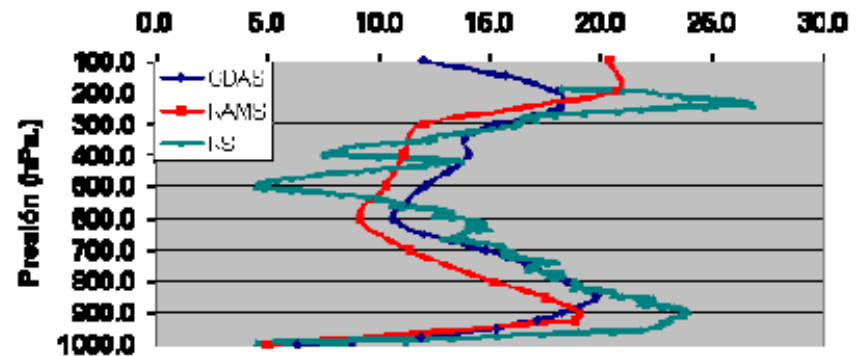
**FIG. 11.1** Circulação atmosférica nos baixos níveis (850 hPa) em m/s e transporte verticalmente integrado ( $\text{m.g.s}^{-1}.\text{kg}^{-1}$ ) para verão (NDJF) e inverno (MAJJ), e para os compostos de eventos JBNAS nessas duas estações. Os eventos são detectados em Santa Cruz, Bolívia, segundo o critério 1 de Bonner modificado  
 Fonte: Marengo et al., 2004. (17.8S, 63.2W)



# Perfil vertical



(a)



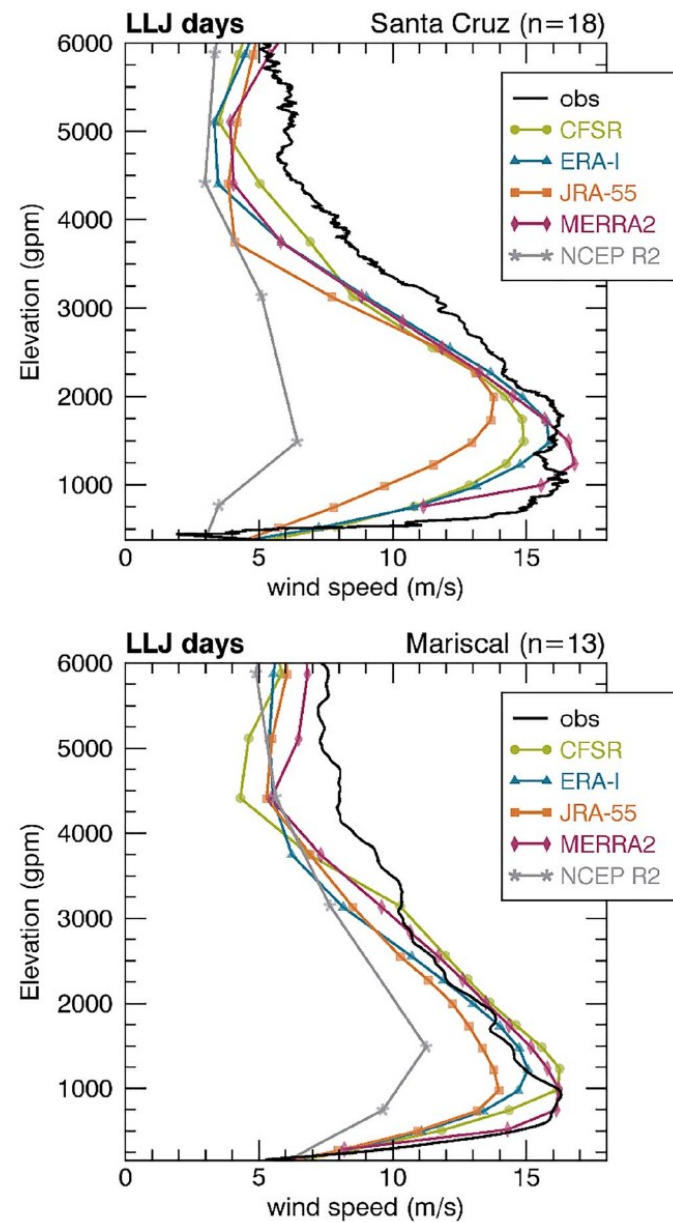
(b)

Figura 3.13: Perfiles verticales (en niveles de presión) de velocidad del viento ( $\text{m s}^{-1}$ ) para las 06 UTC del día 19 de diciembre de 2002, en a) Santiago del Estero y b) Resistencia. Línea verde: Datos de radiosonda, línea azul: GDAS y línea roja: RAMS

Ruiz 2004

Los nuevos reanálisis reproducen mejor el CCCB, pero aún queda margen para Mejorar.

Habría que ver como es ERA5.



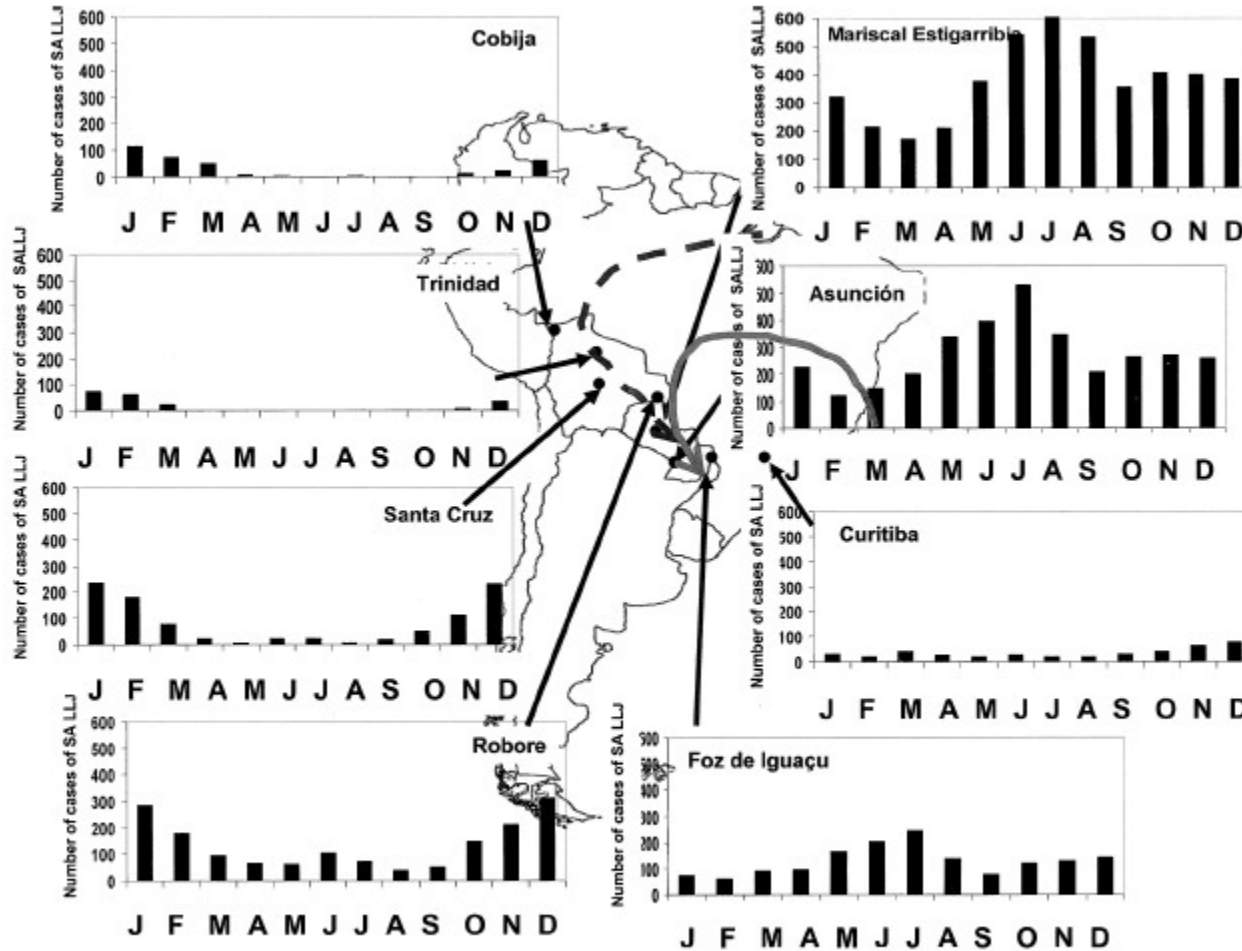
**Figure 4.** Vertical profiles of mean wind speed (m/s) at 06 UTC near Santa Cruz (*top*) and Mariscal (*bottom*). Profiles are averaged over all South American low-level jet days identified during the South American Low-Level Jet Experiment (SALLJEX) field campaign for which observations are available. Radiosonde profiles are in black, and reanalysis profiles are colored according to the legend.

# Climatologías de la CCCB

15 JUNE 2004

MARENGO ET AL.

2263



Generada a partir del Reanálisis del NCEP. Promedios entre 1950-2000

Marengo y otros 2004

FIG. 2. Annual cycle of number of cases verifying SALLJ Bonner criterion 1. PACS-SONET and upper-air stations are shown by dots at the core and the exit region of the jet. Solid gray arrow shows the trajectory of tropical moist air coming from Amazonia, and the dotted gray arrow shows the trajectory of subtropical air from the subtropical Atlantic high. The cases were verified using the NCEP-NCAR reanalyses at the grid box closest to the stations.

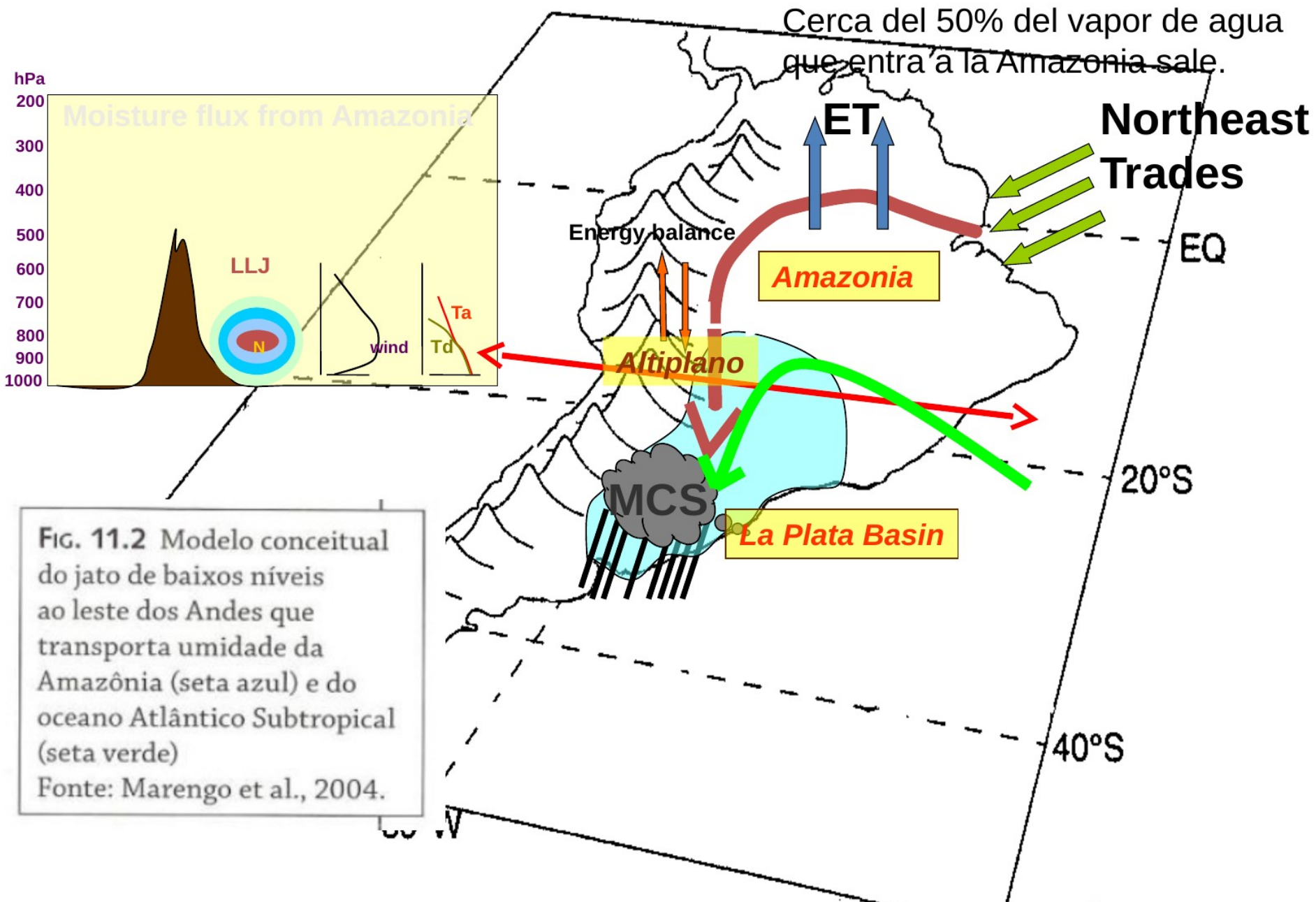
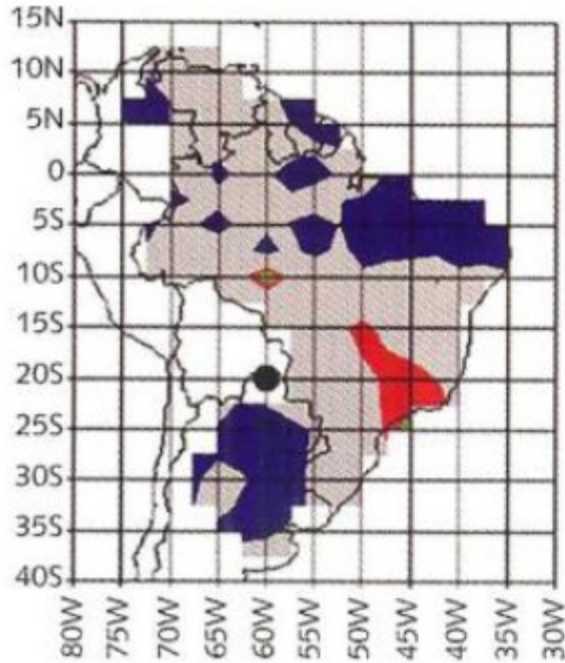


FIG. 11.2 Modelo conceitual do jato de baixos níveis ao leste dos Andes que transporta umidade da Amazônia (seta azul) e do oceano Atlântico Subtropical (seta verde)  
 Fonte: Marengo et al., 2004.

