THE HYDROLOGIC CYCLE OF THE LA PLATA BASIN IN SOUTH AMERICA

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ABSTRACT

The main components of the hydrologic cycle of the La Plata basin in southeastern South America are investigated using a combination of observations, satellite products, and National Centers for Environmental Prediction (NCEP)–National Center for Atmospheric Research (NCAR) global reanalyses. La Plata basin is second only to the Amazon basin in South America in river discharge and size and plays a critical role in the economies of the region. It is a primary factor in energy production, water resources, transportation, agriculture, and livestock.

Of particular interest was the evaluation of the annual cycle of the hydrologic cycle components. The La Plata annual-mean river discharge is about 21 000 m3 s21, and the amplitude of its mean annual cycle is small: it is slightly larger during late summer, but continues with large volumes even during winter. The reason for this is that different precipitation regimes over different locations contribute to the total river discharge. One regime is found toward the northern boundary, where precipitation peaks during summer in association with the southernmost extension of the monsoon system. A second one is found over the central part of the basin, where precipitation peaks at different times in the seasonal cycle. Further analysis of the main tributaries of La Plata (Parana´, Uruguay, and Paraguay) reveals that each has a well-defined annual cycle but with different phases that can be traced primarily to each basin's physiography and precipitation regime.

Interannual and interdecadal variability of the basin's precipitation is amplified in the variability of streamflow by a factor of 2, implying a high sensitivity of the hydrologic system to climate changes like those observed in the last few decades. This becomes more important when considering the large variability of streamflow: for example, the historical maxima of river discharge during the year following the onset of El Nin˜o can triple the typical mean river discharge.

A crucial component of the atmospheric water cycle, the low-level jet east of the Andes, supplies moisture from tropical South America to La Plata basin throughout the year. In lower latitudes, the jet has the greatest intensity during summer, but south of about 158S there is a phase shift and the largest moisture fluxes are found during winter and spring. This is an uncommon feature not observed in other regions like the Great Plains of the United States, where the low-level jet develops only during the warm season.