6B.2

CHARACTERIZATION OF THE RAINY SEASON OF MESOAMERICA

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1. INTRODUCTION

The timing and intensity of rainfall in Mesoamerica (Mexico and Central America) is key to the economies and agriculture of the region. The rainy season in this region typically occurs between May and October, every year (Hastenrath 1967). The rainfall peaks twice during a rainy season, once in June and then again in September, with a dry period in July and August during which the rainfall is well below the average for the summer. This dry period is referred to as the mid-summer drought (MSD) or "canicula," meaning "dry spell" in Spanish (Magaña et al. 1999). The MSD is a climatological feature of this region, occurring every year, but with subtle interannual variations in its duration and intensity which have significant implications for crop yields and water resources. The goal of this research is to objectively define the onset, demise and length of the rainy season using different observational datasets, and to characterize the key large-scale features that occur during the climatological onset and demise of the rainy season. The ultimate goal is to assess the predictability of the proposed metrics for onset and demise and the associated seasonal mean rainfall anomalies of the rainy season over Mesoamerica from intra-seasonal to seasonal time scales.

2. DATA & METHODOLOGY

The rainy season onset is defined as the day when the daily cumulative anomalies reach a minimum in the year for the domain as a whole. The rainy season demise is defined as the day when the daily cumulative anomalies reach a maximum in the year. An example of the yearly area averaged rainfall with the daily cumulative anomalies is shown in Figure 1. In order for this objective criterion to work over the Mesoamerican region, the choice of the domain for computing the area average becomes important. The domain chosen for this study is 7-28 °N and 77-109 °W. This includes the countries of Panama, Costa Rica, Nicaragua, Honduras, Guatemala, Belize and Mexico. The choice of the domain in computing these metrics is critical to avoid false onsets and demises of the rainy season from episodic, extreme synoptic or mesoscale events.

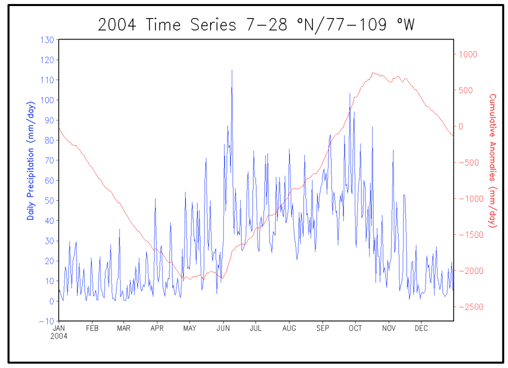

Figure 1. Area-averaged Mesoamerican (7-28 °N and 77-109 °W) rainfall for 2004 is shown in blue. The corresponding daily cumulative anomalies are shown in red.

The data used in this study is The NOAA Climate Prediction Center (CPC) Unified Gauge-Based Analysis of Global Precipitation data for land only on a 0.5 by 0.5 degree resolution. The retrospective version of the data is available from January 1979 until December 2005.

3. ONSET, DEMISE, LENGTH OF THE RAINY SEASON

The onset and demise dates are calculated with respect to the climatological area averaged rainfall for 7-28 °N and 77-109 °W for 1979-2005. The climatological average onset date is 142th Julian day, which corresponds to May 22. The climatological average demise date is 301th Julian day (or October 28). The corresponding climatological average length of the rainy season is 159 days (approximately 5 months). The time series of the onset, demise and length dates are shown in Figure 2. The trends were tested for 5% significance, and no significant trend was found in any of the three metrics following Mann (1945) and Kendall (1975).

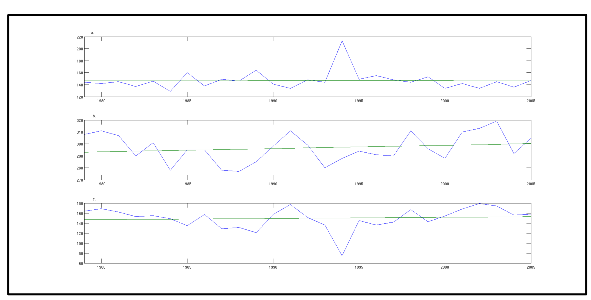

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Figure 2. a.) Onset dates (Julian Day), b.) demise dates (Julian Day) and c.) length of the rainy season (number of days) from 1979 and 2005 using CPC Unified Gauge-Based Analysis data.

1994 is an anomalously dry year, which stands out from the rest of the years in this data set. The onset occurs very late in the season (August 1) and the demise occurs consistent with other years (October 15), therefore the length of the rainy season is short (75 days).

4. CORRELATIONS BETWEEN ONSET/DEMISE AND SEASONAL MEAN RAINFALL

4.1.1 SEASONAL MEAN RAINFALL ANOMALIES

The climatological seasonal mean rainfall for the Mesoamerican region computed between onset and demise dates of the rainy season is 4.93 mm/day. The correlation coefficient between the onset date and the seasonal mean anomalies is -0.5036. The negative correlation means that an early onset date (negative anomaly of onset date) is likely associated with larger seasonal rainfall anomalies in the seasonal mean. Conversely, a late onset date is likely associated with smaller seasonal rainfall anomalies. The correlation coefficient between the demise date and the seasonal mean anomalies is +0.1733. The correlation coefficient between the length of the rainy season and the seasonal mean anomalies is +0.4628. This positive correlation indicates that when the length of the rainy season is long, the mean rainfall anomalies will be large.

4.1.2 SPATIAL CORRELATIONS OF SEASONAL MEAN RAINFALL

Figure 3. shows the correlation between the onset dates with the seasonal rainfall at every grid point in the 7-28 °N/77-109 °W area. This shows the specific areas that have a strong negative correlation. Meaning, when an early onset occurs, there are larger seasonal anomalies in the regions of southern Mexico and Nicaragua. Northern Mexico has low correlation coefficients compared to the rest of Central America.

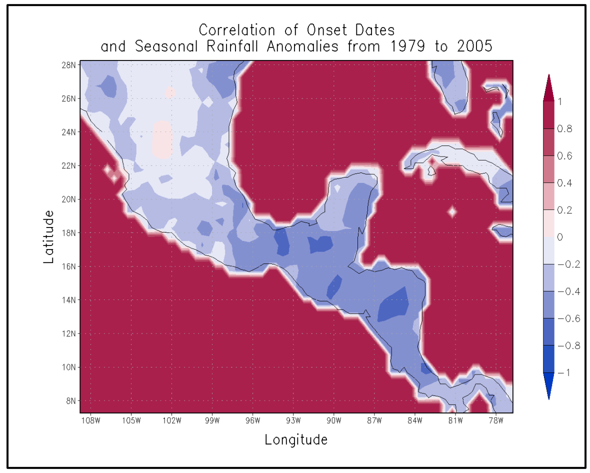

Figure 3. Correlation coefficients between onset dates and seasonal rainfall anomalies for CPC Data from 1979-2005.

5. CONCLUSIONS

This study introduces a novel metric to monitor the rainy season over Mesoamerica. The novelty of the onset metric is that it is able to help us anticipate the ensuing seasonal rain anomalies over Mesoamerica. This study notes that the variance of the seasonal rain anomalies explained by onset date is more than the demise date variations. This makes the monitoring of the onset metric very useful. We are currently investigating the role of the onset date variations of the rainy season on the mid-summer drought variability in the region.

6. REFERENCES

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