10th International Training Workshop Climate Variability and Predictions (10 ITWCVP)

Sub-Seasonal to Seasonal Forecasting

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Basic State of the Climate

The Andean Climate

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Geographical setting

Equatorial Andes

Altiplano

Subtropical Andes

Patagonia

Amazon basin

Brazilian highlands

Llanos

Guinas highlands

Chaco

Pampas
Precipitation features

1. ITCZ
2. Continental convection
3. Altiplano convection
4. SACZ
5. Pampas convection
6. Midlatitude storm track
7. Orographic precipitation
8. Coastal desert
9. NE Brazil semiarid
10. Patagonia dry zone

Circulation features

1. ITCZ
2. Trade winds
3. Subtropical high
4. Midlatitude westerlies
5. Low level jet
6. SACZ
7. Bolivian high
8. NE Brazil trough
9. Tropical easterlies
10. Midlatitude westerlies
11. Jet stream
Schematics of the low-level atmospheric flow around the Andes cordillera. Also shown major climate features of South America.
Section Across South America Displaying Schematically the major large scale elements to the South America Monsoon Systems
Pressure-longitude cross section of the meridonal wind at 27° S during austral spring (SON). Contour interval is 2 m/s, the zero line is omitted and negative values in dashed lines. The brown area represents the Andes profile at this latitude. To the west of the Andes there is southerly low-level jet (signalled by S) just off the coast and a northerly jet (signalled by N1) close to the Andean slope. To the east of the Andes there is evidence of the northerly low-level jet (signalled by N2).
Climatological (long-term mean) precipitation over South America displayed over terrain elevation for austral summer (December-January-February, top) and winter (June-July-August, bottom).
The seasonal cycle (for modern boundary conditions) in the GFDL model of precipitation (solid, mm/day) and zonal wind at 200 hPa (dashed, m/s) over the central Altiplano (60°-78°W and 20°-10°S).
Long-term mean CMAP precipitation (shaded — scale at right) and 925 hPa wind vectors (arrows — scale at bottom) for (a) January and (b) July. Right panels: long-term mean precipitation (shaded — scale at right) and streamlines at 300 hPa (streamlines) for (c) January and (d) July.
Calentamiento diabático

0 km

12 km

$t < 2 \text{ hr}$

$t \sim 12-24 \text{ hr}$

$\mathbf{A}$

Div

$\mathbf{B}$

Con

$f = 0$

$f < 0$

Sur

Este
$f = 0$

$f < 0$

$t \sim$ días

$\beta v > 0$

$\beta v < 0$

$t \sim$ semanas

Sur

Este

Div

Con

B

A
Pressure-latitude cross section of the long-term mean zonal wind averaged between 80° - 60° W for austral summer (DJF, top) and winter (JJA, bottom). Positive contour interval is 10 m/s (solid green lines). Negative contour interval is 5 m/s (red dashed lines). Areas with easterly flow are shown in grey. Brown area indicates mean Andes height.
Schematic representation of the circulation patterns and different air masses over and adjacent to the central Andes, in a vertical-longitude section at the latitudes of the Altiplano, for (a) rainy episodes and (b) dry episodes. Large, open arrows indicate the sense of the upper-level, large-scale low. Solid (dashed) curves represent the transport of moist (dry) air by the regional circulation over the Andean slopes. Thin vertical arrows represent the large-scale subsidence over the subtropical SE Pacific that maintains the strong trade inversion (solid line).
Anual Cycle and Spacial Distribution

Reanalysis data at 17.5°S 70°W

a. Zonal wind speed
Intraseasonal Variability

Reanalysis data at 17.5°S 70°W

a. Zonal wind speed
Key atmospheric features over the South East Pacific

- Subtropical High
- Coastal jet
- SCu deck
- SAM
- ITCZ
- Andes Mts.
Annual cycle of ASST
Annual cycle of SLP
The extensive and persistent deck of SCu over the SSEP plays an important role in the regional and global climate by substantially reducing the amount of solar radiation that reaches the sea surface.
Cloud field has significant spatial variability
Annual cycle of SCu and inter-regional differences largely explained by low level stability.
Coastal upwelling and Equatorial upwelling

Phytoplankton thriving in the upwelling along the equator show up as a thin, light blue band.

The high phytoplankton concentrations induced by upwelling along the South American coast support one of the world's richest fisheries.
• V > 8 m/s off central Chile almost always associated with a southerly jet (dark shaded)

• Jet events typically a week long (3-15 days)

• More frequent, stronger and longer in summer.
Impacts of Jet Events on SST
Impacts of Jet Events on SST

Wind, SST and SST anomalies

Renault et al. 2006
STORM TRACK
Baroclinic Wave HS
a. May 14 0000 UTC

28°C

12°C
THANKS