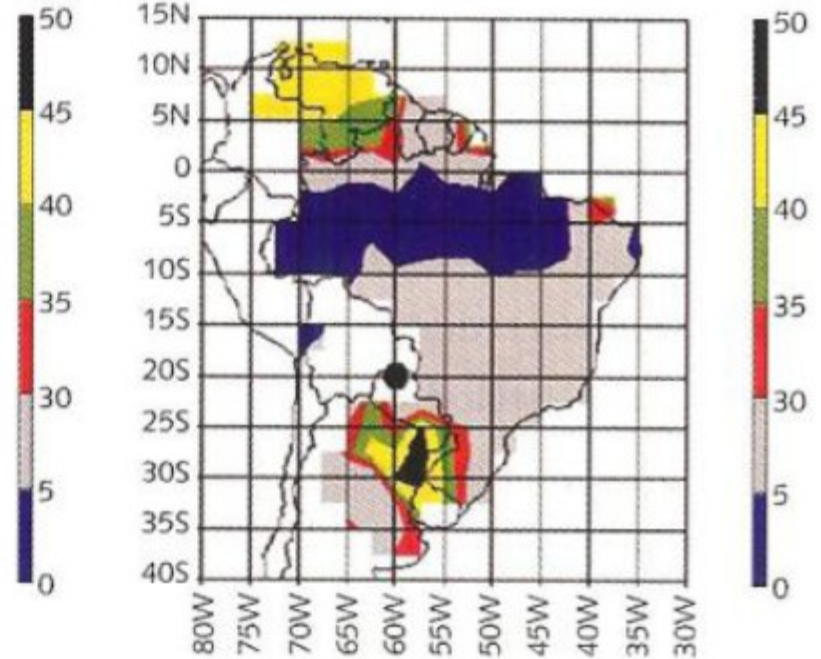
# La CCCB de Sudamérica



# % de Eventos Extremos de Lluvia asociados a intensidad del CCCB

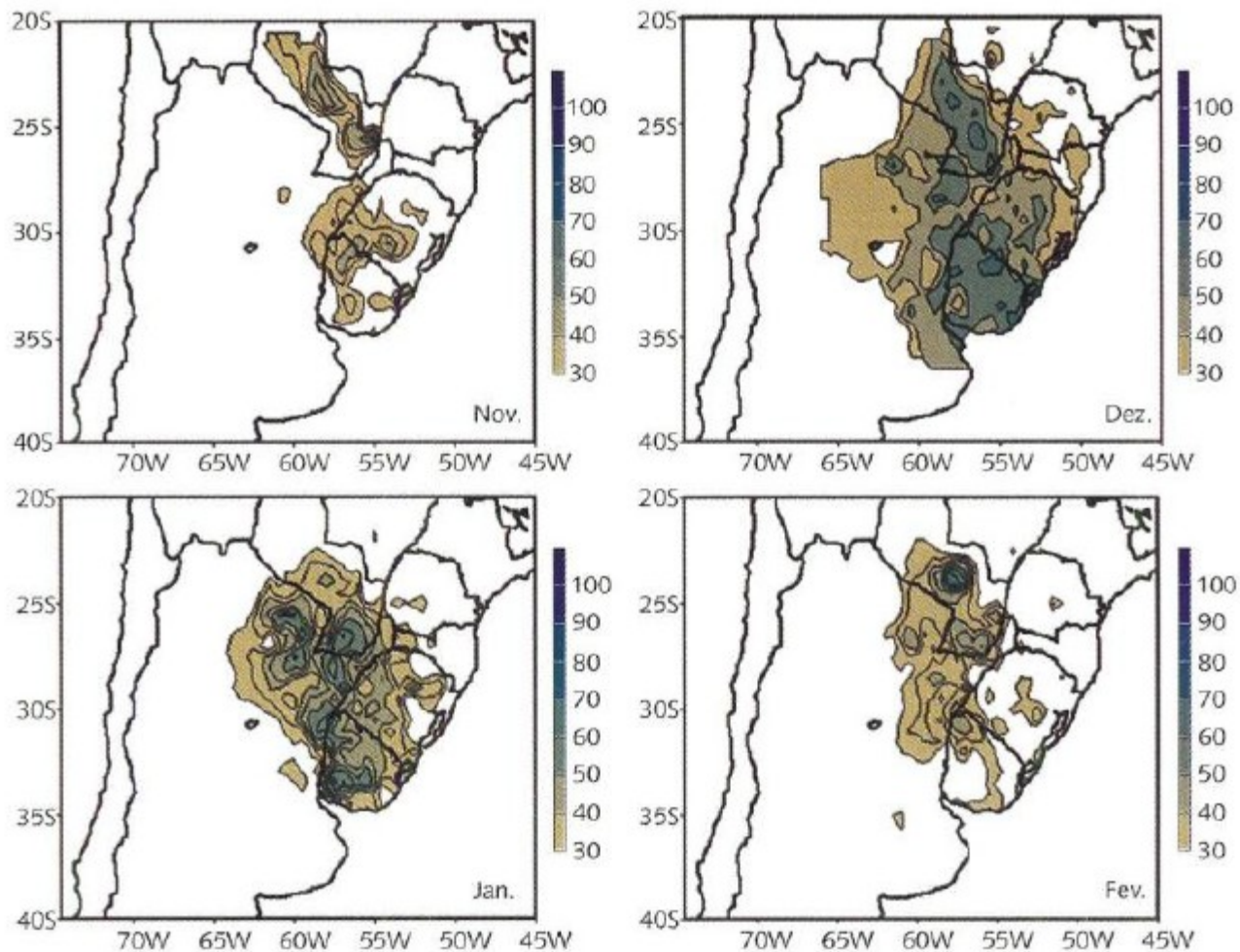


CCCB debil



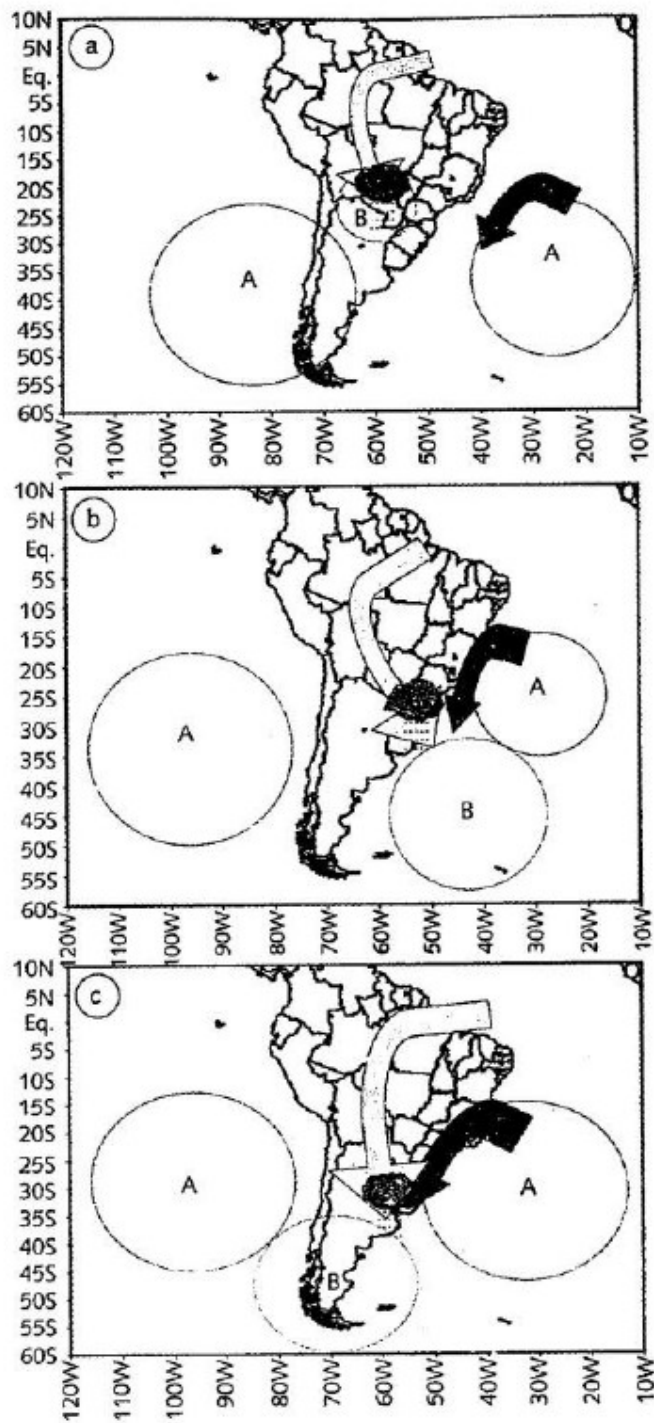
CCCB intenso

(punto negro es la referencia para el CCCB)



**FIG. 11.5** Percentual de ocorrência de EEP ao sul de 20°S em dias de atuação do JBN nos meses de novembro a fevereiro. A escala de cores começa em 30%  
 Fonte: Weykamp e Ambrizzi, 2006.

(EEP – eventos extremos de precipitacion)

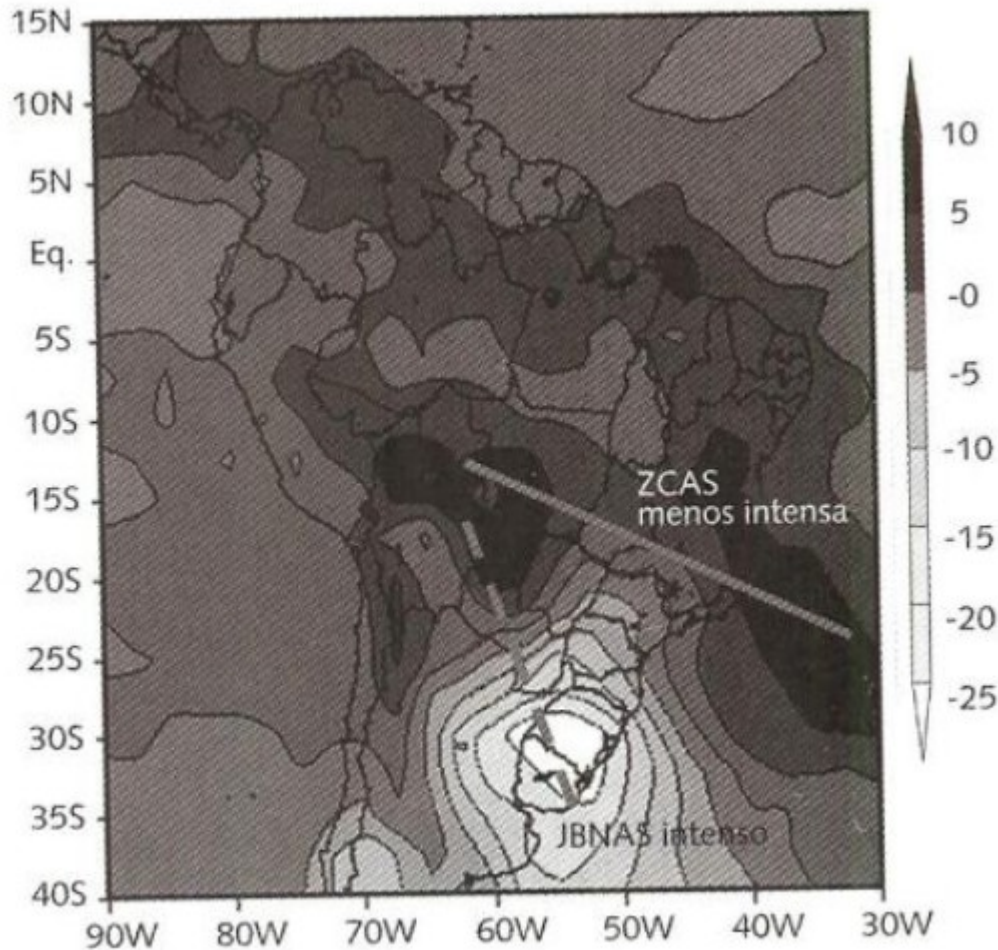


NA FIG. 11.7a a situação é favorável à ocorrência de EEP sobre a área A1. Nesse caso, as altas subtropicais estiveram presentes e mais ao sul de sua posição climatológica, barrando a entrada dos sistemas de baixa pressão, fazendo o JBN dirigir-se para a Baixa do Chaco. Um fator importante nesse caso foi a persistência do escoamento a leste dos Andes, dirigido para essa região, com dois dias de antecedência ao evento. No caso de EEP sobre a área A2 (Fig. 11.7b), o avanço de ciclones extratropicais pelo Atlântico forçou o JBNAS a deslocar-se mais para leste, até o Atlântico, passando pela região Sul do Brasil. A circulação da ASAS, apesar de mais enfraquecida do que no caso anterior, também contribuiu para o aumento da umidade sobre a área A2. No caso do EEP sobre a área A3 (Fig. 11.7c), um intenso sistema de baixa pressão oriundo do oceano Pacífico atravessou os Andes e ficou sobre o sul da Argentina, forçando o JBNAS a dirigir-se até a latitude de 35°S, aproximadamente. Nessa situação, o JBNAS posicionou-se de uma forma mais meridional do que nos outros casos. Para esse evento também foi observada intensa contribuição no transporte de umidade do Atlântico, por meio da circulação da ASAS, que esteve bastante próxima do continente.

**FIG. 11.7** Modelos conceituais para a ocorrência de EEP sobre as áreas (a) A1 – Paraguai, (b) A2 – região Sul do Brasil e (c) A3 – Uruguai e leste da Argentina  
 Fonte: Weykamp e Ambrizzi, 2006.



# Variabilidade Intraestacional de la CCCB asociado a dipolo en OLR ZCAS-SESA

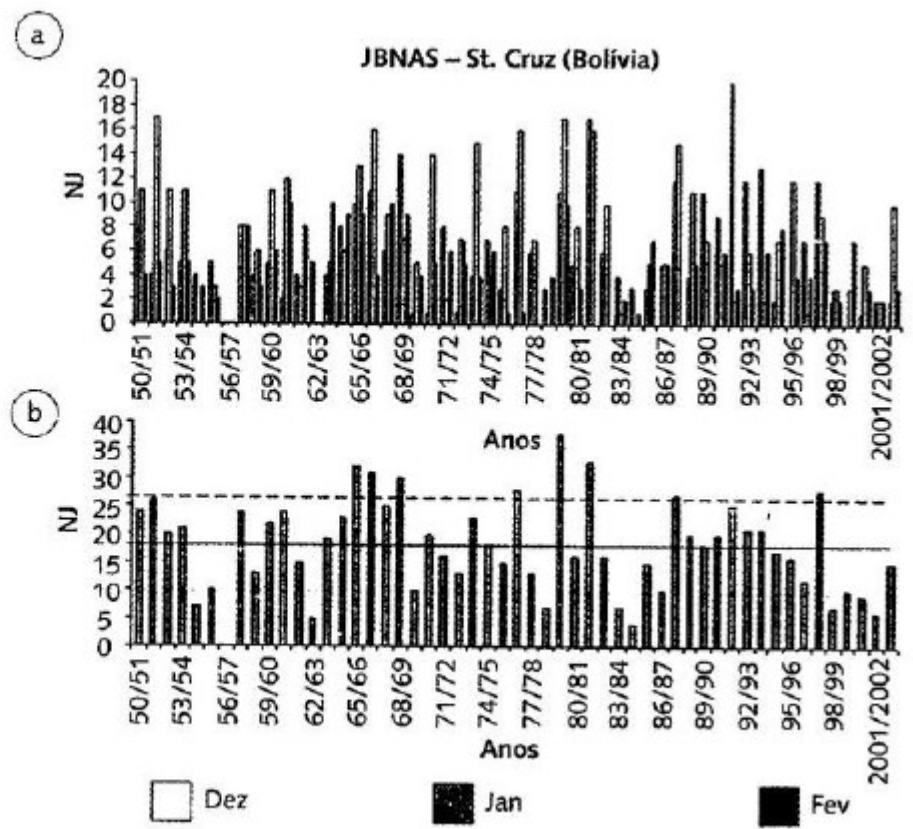


**FIG. 11.3** Diferença entre as anomalias de ROL ( $W/m^2$ ) para uma composição de JBNAS durante o verão e a média climatológica de verão no período de 1975-2000  
Fonte: Marengo et al., 2004.



# Variabilidade Interanual: Mas (menos) eventos CCCB durante El Niño (La Niña)

**FIG. 11.8** Frequência de JBNAS durante o verão austral no período de 1950 a 2003 (a) mensal e (b) sazonal. Os casos foram baseados no ponto 17,75°S, 63,06°W, usando-se o critério 1 de Bonner modificado. As linhas tracejada e pontilhada representam um desvio padrão acima e abaixo da média (linha cheia) Fonte: Silva, Ambrizzi e Marengo, 2009.



