Proceedings of 8 ICSHMO, Foz do Iguaçu, Brazil, April 24-28, 2006, INPE, p. 1113-1116.

THE DIURNAL CYCLE OF PRECIPITATION OVER SOUTH AMERICA BASED ON CMORPH

Vernon E. Kousky, John E. Janowiak and Robert J. Joyce
NOAA/ Climate Prediction Center
Camp Springs, MD 20746

1. Introduction

The diurnal cycle of precipitation over the region of South America is examined using high spatial and temporal resolution analyses that have been produced by NOAA's Climate Prediction Center morphing technique (CMORPH) (Joyce et al. 2004). The 8-km spatial resolution (at the equator) and 30-minute temporal resolution of these analyses permit an in-depth look at the diurnal cycle of precipitation.

2. Results

Major features of the summertime diurnal cycle, as depicted by CMORPH for the South American Monsoon, include an afternoon maximum in precipitation over the Andes and the high terrain in central and eastern Brazil, a nocturnal maximum in precipitation over areas just east of the Andes (western Argentina, central Bolivia and western Paraguay), and a nocturnal maximum over the Atlantic Ocean in the vicinity of the South Atlantic Convergence Zone (Fig. 1, upper right panel) (also see Janowiak et al. 2005). A remarkable diurnal cycle in precipitation occurs in coastal areas of northern and northeastern South America. With daytime heating, precipitation rapidly develops along and just inland from the coast (Fig. 1, lower right panel), probably related to the sea breeze. This precipitation advances westward and southward, producing a nocturnal maximum in areas approximately 500 km inland from the coast (Fig. 1, upper right panel). The inland propagation of sea-breeze-induced rainfall systems is a feature most frequently found during late SH summer (December-February) and fall (March-May). The seasonal average diurnal cycle for equatorial South America (Eq. – 5ºN) for March-May 2003 (Fig. 2) indicates that sea-breeze-induced precipitation systems propagate westward, reaching the western Amazon Basin in about two days. As these systems propagate inland they contribute to a nocturnal precipitation maximum in some areas and a diurnal precipitation maximum in other areas. A nocturnal or early morning precipitation maximum also occurs along the immediate coast and offshore in the vicinity of the Atlantic ITCZ and over the Pacific near the west coast of South America.

The seasonality of the diurnal cycle for the region east of the Andes (northern Argentina-southern Brazil, Fig. 3) indicates that the nocturnal maximum over western and central northern Argentina (top two panels) is strongest during October-December, and weaker and slightly later during January-March. Over northeastern Argentina and southern Brazil an early morning maximum is observed during October-November (austral spring), but rainfall occurs throughout the 24-hour period, probably due to the influence of cold fronts that are an important mechanism for organizing precipitation, especially during the austral spring. These results should be considered tentative, due to the limited sample size (number of events) used in creating the mean diurnal cycle.

Corresponding author address: Vernon E. Kousky, NOAA/Climate Prediction Center, Rm. 605, 5200 Auth Rd., Camp Springs, MD 20746. E-mail: Vernon.Kousky@noaa.gov

3. References

Janowiak, J. E., V. E. Kousky and R. J. Joyce, 2005: The diurnal cycle of precipitation determined from the CMORPH high spatial and temporal resolution global precipitation analyses. *J. Geophys. Res. Atmos.,* (in press).

Joyce, R. J., J. E. Janowiak, P. A. Arkin, and P. Xie, 2004: CMORPH: A method that produces global precipitation estimates from passive microwave and infrared data at high spatial and temporal resolution. *J. Hydromet*., **5**, 487-503.

