South America Physical Map



Southern La Plata Basin: Regional Climatology

Extracted from Barros V, Clarke R, Silva Días, P, 2006. Climate Change in the La Plata Basin. Chapter II: La Plata Basin Climatology. - 1a ed. - Buenos Aires : Consejo Nacional de Investigaciones Científicas y Técnicas - CONICET, 232 p.

The climatic characteristics of the mean sea level pressure fields show a notorious seasonality (Figure 1). This seasonality is of great importance in determining the low-level circulation and its associated moisture advection to the region of interest (southern La Plata Basin).

During summer, the high pressure cells over the eastern South Pacific and western South Atlantic are positioned in their southernmost location, limitating the westerlies to the south of 50°S. A thermo-orographic low is located in the center of the continent over the eastern Andes mountain range.

During winter, both the semi-permanent high systems and the westerlies are in their northernmost position. The circulation is dominated by frontal systems and perturbations.



Figure 1. Mean sea level pressure fields for summer (DJF) and winter (JJA).

Brief comments on some particular features:

- The South Atlantic High dominates the low level circulation east of the Andes: the easterly flow from the equatorial Atlantic Ocean turns south towards the subtropical region when reaching the proximity of the Andes, resulting in a predominant meridional component from the North all year long.
- This meridional circulation is responsible for the moisture advection at low levels from the Amazonia to subtropical and mid-latitudes, bordering the Andes. This flux many times takes the characteristics of a low level jet in low layers (LLJ). The LLJ is present all over the year.
- The Andes range has also a significant influence on air masses meridional movement: incursions of both polar and tropical air masses are favored along the eastern side of the Andes generating favorable conditions for the occurrence of extreme temperature events in southern La Plata Basin.
- In winter, the mid-latitude circulation (baroclinic waves) usually penetrates sporadic and deeply toward the tropics, accompanied by intrusions of polar air, with the consequent and important plunges of the air temperature still in the most northern part of the basin (called friagens in Brazil).
- As a result of the advection of moisture from the tropical continent, enhanced by the presence of the LLJ throughout the year, and because of synoptic disturbances, the rainfall regime in <u>eastern South America south of 20°S</u> has not a pronounced annual cycle (see, Barros et al., 2006. Chapter II):

- During the warm season (Oct-Apr), mesoscale convective complexes are frequent, and they account for a large part of the total precipitation.
- In addition, there are frequent cyclogenesis during the transition seasons over eastern subtropical South America.
- During the cold season, the most relevant forcing is due to synoptic activity, which accounts for much of the seasonal precipitation in southeastern SA.
- On the other hand, in <u>western Argentina and in the Chaco region stretching over Paraguay</u> <u>and Argentina</u>, the rainfall regime has typical monsoon features. The rainy season begins in September, ending the dry winter season, and it lasts until the austral autumn (see, Barros et al., 2006. Chapter II).
- Summer systems:
 - The intermittent termal-orographic depression of the Argentine Northwest, present all along the year but more intense during summer. Its presence strengthens moisture advection from the North and favors the rainy season western Argentina.
 - The South Atlantic Convergence Zone (SACZ): It is an elongation of the tropical convection in the centre of Amazonia towards the Atlantic Ocean. It is located around 20°S, continuing over the ocean up to latitudes close to 45°S. Events with strong (weak) convective activity over the SACZ are associated with negative (positive) rainfall anomalies in southern La Plata Basin.
 - The Bolivia High: It is a circulation pattern that appears in the high troposphere during the warm season. It establishes every year in September, linked to the nucleus of the tropical continental convection (its divergent flux at high levels is linked to abundant rainfall in the Highland (altiplano) itself and in the Northeast region of the La Plata basin).

Predictors

The climatic characteristics described above should be captured by predictors. Near the Andes, reanalyses are not good enough at low levels. In this sense, sometimes U and V (zonal and meridional wind components) are better in representing circulation at low levels.

We could suggest a list of possible predictors, as follows:

- Mean sea level pressure
- Air Temperature (500, 850 hPa and 2 m)
- U and V (200, 500, 700, 850 hPa)
- Geopotential Height (200, 500, 700, 850 hPa)
- Specific Humidity (700, 850 hPa)
- Relative Humidity (700, 850 hPa)