# Posibles causas/mecanismos de formación

## LOCALES:

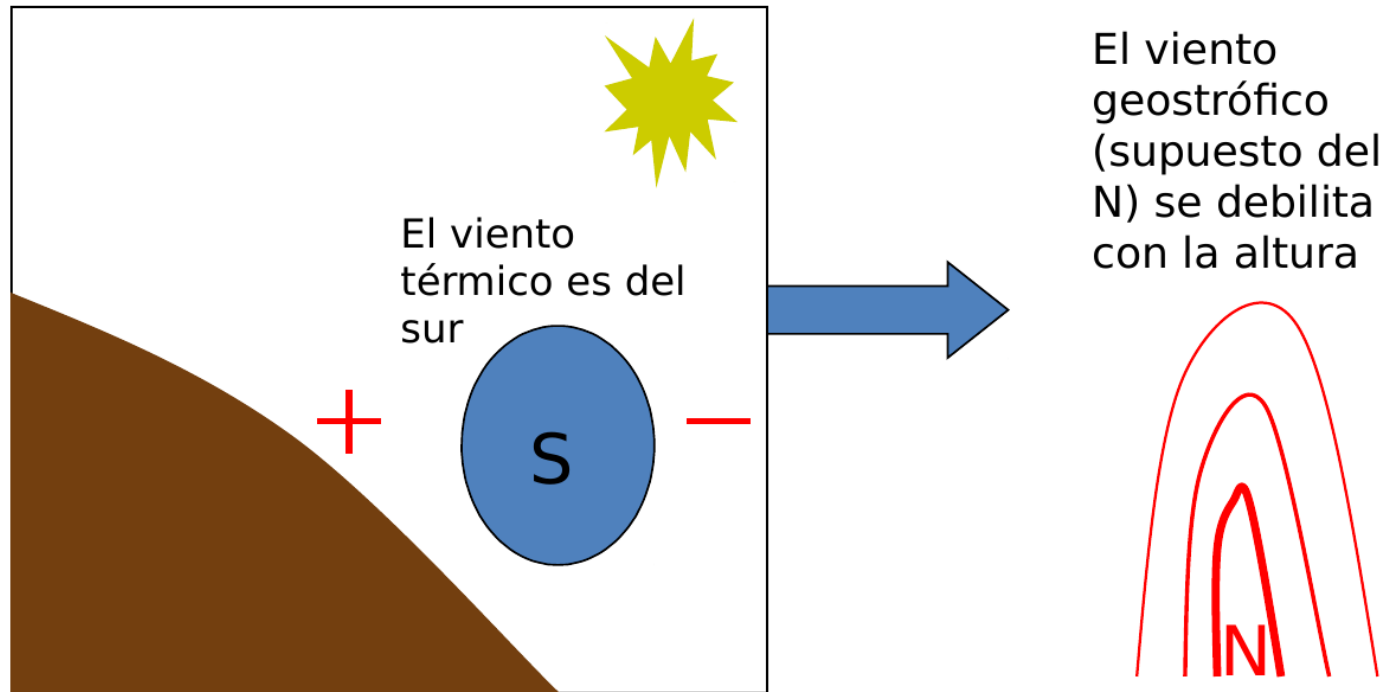
- Blackadar (1959) introduce una teoría para explicar las oscilaciones del viento dentro de la CLP, excitadas por el ciclo diario de calentamiento sobre la superficie.
- Holton (1967), Mc Nieder y Pielke (1981) Bonner y Paegle (1970), estudiaron cómo se modifica este ciclo diario debido a la presencia de una pendiente en el terreno
- Fast y McCorcle (1990) incluyeron otros efectos como las inhomogeneidades en el contenido de humedad en el suelo o el tipo de suelo

## REGIONALES/SINOPTICOS:

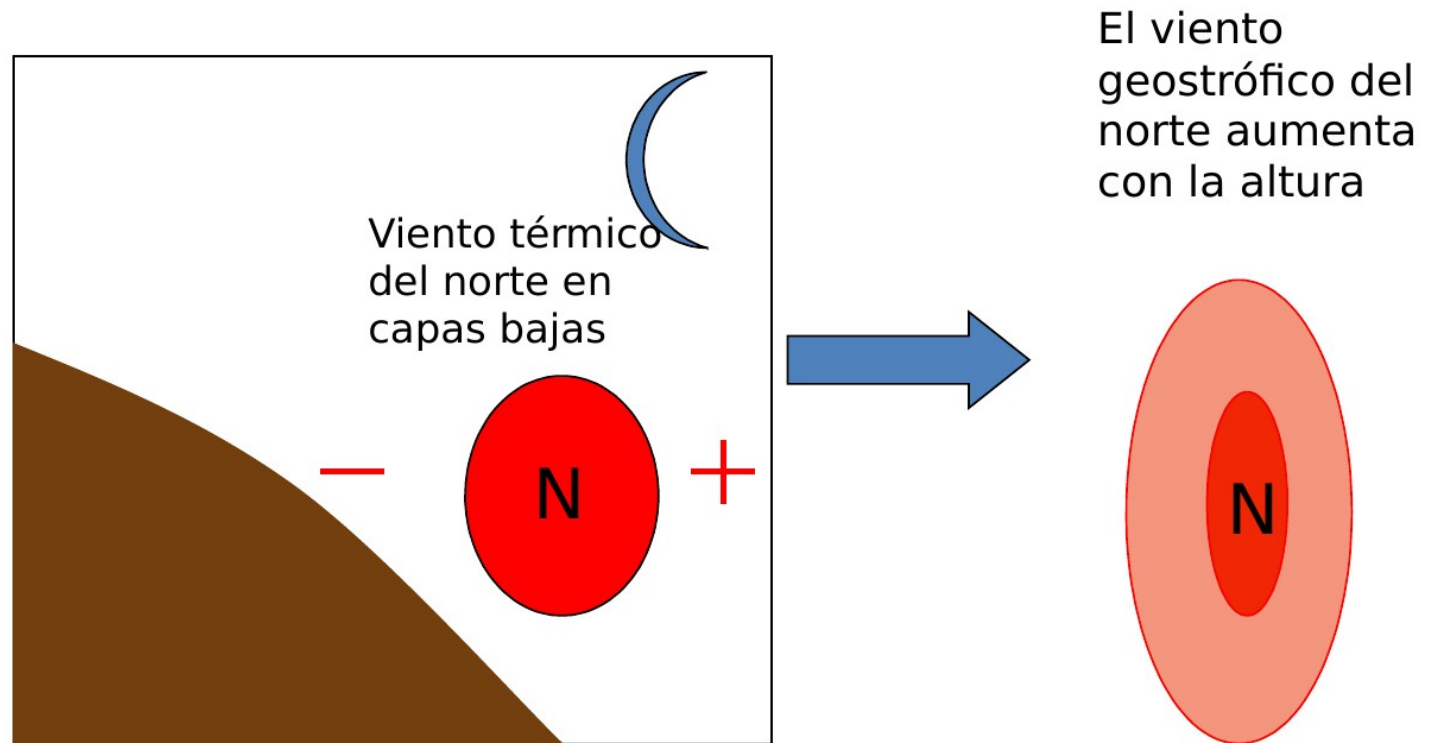
- Wexler (1961) efecto canalizador de la topografía y el acople entre la dinámica de capas bajas y la atmósfera superior en presencia de máximos de viento en niveles altos estudiado por Uccellini y Johnson (1979), y Uccellini y otros (1987).

# Esquema de la respuesta del viento medio al calentamiento diferencial y a la fricción

$$V_T = \frac{R}{f} \frac{\partial T}{\partial x} \ln \frac{P_0}{P_1}$$



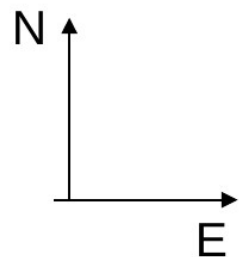
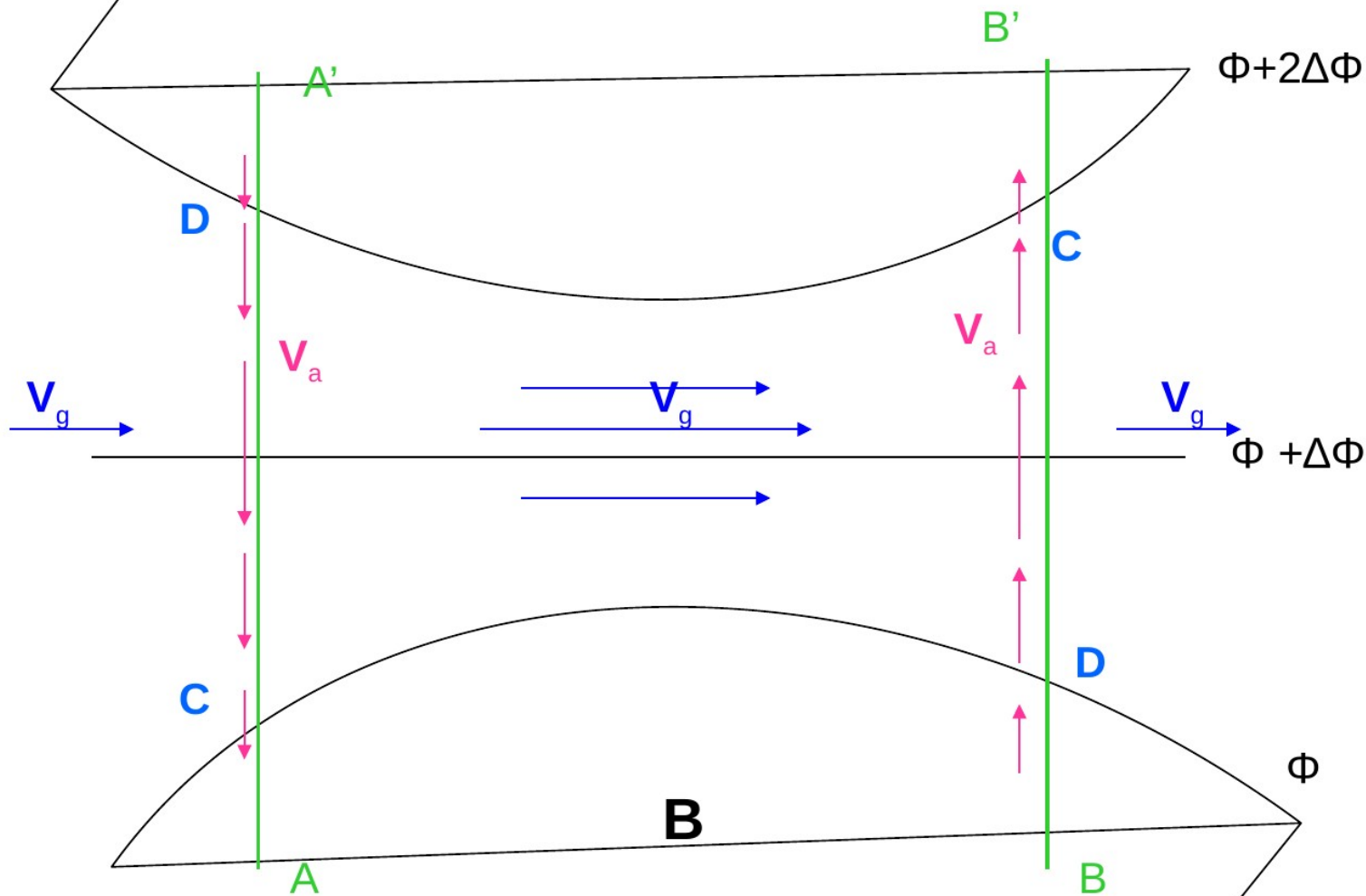
La fricción actúa atenuando al viento real en la CLA, con lo cual se espera observar vientos del norte SUB-GEOSTROFICOS durante el día, cerca de la superficie



La fricción no es eficiente en la noche, con lo que el viento real, por encima de la capa superficial, se acelera y resultan vientos SUPER-GEOSTROFICOS del norte en horas nocturnas

# Modelo teórico del acople entre capas altas y bajas

HS



$$\frac{dV_g}{dt} = f V_a \times k \quad \Rightarrow \quad \frac{du_g}{dt} = f v_a \quad \text{y} \quad \frac{dv_g}{dt} = -f u_a$$