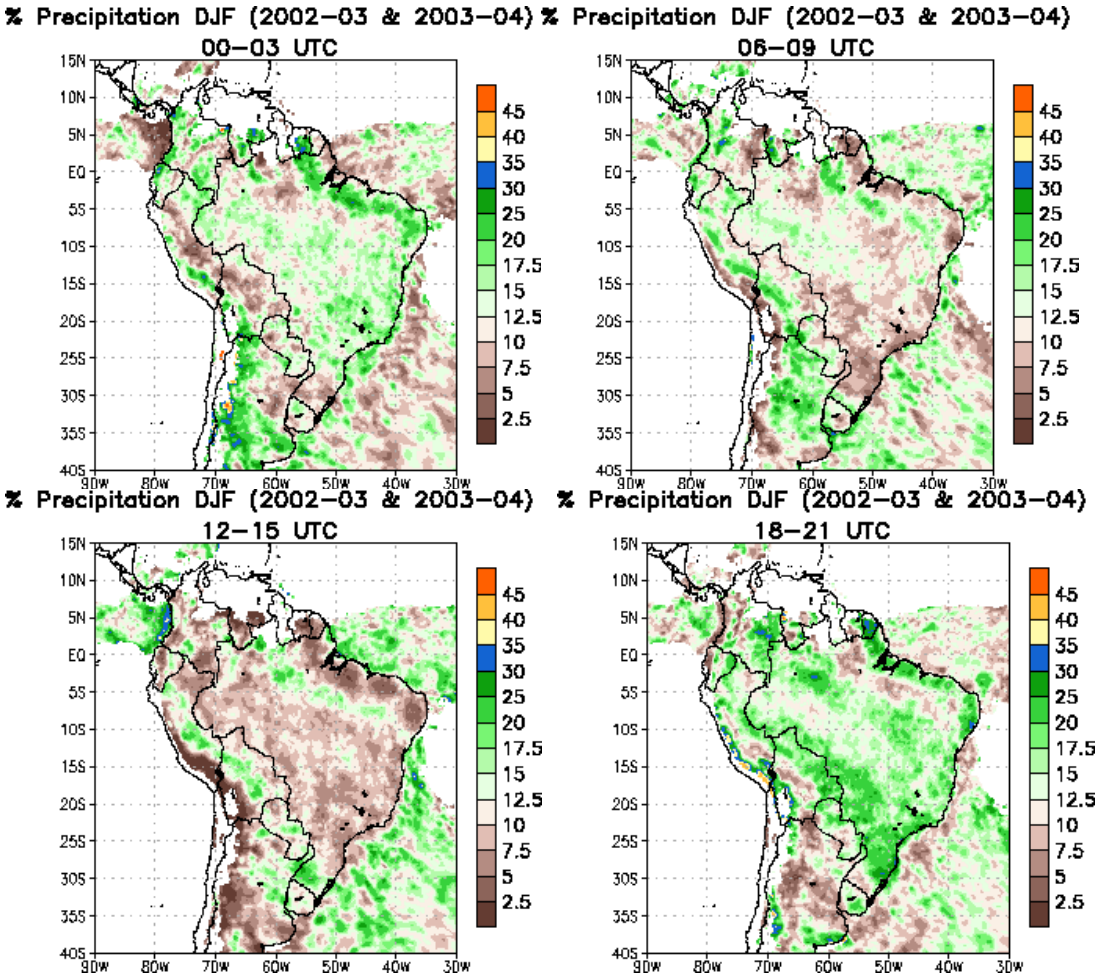

Fig. 1. Percent of mean December-February (2002/03-2003/04) daily precipitation occurring in selected 3-h intervals. If precipitation were equally distributed throughout the day, then 12.5% of the daily total would be expected to occur in each 3-h period. Local time east (west) of 60ºW is UTC time minus 3 (4) hs.

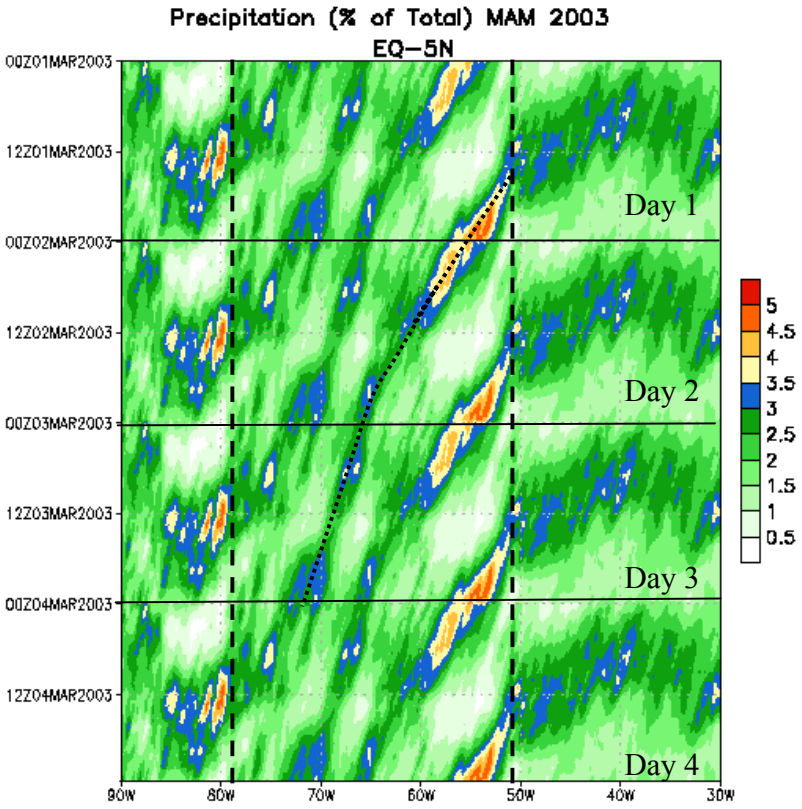

Fig. 2. Time-longitude section of percent of mean daily precipitation. The mean diurnal cycle is repeated 4 times and is computed at an interval of 0.5 hs. Approximately 2.1% (100/48) would be expected during each interval if the precipitation were equally distributed in time throughout the 24 hs. The approximate positions of the east and west coasts of South America are indicated by the vertical dashed lines. The dotted line indicates the westward progression of convection initiated along the east coast of the continent near the mouth of the Amazon River.

