Introduction

The annual rainfall cycle in the Caribbean is characterized by a bimodal pattern with peaks in the late spring (“early rainfall season”) and late summer (“late rainfall season”) with a mid-summer minimum (“mid-summer drought”). The time average rainfall pattern during the early rainfall season reveals a distinct southward to northeast spatial pattern, known as the Caribbean rain-belt, that is similar to other northern-hemisphere subtropical rain-belts. A series of Caribbean farmer interviews guided my decision to focus on the dynamics and evolution of the Caribbean rain-belt. Results from former interviews reveal that their livelihoods are more vulnerable to variability in the timing and amount of the early season rains rather than variability in the mid-summer drying. Therefore, there is a strong social and economic relevance to understand rainfall-dynamics during the Caribbean early rainfall season.

Method

The atmospheric dynamics that contribute to the Caribbean rain-belt are diagnosed from the quasi-geostrophic omega equation from daily observations. Forcing for ascent at the upper troposphere is supported by positive zonal wind at 200hPa and jet streaks, while positive temperature advection from the tropics at 850hPa provides forcing for ascent in the mid-troposphere. Moisture availability for the Caribbean rain-belt is regulated by local sea surface temperature and by moisture advection from the tropics in the lower troposphere. The forcing for ascent weakens throughout the Caribbean and strengthens in the tropics in the lower troposphere. The forcing for ascent at the upper troposphere is diagnosed from the quasi-geostrophic omega equation from daily observations.

Defining the Caribbean Early Rain Season (ERS)

The difference between the average accumulated rainfall during June from the average accumulated rainfall during May 13–18 (Early Rained Season) and the climatology (2000–2014) is shown to the right. The rainfall accumulation from daily observations is presented in a color scale to describe the early rain season period.

Caribbean Rain-Belt Climatology

The seasonal “weather-events” during the 2011 Early Rain Season.

Summary

Schematic diagram representing the environmental factors that contribute to the Caribbean rain-belt, mid-latitude inter-tropical discontinuities, wind (vector black arrows) advection warms air from the tropics and induces ascending motion along the jet stream (thick black lines). The jet stream can be observed in the dry season (left), the mid-latitude trough (middle), and the wet season (right). Climatology calculated from 1998–2014.