La máxima aceleración es en el eje del J

Componentes  
ageostróficas



Convergencias

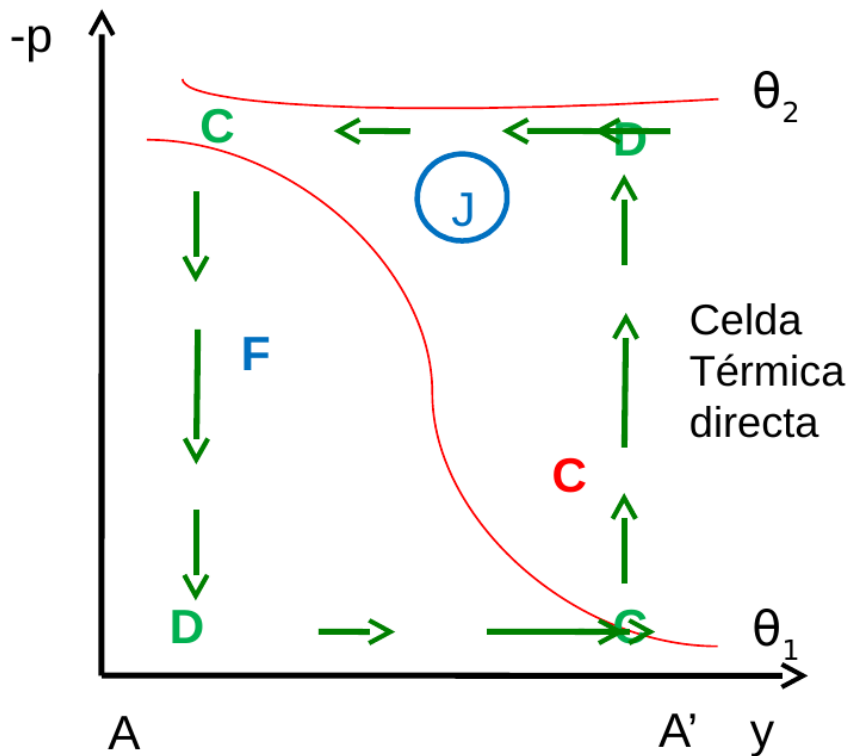
Divergencias

Circulaciones transversales o  
secundarias

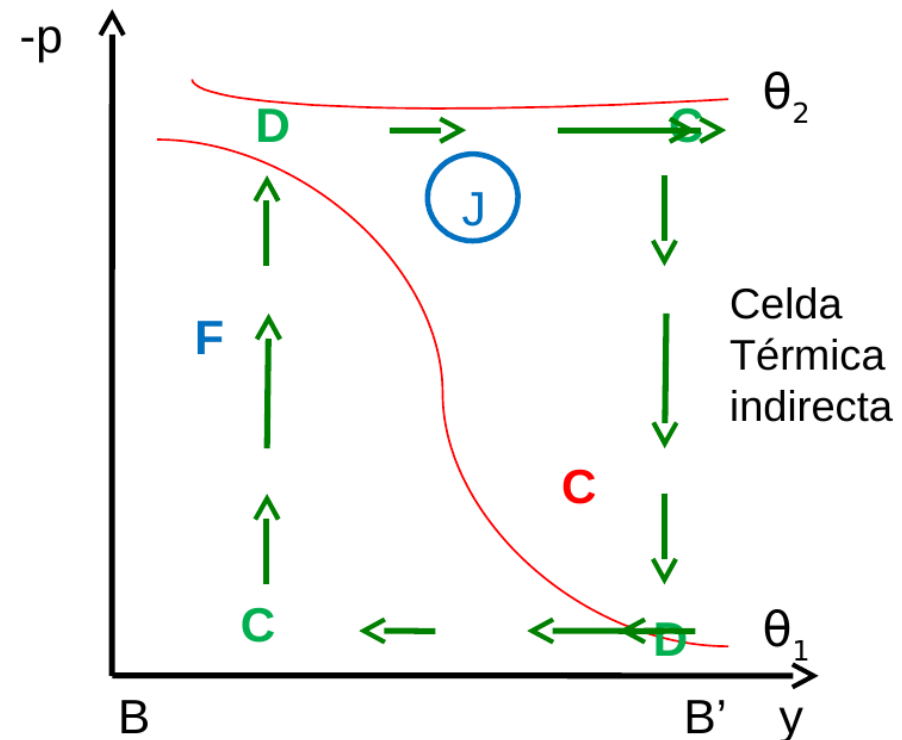


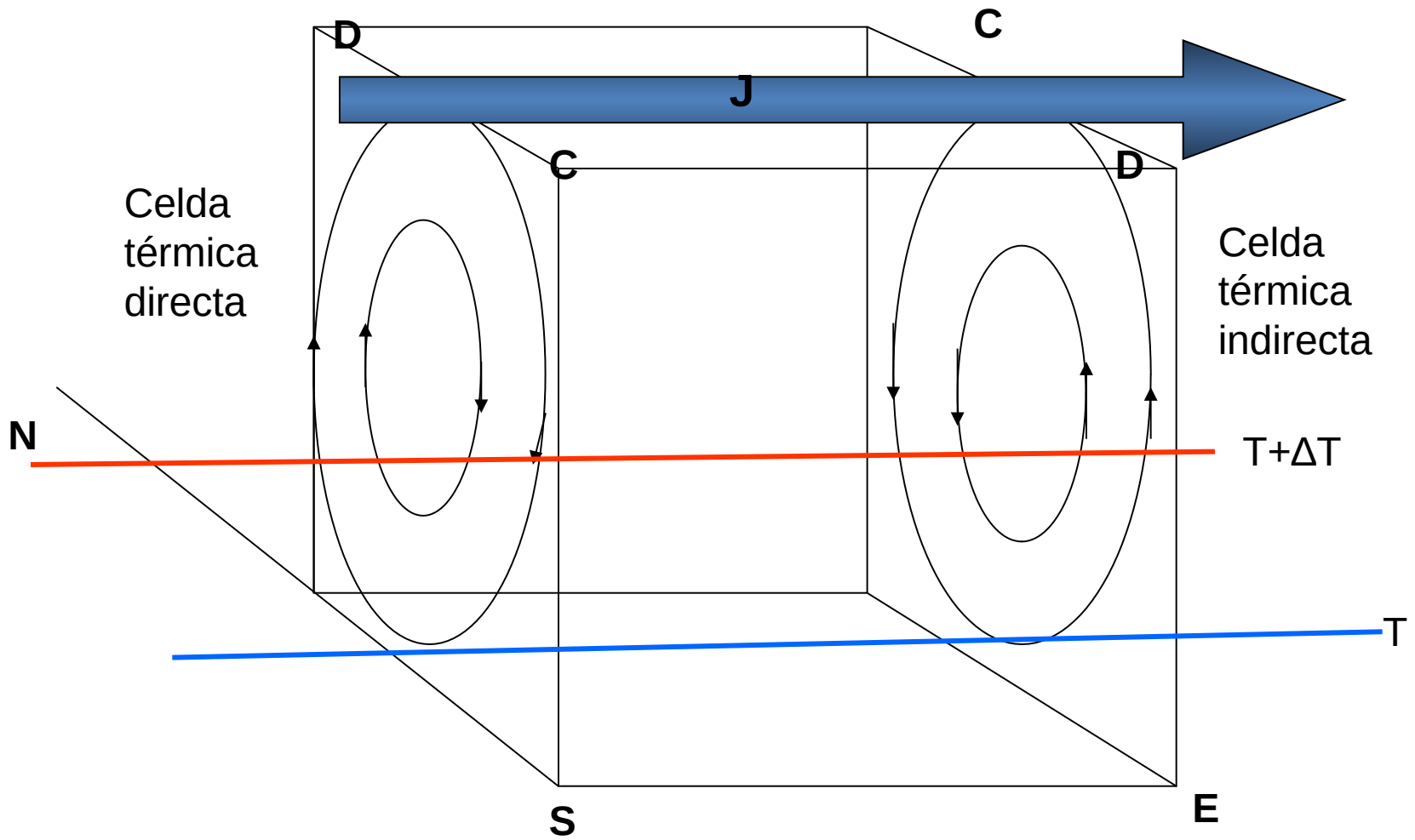
Principio de Dines

Corte AA'  $\Rightarrow$  celda de circulación  
directa a la entrada de J

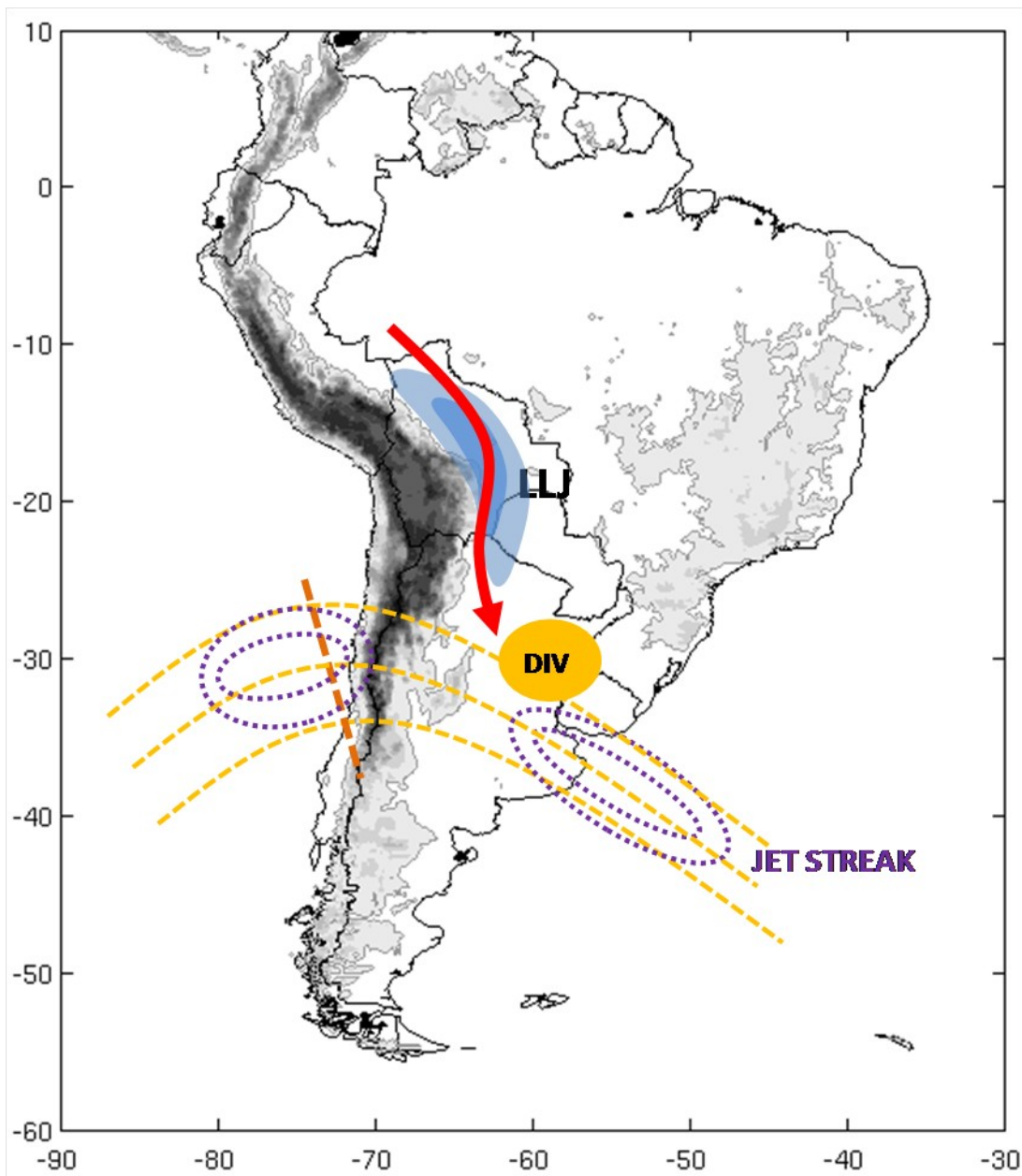


Corte BB'  $\Rightarrow$  celda de circulación  
indirecta a la salida de J









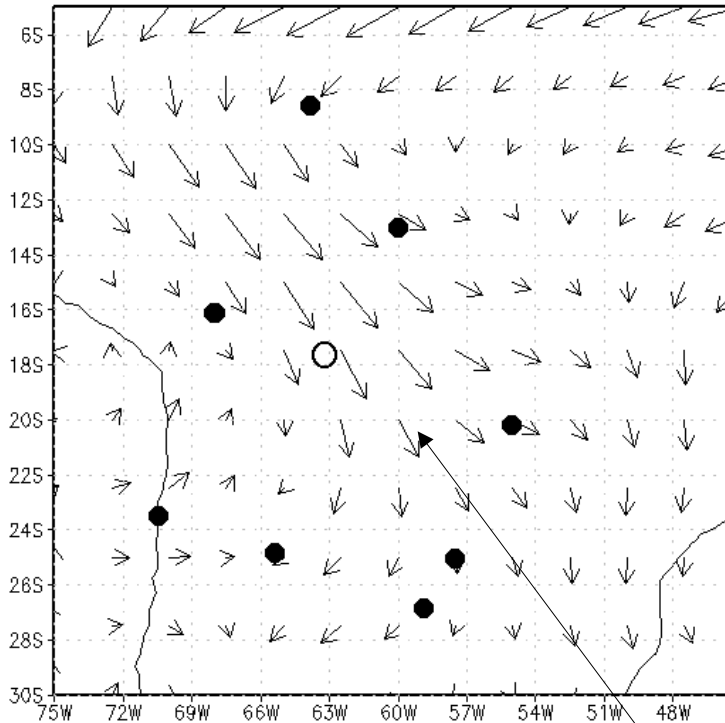
eumetrain

- El jet de niveles altos se desacelera cuando cruza las montañas. La celda indirecta que se crea a la salida del maximo del jet refuerza el CCCB.
  - El NW-SE jet de niveles altos sobre Uruguay tiene una celda directa en su entrada que refuerza la convergencia en niveles bajos favoreciendo el desarrollo de convección.
- el norte de Uy es una zona con fuerte desarrollo de SCM

# Climatologías de la CCCB Sudamericana

- Lichtenstein (1980) y Fernández y Necco (1982), describen, utilizando datos observacionales, la presencia de una corriente en chorro en capas bajas con dirección norte-sur al este de los Andes, en tanto que Inzunza y Berri (1990) documentaron las características del transporte de humedad y viento en capas bajas asociados con la presencia de la corriente en chorro en dichos niveles.
- Sugahara y Da Rocha (1996) la identifican a partir de los análisis del Centro Europeo

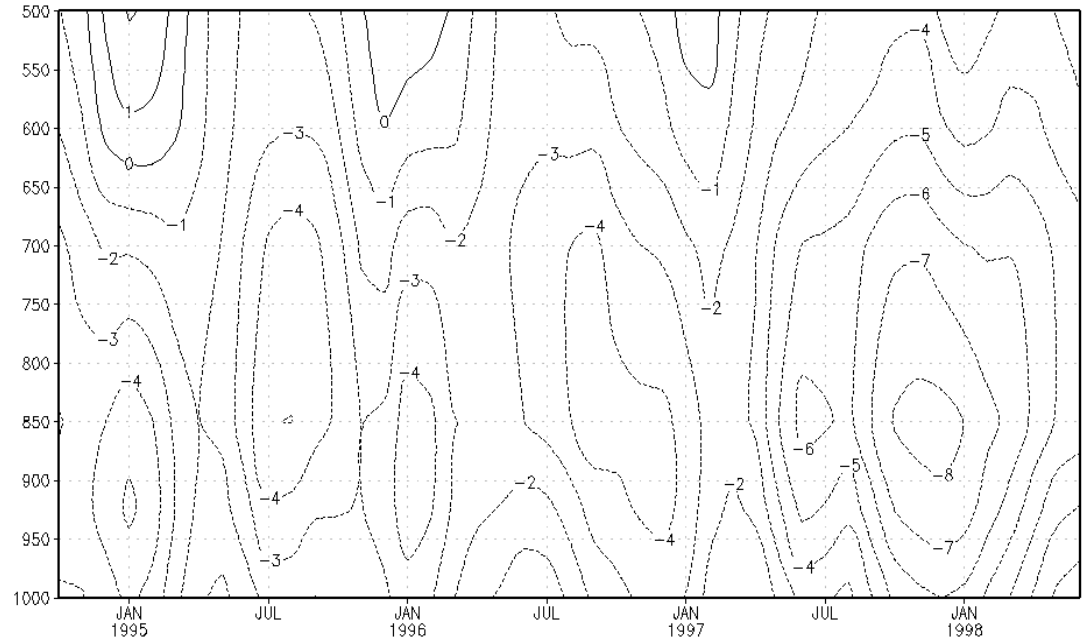
# Climatologías de la CCCB Sudamericana



MAX=6.54286  
MIN=0.177953



- *Figure 1: The NCEP long-term mean 850 hPa wind vectors for the months of December-February for South America. Solid dots are radiosonde stations, open circle is Santa Cruz, Bolivia.*
- *Douglas y otros, 1998*



- *Figure 4: Time - height section of the mean v-wind at 15°S, 62.5°W, near the core of the SLLPW. Douglas y otros, 1998*

Vacio Observacional - SALLJEX

# South America Low Level Jet field EXperiment

## Objetivo:

Mejorar la descripción espacial y temporal de la CCCB



*Del 1 de  
noviembre de  
2002 al 28 de  
febrero de  
2003*

**Para comprender el rol que tiene la corriente en chorro en capas bajas en los intercambios de calor y humedad que se dan entre los trópicos y los extra trópicos así como también los aspectos de la hidrología, el clima y su variabilidad que se vinculan con esta corriente.**

# Componentes observacionales del SALLJEX : altura

- **4504** observaciones con globo piloto en 26 estaciones
- **279** Radiosondeos extra sobre Argentina, **200** sobre Bolivia y Paraguay y **120** sobre Brasil



Aproximadamente  
entre 4 y 6  
observadores en cada  
punto



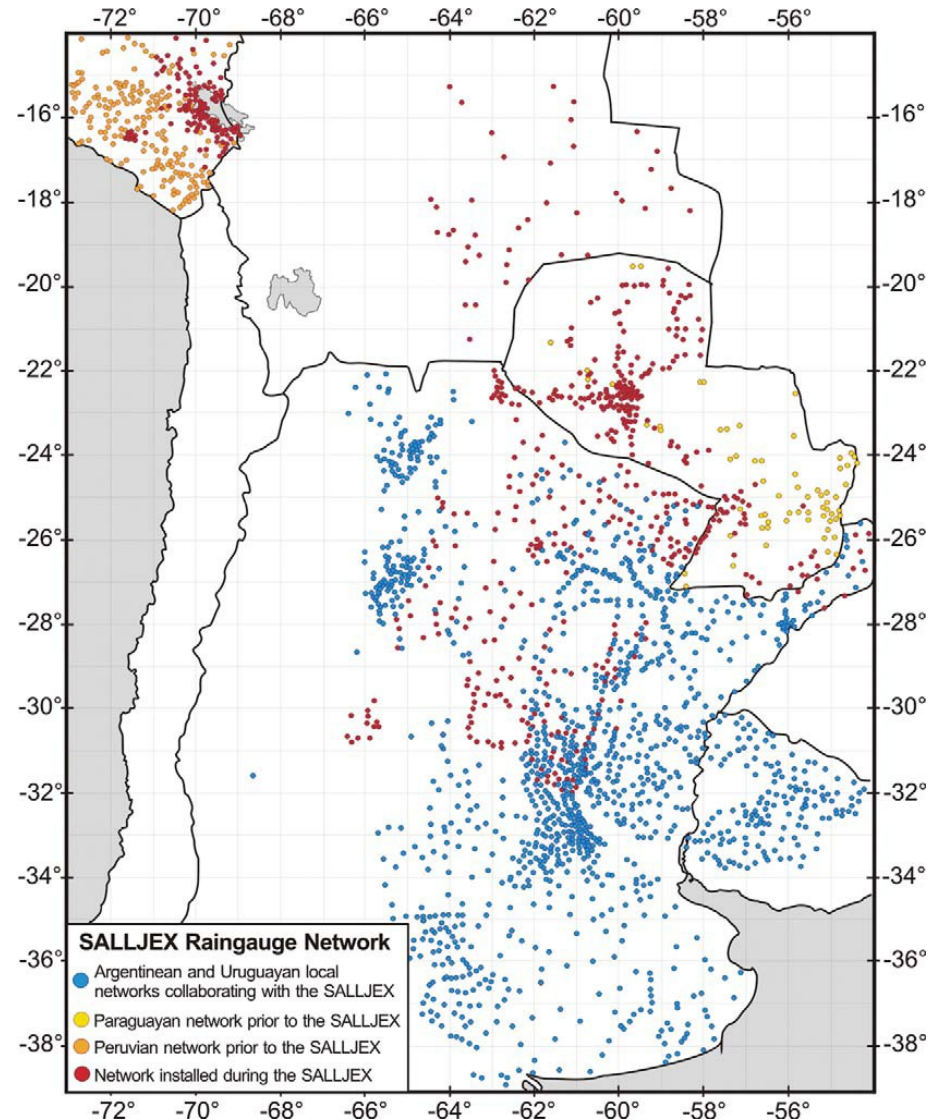
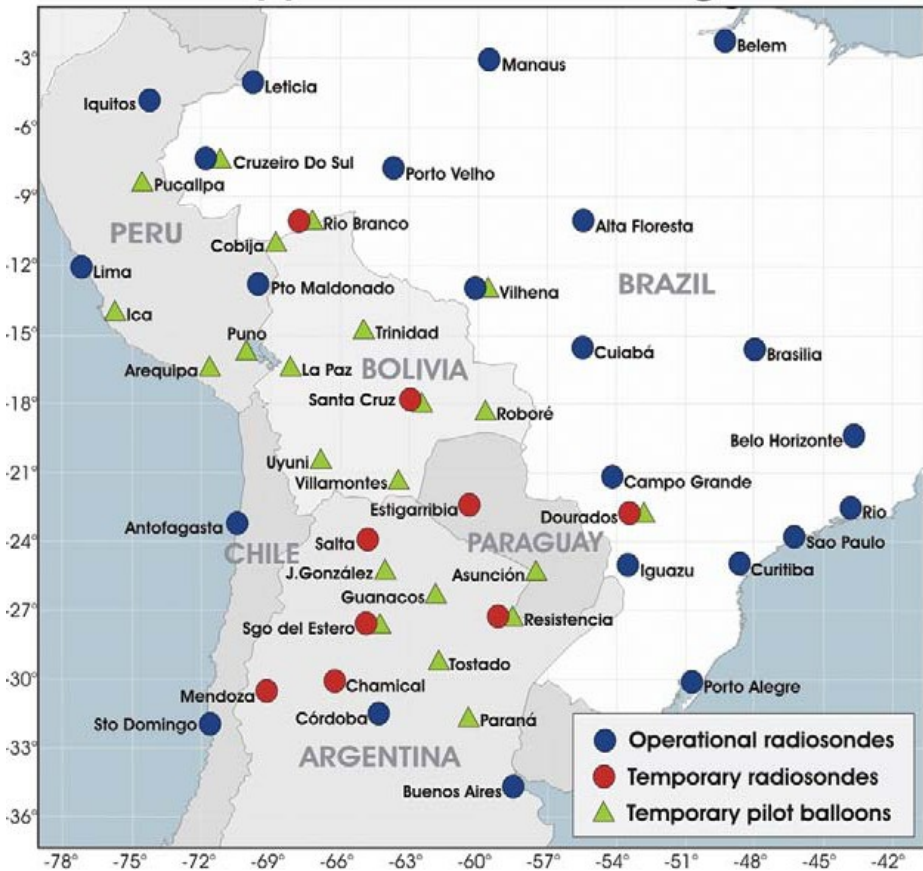
**~140**  
**observadores**  
**extra**





# South America Low Level Jet field EXperiment

SALLJEX Upper Air Network During the SOP



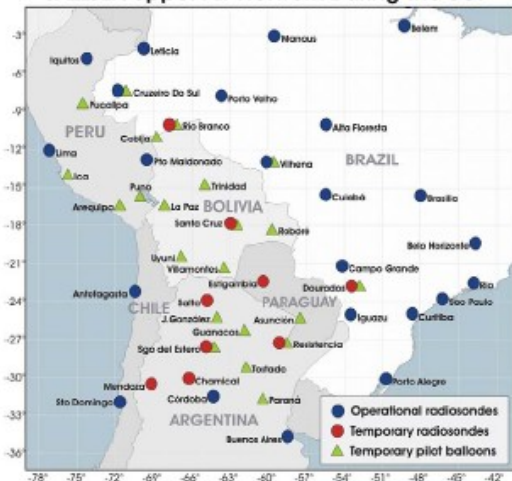


FIG. 4. Radiosonde and pilot balloon networks of SALLJEX.