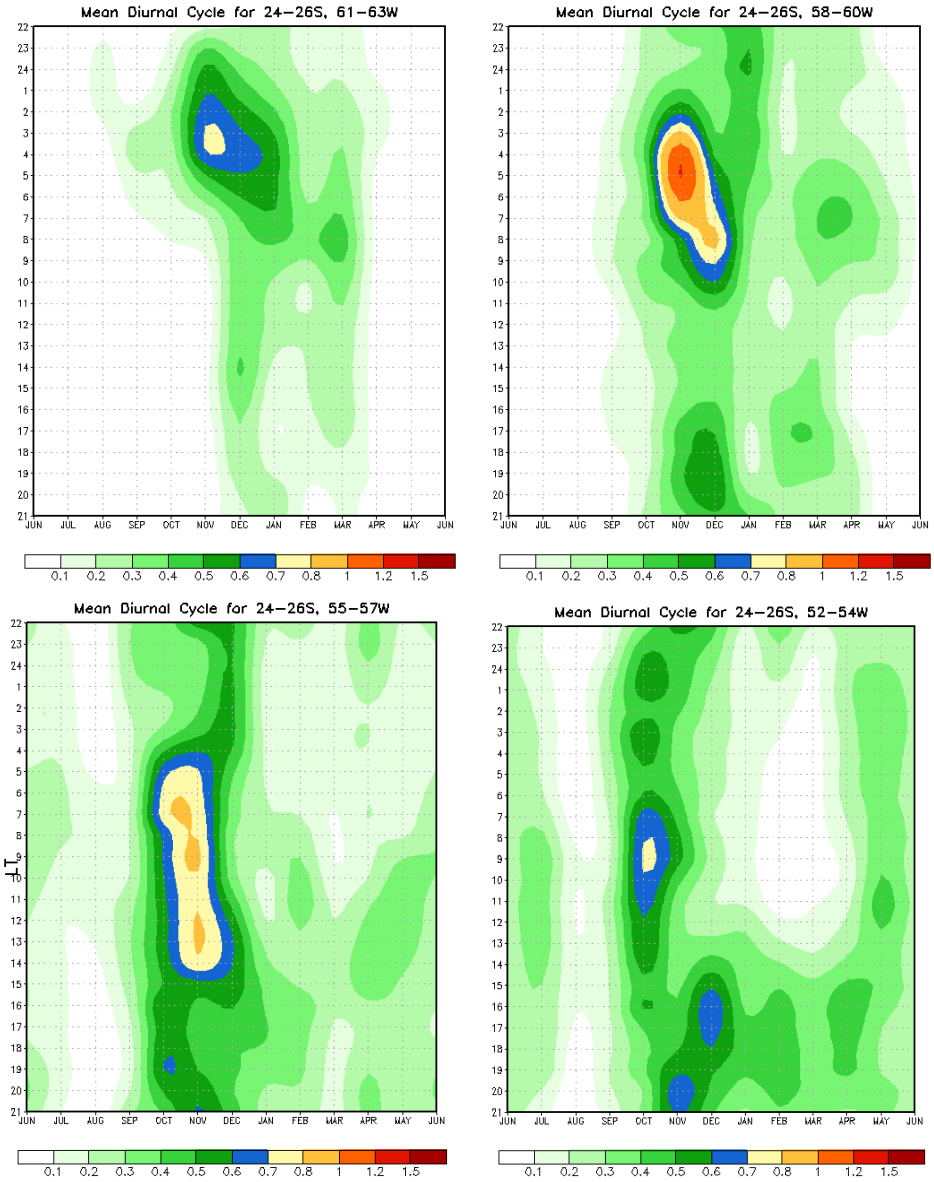

Fig. 3. Mean diurnal cycle of precipitation for selected longitude bands (centered on 62W, 59W, 56W and 53W) averaged over 24-26S. The local time (y-axis) is for eastern South America. Data for January-June are from 2003-2005, for July-November the data are from 2003-2004, and for December the data are from 2002-2004.