# Algunos resultados del SALLJEX

## Asunción 1000 m asl

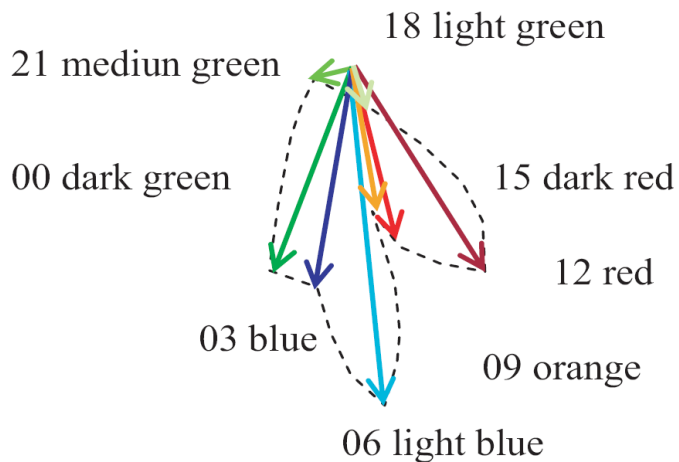


Figure 3: Mean summer diurnal wind gyre (m/s) at Asunción (Paraguay) at 1000 m asl. UTC times.

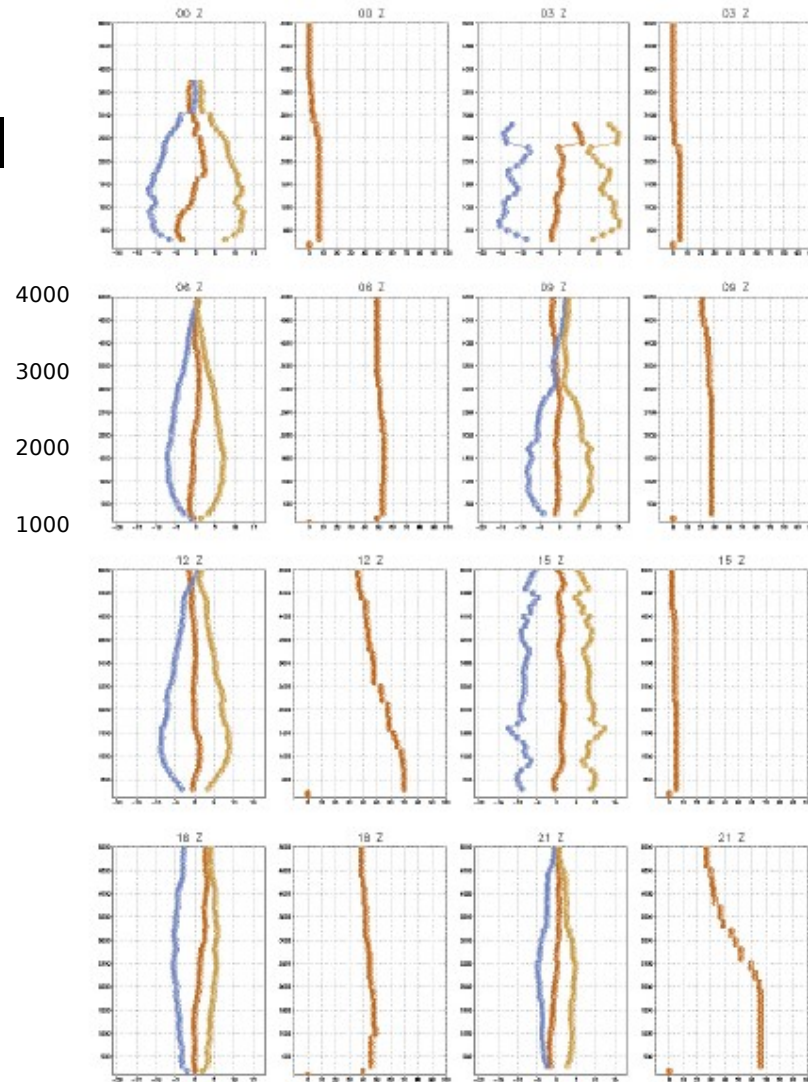
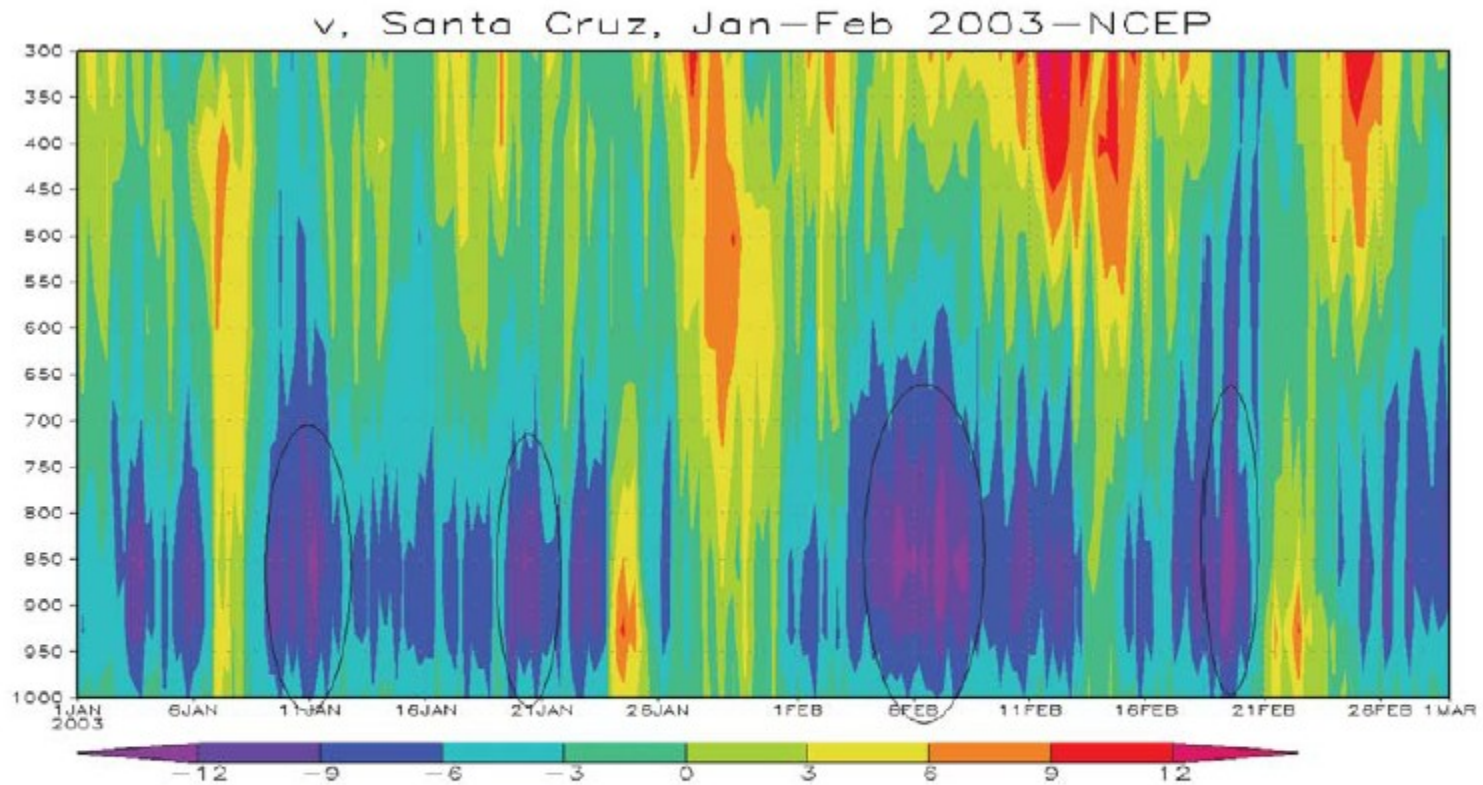


Figure 2: Mean summer vertical wind speed (yellow), zonal (red) and meridional (blue) wind components (left in m/s) and number of observations as function of height (right) at Mariscal Estigarribia. Each panel corresponds to a different time (as indicated).

file. Studies based on the 4-times-a-day available NCEP–NCAR reanalysis (Marengo et al. 2004b), ERA (Salio et al. 2002), and 40-km-resolution ETA/CPTEC model forecast products (Saulo et al. 2000) suggest that South American LLJs are more frequent and intense between 0600 and 1200 UTC for the warm season north of 20°S near the core of the jet, shifting to 0000 and 0600 UTC when the maximum is found further south (~30°S). The few upper-air observations that are available since 1998 have localized the maximum of the wind between 1000 and 1600 m ASL in Santa Cruz de la Sierra (Douglas et al. 1999) with a lateral extension of about 500 km. Numerical simulations of individual



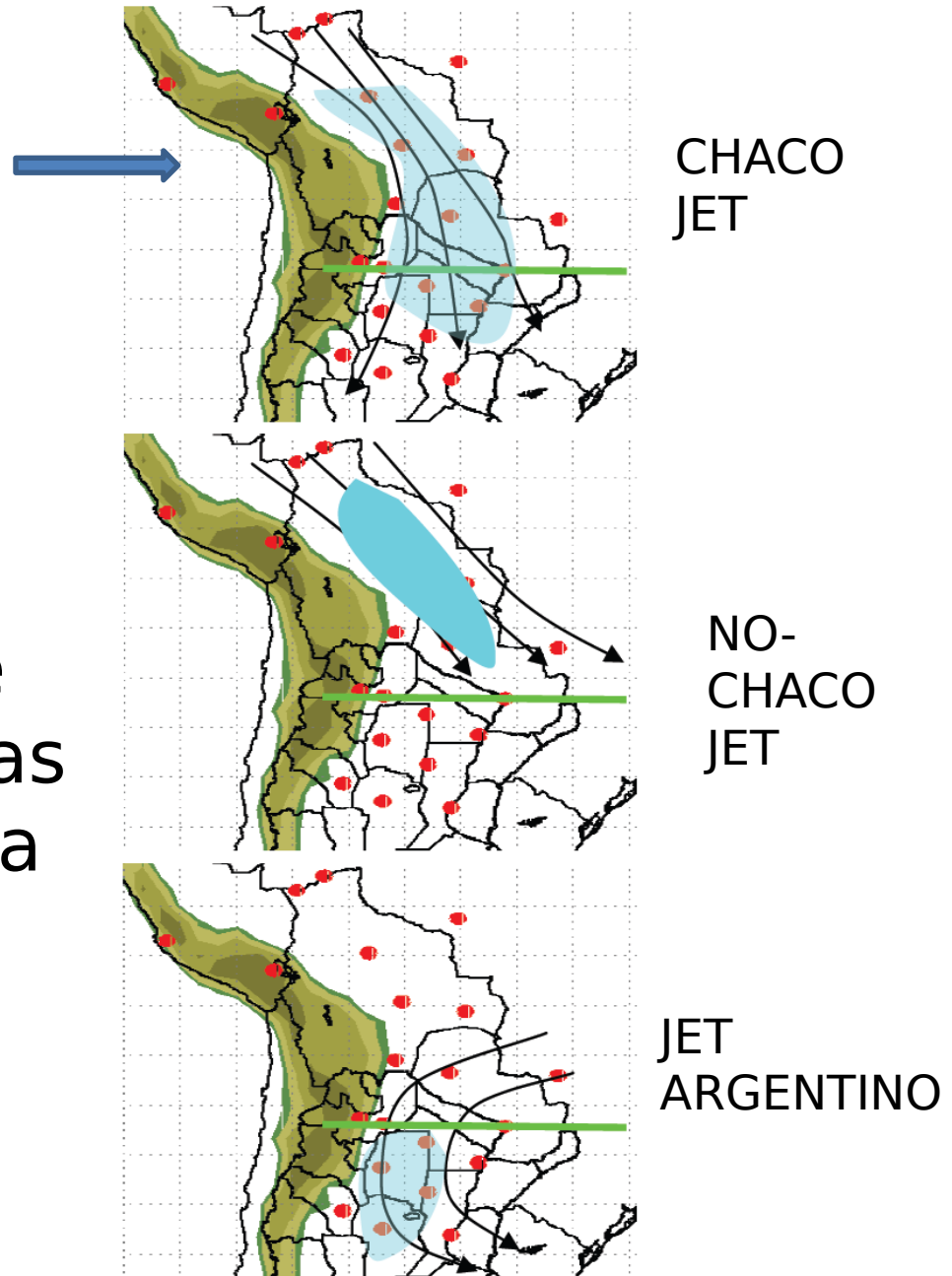


**FIG. 7. Episodes of LLJ detected in Santa Cruz de la Sierra during the Jan–Feb 2003 period using the NCEP–NCAR reanalyses as depicted from Hovmoeller diagram of the vertical profile of meridional wind. Contour interval is  $3 \text{ m s}^{-1}$ .**

Cuando se cumple el criterio de CCCB y la isotaca de 12 m/s se extiende hasta 25° S, y  $v < 0$  y además  $v > u$  -> **Evento Chaco**.

Modelo simplificado de circulación en capas bajas predominante durante la estación cálida

Nicolini y otros  
2006



# CCCB

[https://resources.eumetrain.org/satmanu/  
CM4SH/Argentina/Sallj/print.htm](https://resources.eumetrain.org/satmanu/CM4SH/Argentina/Sallj/print.htm)

**Table1:** Frequency of LLJ occurrences by type in SESA (2000-2003)

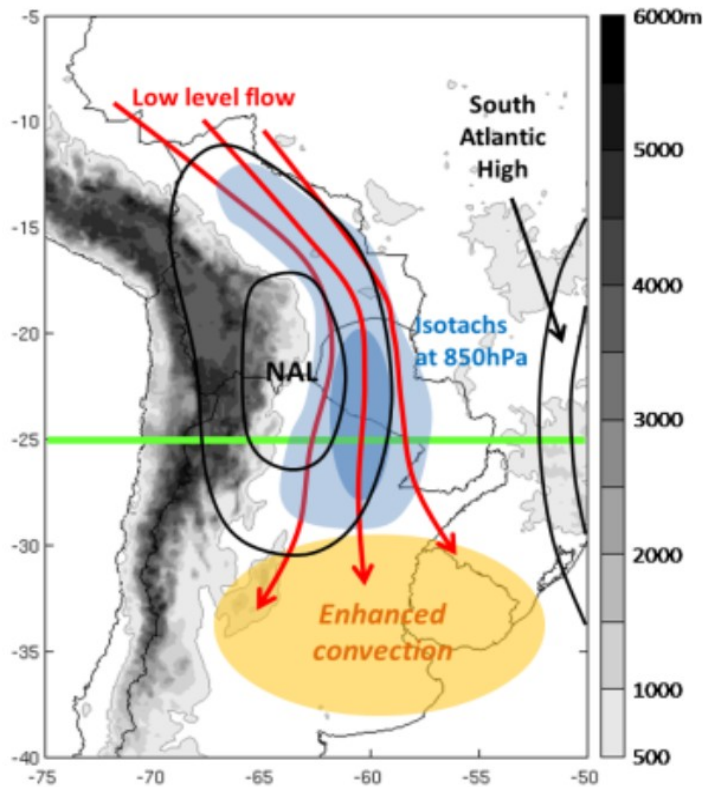
	<b>SON %</b>	<b>DJF %</b>	<b>MAM %</b>	<b>JJA %</b>	<b>Total %</b>
<b>CJE</b>	25	21	19	30	24
<b>NCJE</b>	14	15	11	9	12
<b>LLJ-ARG</b>	17	14	18	19	17
<b>NOLLJ</b>	44	50	52	42	47
<b>Total</b>	100	100	100	100	100

# Chaco Jet Events

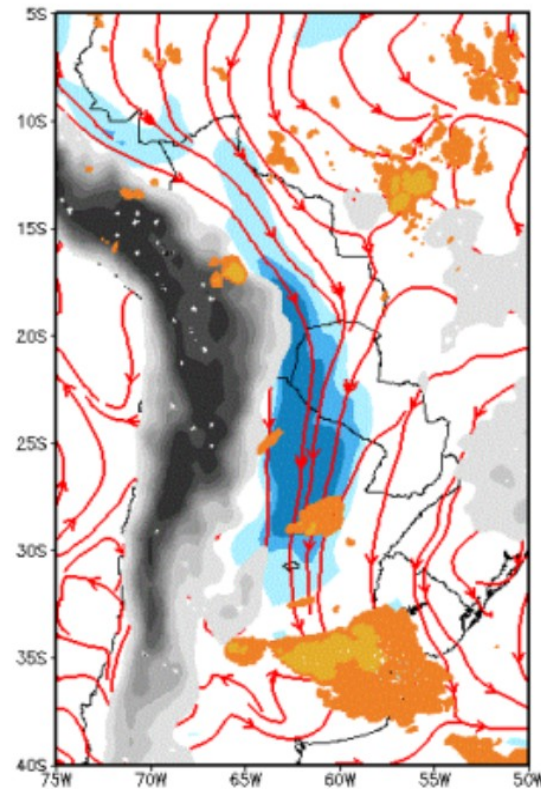
This event occurs when the SALLJ's wind maximum penetrates south of 25°S. The meridional flow lengthens as a consequence of the deepening of the thermal North Argentinian Low (NAL) commonly observed over northwestern Argentina near the Andean slopes (\*). The interaction between the NAL and the Atlantic high strengthens the pressure gradient and, by so doing, increases the northerly wind component.

The thermodynamic structure and winds of the Chaco jet enhance convective instability by transporting heat and moisture over SESA. The low- and mid-level moisture flux convergence over the region is ten times greater than the summer mean during this event. The CJE only represents 17% of the mean climatological values of the summer season in the southern Argentina, but accounts for a significant amount of the precipitation in SESA (Salio et al., 2007). Most of the convective activity occurs over central and eastern Argentina, southern Brazil and Uruguay.

*Schematics of the circulation in low levels during a CJE.*



*Example: 7 January 2001, 06:00 UTC; red: streamlines 850 hPa; blue: isotachs 850 hPa > 10 m/s; dark orange: IR brightness temperature < 235K; light orange: IR brightness temperature < 210K.*



La NAL es una baja térmica que está relacionada con la baja del Chaco.

Se intensifica por subsidencia de aire asociado al jet de niveles altos y a calentamiento de la superficie



## Mapas medios correspondientes a las 12 UTC

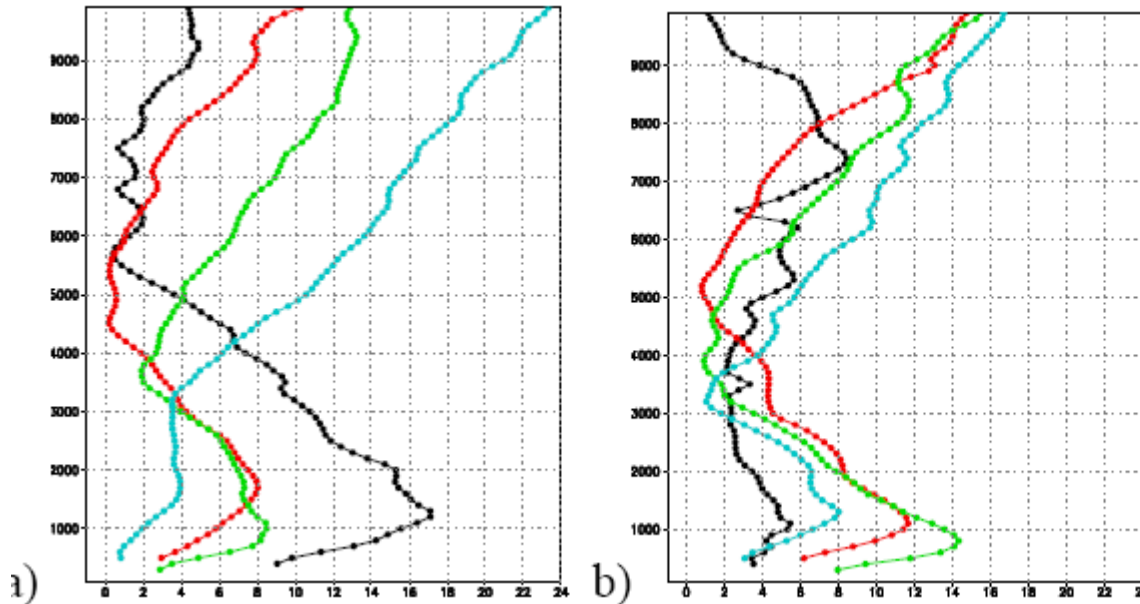


Figura 9: Perfil de velocidad del viento (m/s) en Santa Cruz de la Sierra (línea negra), Joaquín V. González (línea roja), Santiago del Estero (línea verde) y Córdoba (línea celeste) correspondiente a las situaciones de evento Chaco Jet (figura a) y jet en capas bajas en Argentina (figura b)

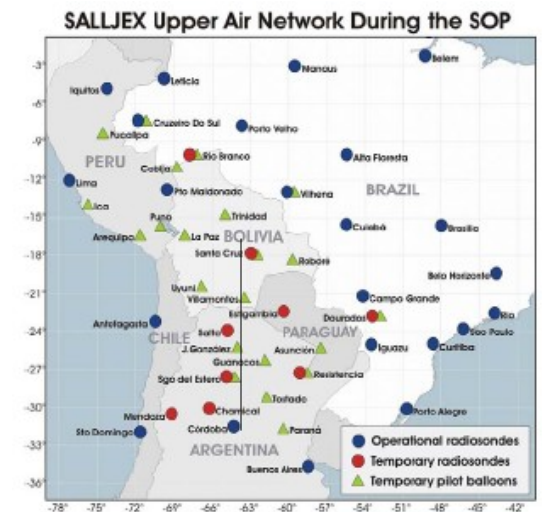


FIG. 4. Radiosonde and pilot balloon networks of SALLJEX

## Climatología del Jet del Chaco en verano

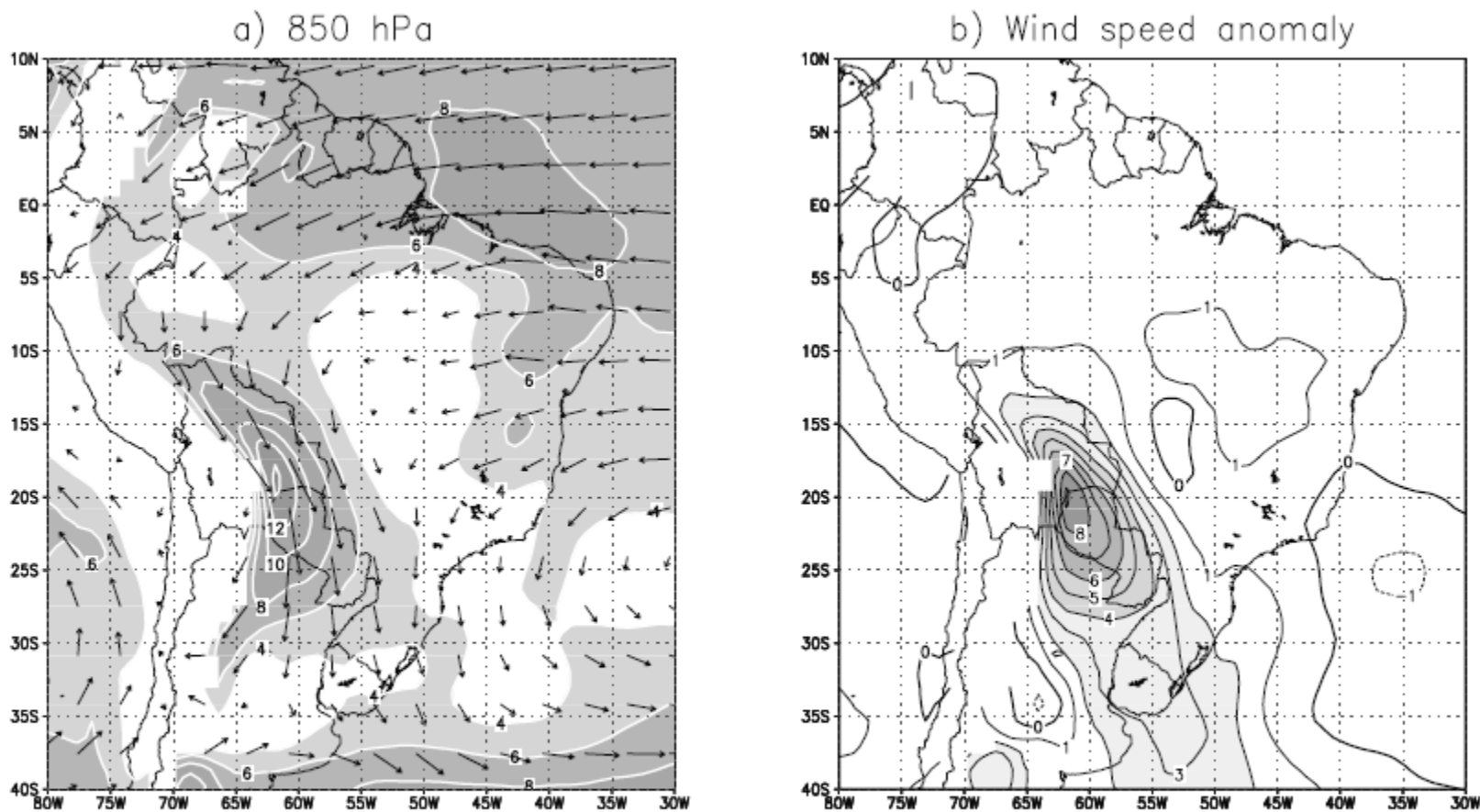
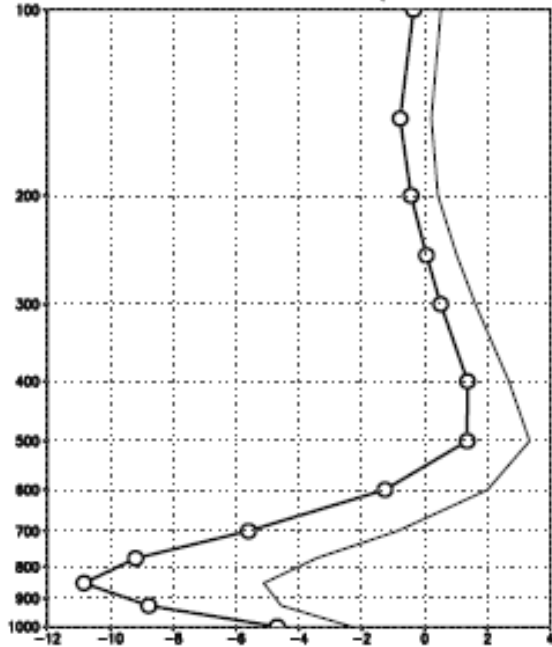


Figure 8. (a) Wind (vector) and wind speed (contoured every  $1 \text{ m s}^{-1}$ , values greater than  $4 \text{ m s}^{-1}$  are shaded) composite at 850 hPa for CJE. (b) Wind speed composite anomalies at 850 hPa for CJE are contoured every  $1 \text{ m s}^{-1}$ ; values greater than  $4 \text{ m s}^{-1}$  are shaded.

## Eventos Chaco, verano

a) Santa Cruz de la Sierra (-17.38S - 63W)



b) Resistencia (-27S - 58W)

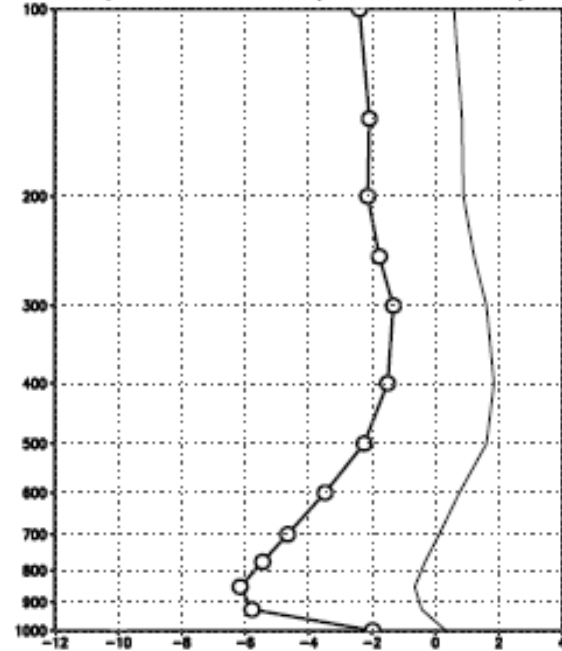


Figure 9. Meridional wind profile composite for Chaco Jet events (open dot line) and summer (solid line) at (a) Santa Cruz de la Sierra, Bolivia (17.38S, 63W); (b) Resistencia, Argentina (27S, 58W)

Salio et al (JGR, 2002)



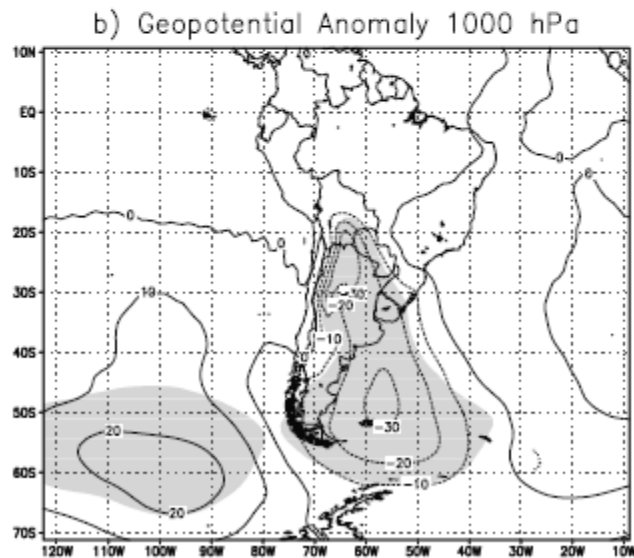
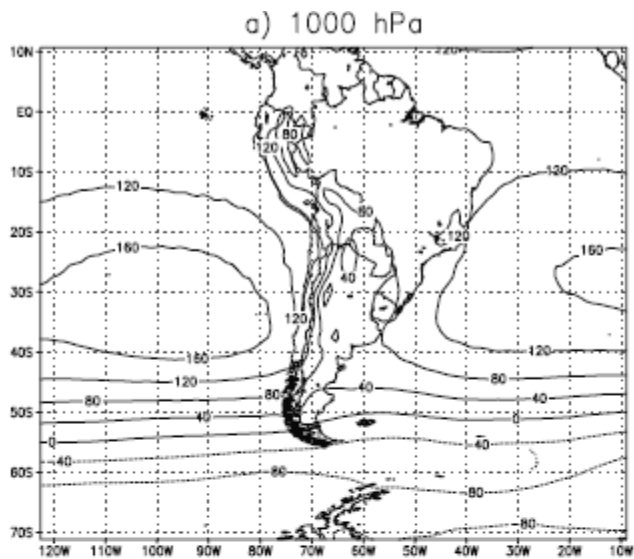


Figure 10. (a) Geopotential height composite for CJEs at 1000 hPa contoured every 40 mgp. (b) Geopotential height composite anomalies for CJEs at 1000 hPa contoured every 10 mgp. Negative values are dashed. Light shading indicates the 95% significance level.

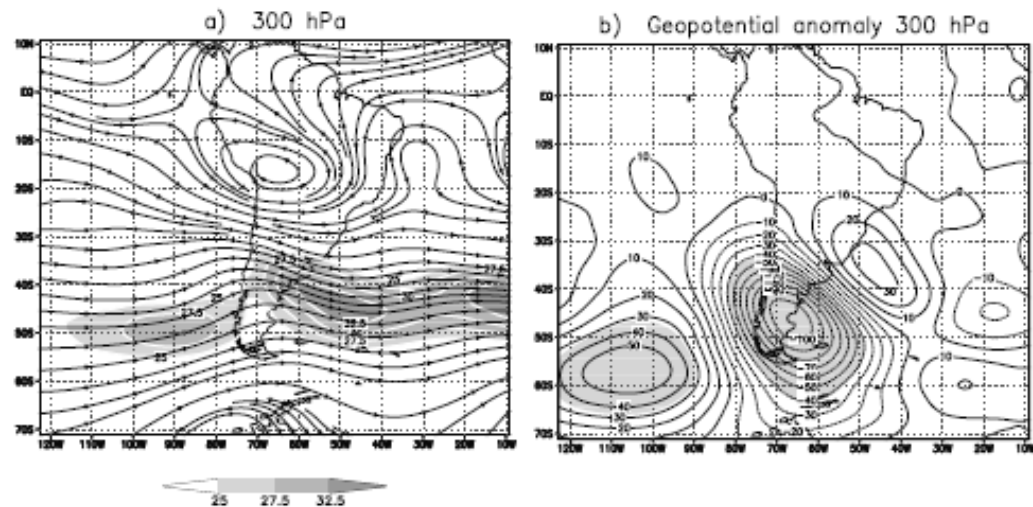


Figure 11. (a) Streamlines and wind speed (contoured, values greater than  $25 \text{ m s}^{-1}$  are shaded) composite for CJEs at 300 hPa. (b) Geopotential composite anomalies for CJEs at 300 hPa contoured every 10 mgp. Negative values are dashed. Light shading indicates the 95% significance level.

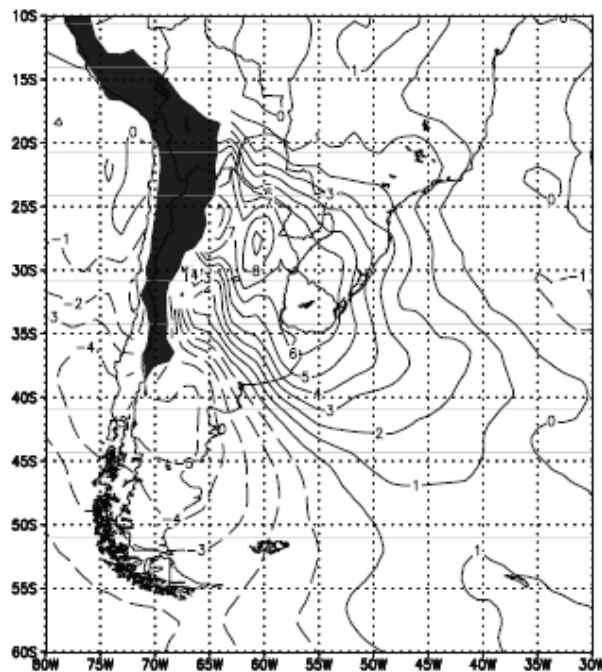


Figure 13. Equivalent potential temperature composite anomalies for CJEs at 850 hPa contoured every  $1^\circ\text{C}$ . Negative values are dashed.

# Eventos Chaco, verano

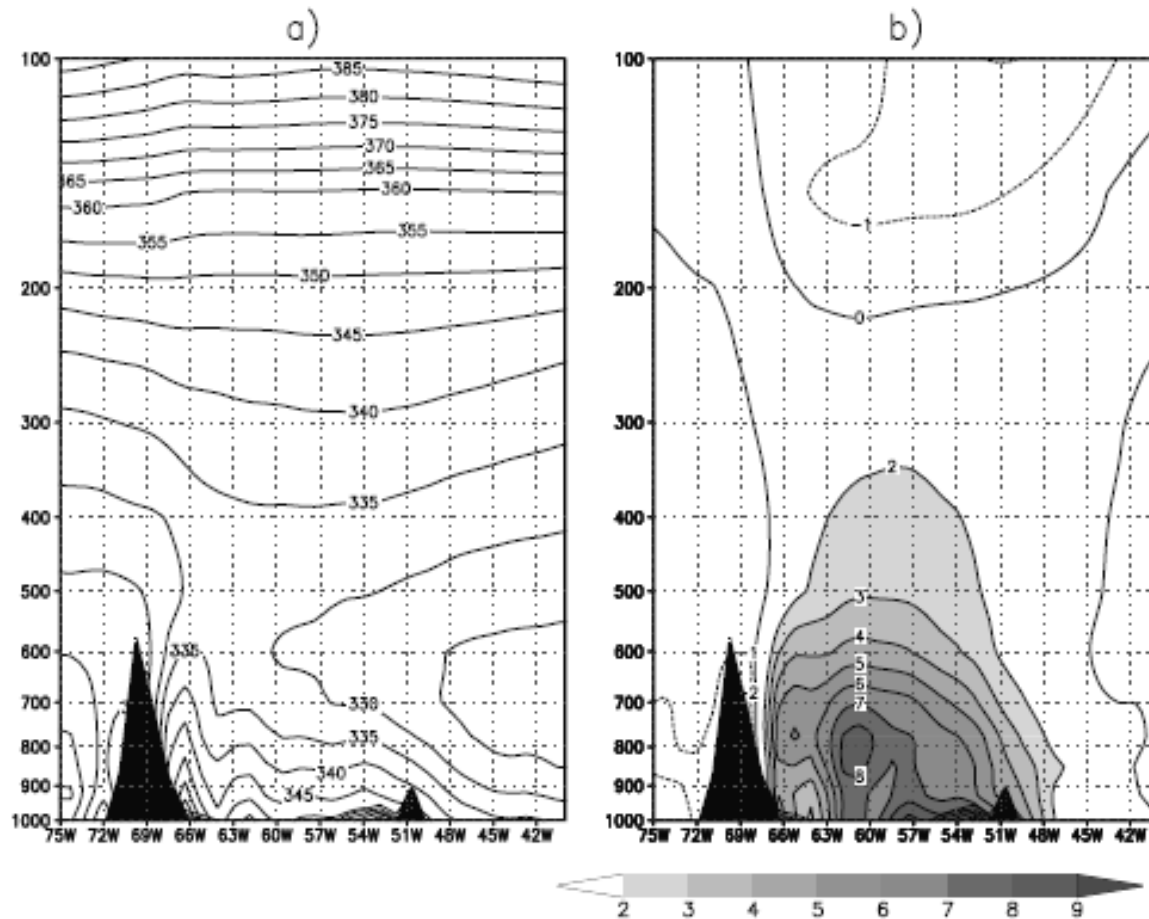
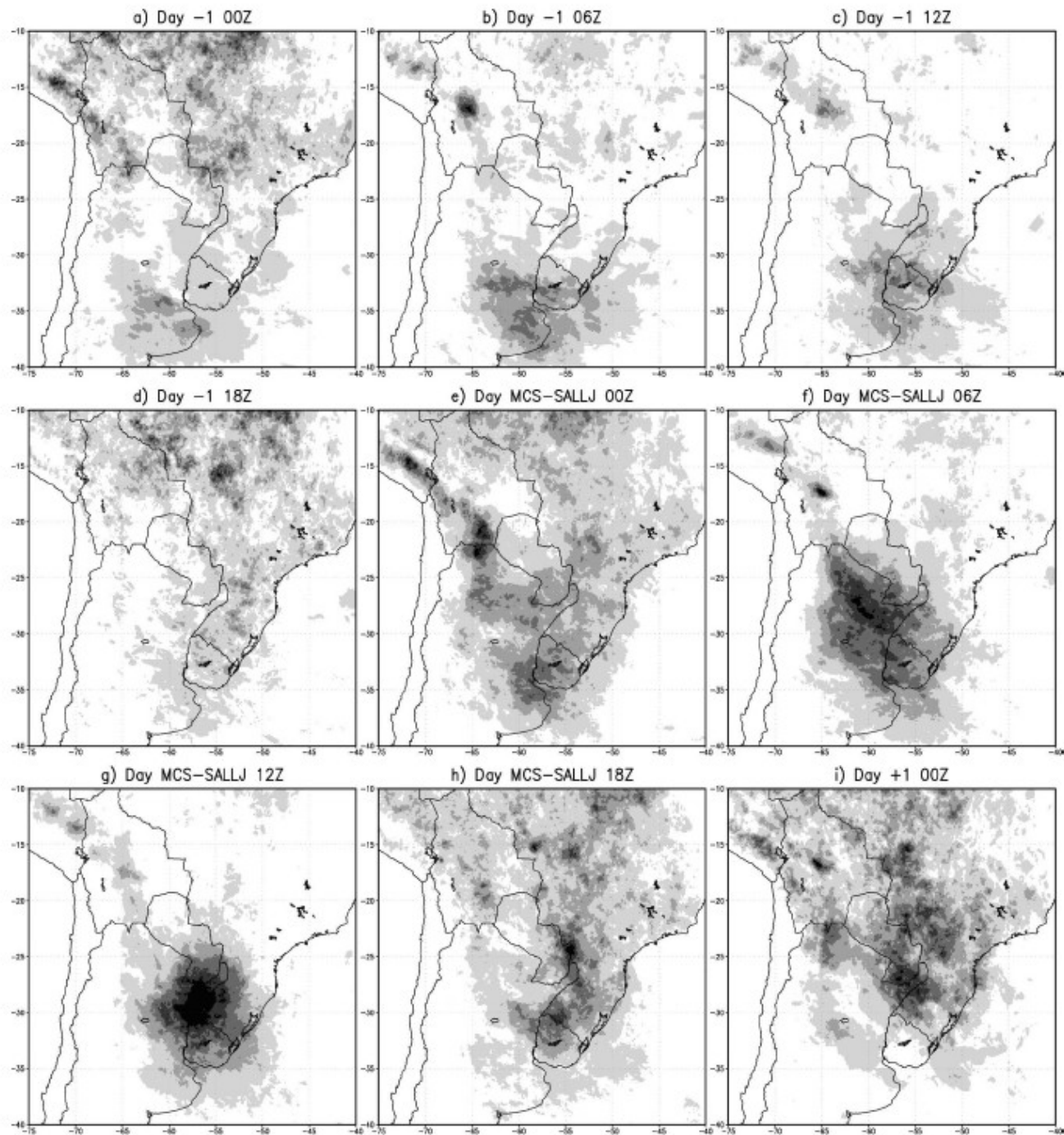


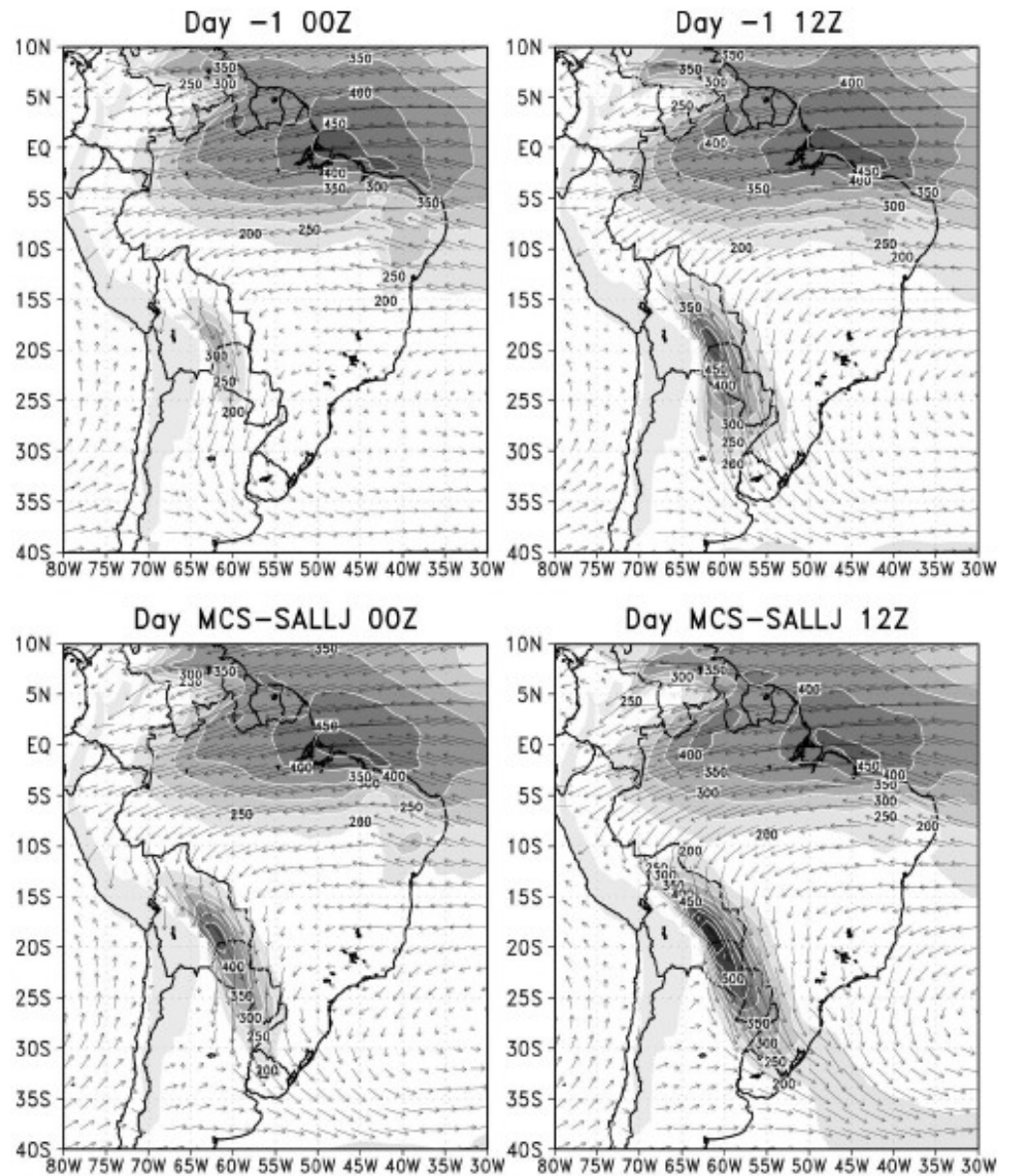
Figure 14. Longitude-pressure section of (a) equivalent potential temperature composite for CJEs at 30°S (contoured every 5°C) and (b) same as Figure 14a but for composite anomalies. Topographic cross sections are also included.

Salio et al, MWR  
2007

Relación CCCB - MCS  
(Mesoscale  
Convective Systems)

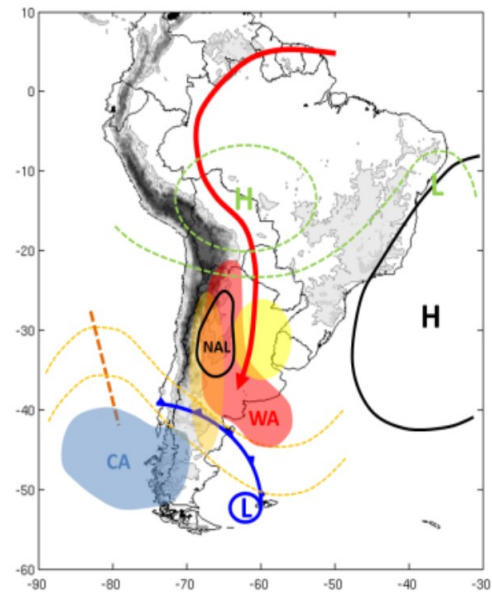


# Flujo de humedad integrado en la vertical





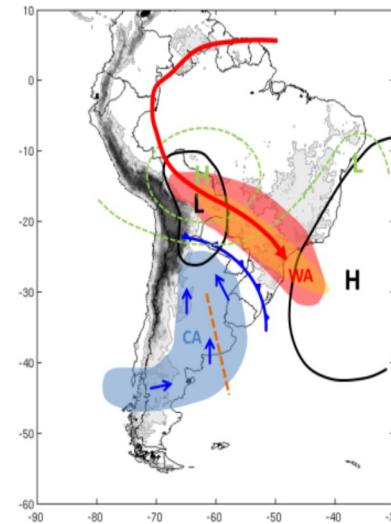
Day - 1



- A polar trough enters the southern cone of South America, sustaining a cold front across Patagonia. There is a jet streak along the central Andes of Chile and Argentina. The ensuing subsidence on the lee side of the Andes induces the gradual deepening of the NAL.
- An intense warm air advection (WAA) southward at low levels ahead of the cold front.
- Convection over central Argentina occurs mainly in the summer. It is formed by the moisture convergence at low levels and the upper divergence that comes with the trough at 500 hPa.

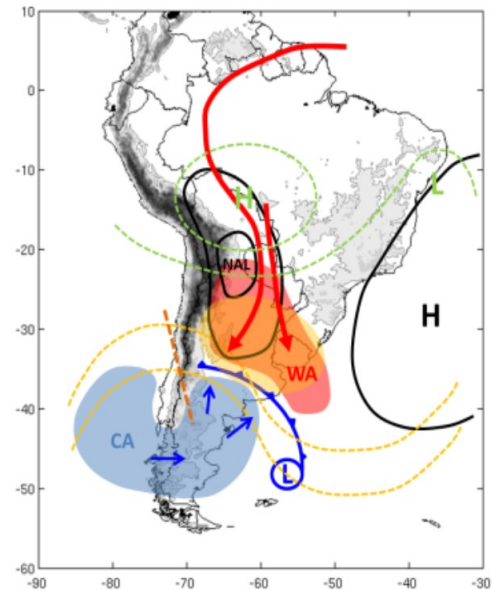
## Ciclo de vida de CJE

Day + 1



- The cold front moves to northern Argentina/southern Paraguay.
- Cold air advection (CAA) dominates central Argentina.
- The warm advection extends from Bolivia to southern Brazil along the axis of the LLJ.
- Convective activity is located ahead of the cold front, in the warm air mass.

Day - 0



- Maximum anomalies of theta-e over central and northern Argentina and Uruguay.
- Strong contrast between cold air behind the front and warm air ahead.
- Strong northerly winds at low levels, satisfying Bonner (1968) criteria, associated with warm and moist advection over a large area in southeastern South America (SESA).
- Enhanced moisture convergence at low levels.
- Propagation of a cold front from southern Argentina toward the northeast, which enhances the convergence at the exit region of the LLJ.
- The environment is ideal for the development of deep organized convection over central and north of Argentina: moist and unstable air, high values of CAPE, and vertical motions.
- Maximum activity of MCSs during the night (03-09UTC).

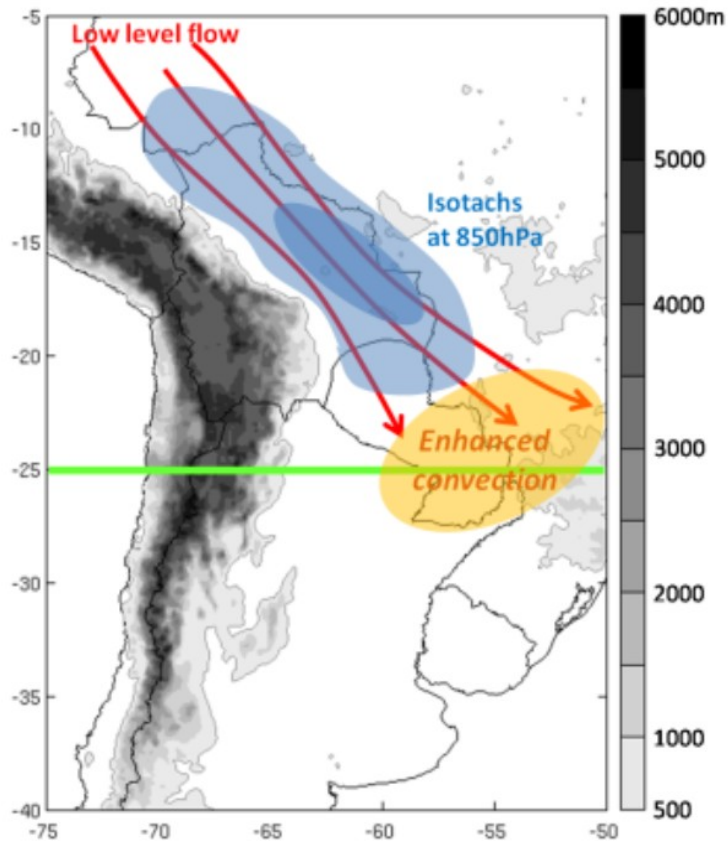


# No Chaco Jet Events

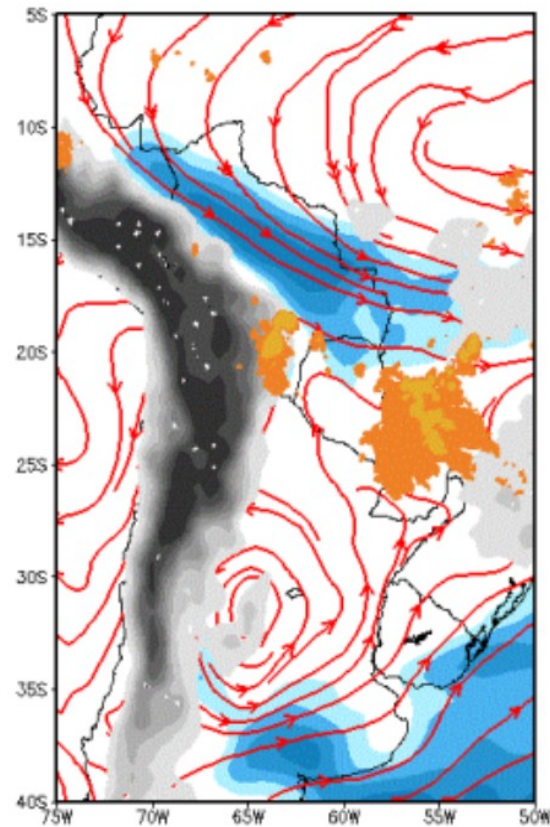
The configuration of these events is similar to that of the CJEs, but the wind maxima do not penetrate south of 25°S. During a NCJE, the wind is more zonal than meridional, whereas with CJEs the meridional component is the most important one.

Convection tends to develop between northern Paraguay and southern Brazil.

*Schematics of the circulation in low levels under NCJE event*



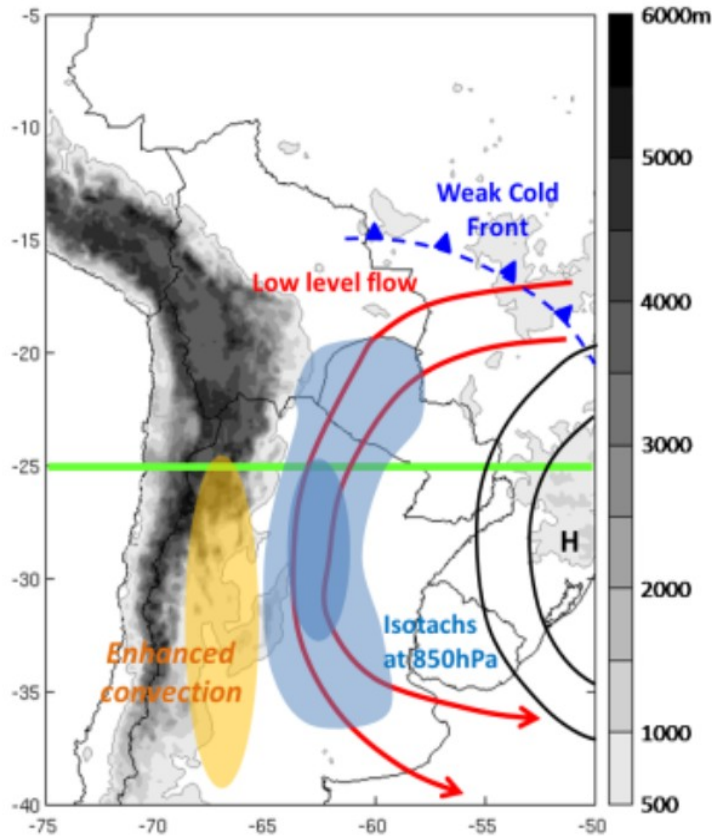
*Example: 6 January 2003, 12:00 UTC; red: streamlines 850 hPa; blue: isotachs 850 hPa > 10 m/s; dark orange: IR brightness temperature < 235K; light orange: IR brightness temperature < 210K.*



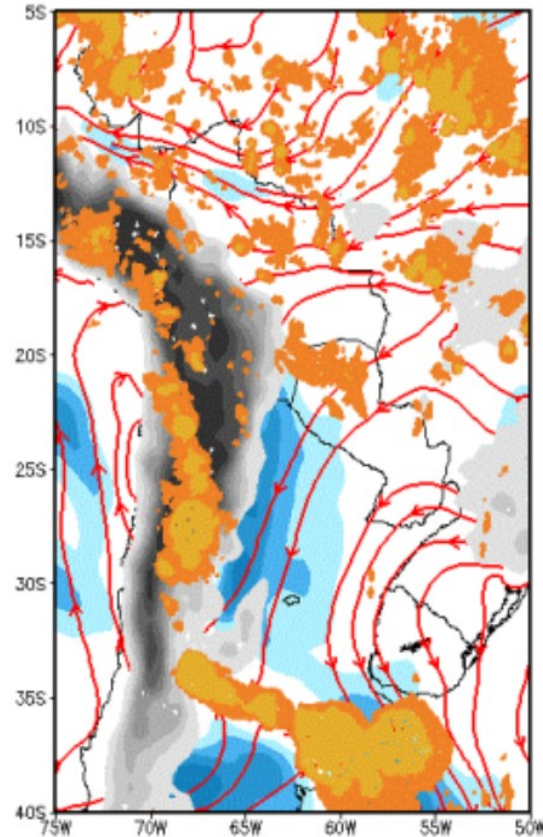
# Argentinian Low Level Jet

There is another LLJ east of the Andes that is independent from the northerly SALLJ. It develops along the western periphery of a postfrontal anticyclone. In these cases, in contrast to CJE and NCJE, the main source of moisture is the Atlantic Ocean. Precipitation develops along the eastern slopes of the Andes in central and northwestern Argentina.

*Schematics of the circulation in low levels under LLJ-ARG event.*



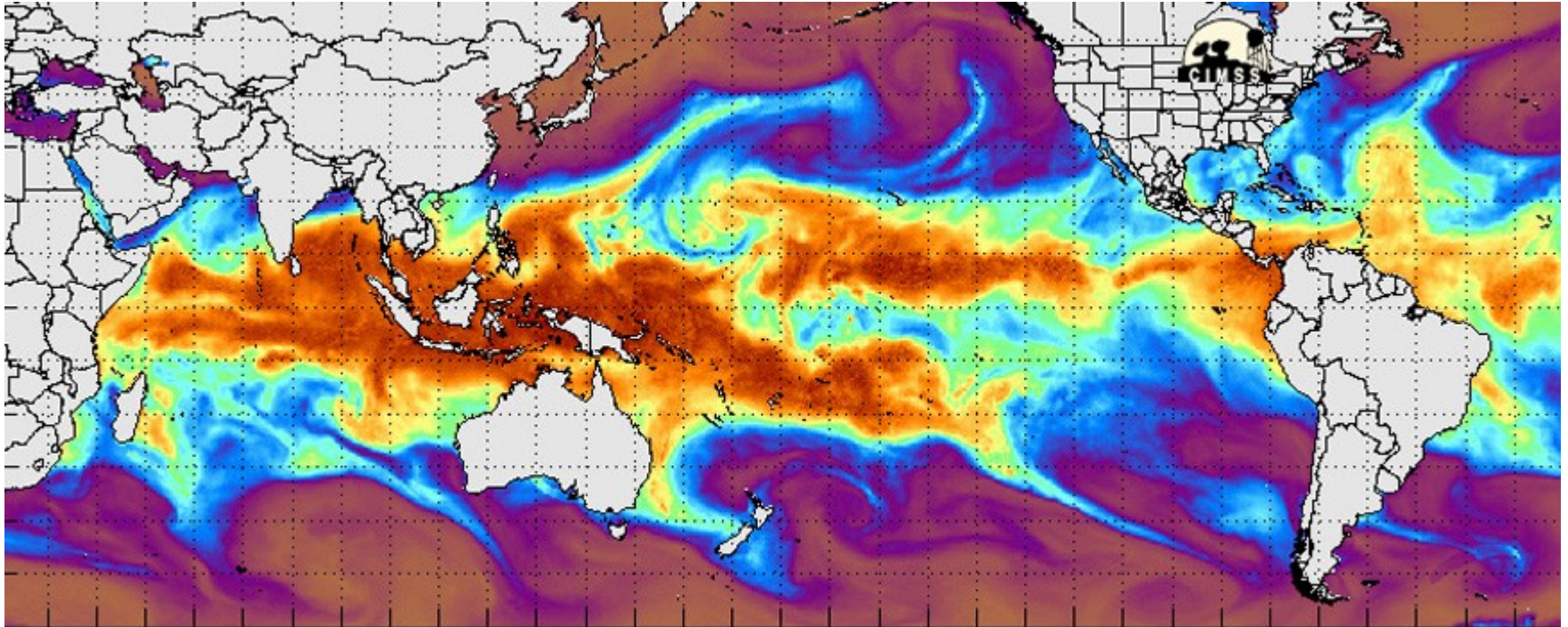
*Example: 1 March 2001, 00:00 UTC; red: streamlines 850 hPa; blue: isotachs 850 hPa > 10 m/s; dark orange: IR brightness temperature < 235K; light orange: IR brightness temperature < 210K.*





**Ríos atmosféricos:** filamentos de contenido de vapor de agua en extratropicos

Generalmente se los define sobre los océanos.

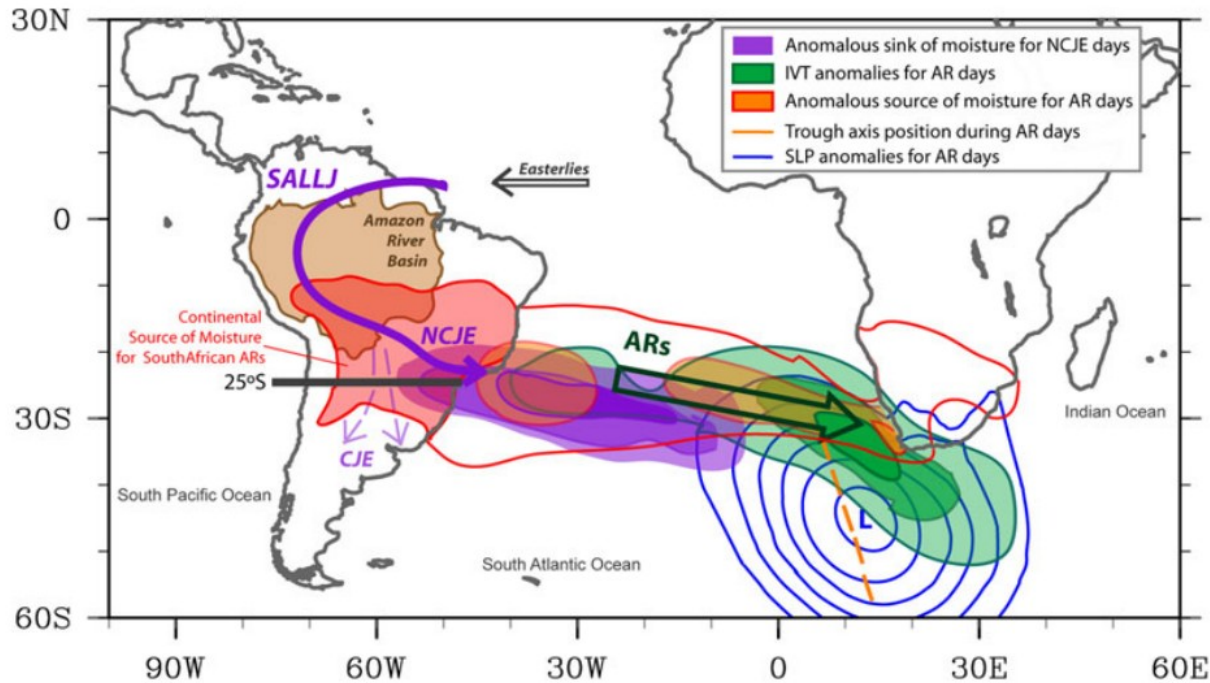


“Aerial river” se reserva a veces para los flujos de humedad en continentes.

Para Chile los ríos atmosféricos representan una fuente fundamental de lluvias intensas.



# CCCB + rios atmosféricos



**Figure 7.** Conceptual model of the combination of the LLJ and ARs to transport moisture from Amazonia (brown area) to southwestern South Africa. Purple arrow indicates the South America low-level jet (SALLJ) in its both configurations; no Chaco jet events (NCJE) returning northern 25°S, and Chaco Jet Events (CJE, dashed lines) crossing southward 25°S. Purple contours are the sinks of moisture during NCJEs during the 10 days before the AR makes landfall in South Africa. Red contours are the sources of moisture during 10 days back for the AR days over South Africa; and the red-colored area over South America is the continental source of moisture. Greenish areas indicate the anomalies of IVT for AR days. Green big arrow indicates the common position of the AR track. Blue lines are the SLP anomalies and the orange dashed line is the trough axis position during AR days.