The rainbands of tropical cyclones (TCs) can affect people hours to days prior to landfall, particularly in the case of large hurricanes such as Katrina (2005). Preparedness actions such as securing outdoor property and evacuating are hindered when rainfall commences. This study focuses on the outer rainbands associated with Hurricane Katrina (2005’s) Louisiana and Mississippi landfalls. Estimating the time when rain begins along the coastline allows a distance and time to be calculated relative to the arrival of the storm’s center. Measuring rainband shape, orientation, and motion relative to the storm center facilitates the examination of TC- environmental interactions and reveals how the outer edge of the TC changes during interaction with continental air masses and land. Our objectives are to 1) determine the hour when rainfall begins at land-based locations relative to the time of the eye’s landfall, and 2) track the position of the leading edge of the outermost rainband before and during landfall.

Defining Start of a Rainfall Event

- Dataset: Stage IV gridded precipitation (Fulton et al. 1998; Lin and Mitchell 2002) http://data.eol.ucar.edu/cdo/landfall of rainfall
- Hourly rainfall totals are tracked at NHC-designated breakpoints (http://www.nhc.noaa.gov/breakpoints.php) (Fig. 1).
- Its maximum intensity occurs at time a, but NARR shows that precipitable water expands (Fig. 5 a, b), and ROCI increases from 555 – 650 km. This is likely due to expansion of the gale-force wind field as Katrina weakens and moves poleward. Increased convergence in the storms to determine the hour when rainfall begins at land-based locations relative to the time of the eye’s landfall, and 2) track the position of the leading edge of the outermost rainband before and during landfall.

Results: Rain Event Timing

- Table 1: Breakpoints, day and time of rain event start, distance from TC center at that time, average rainfall, and maximum rainfall over the 6-hr period used to calculate rain event start. Landfalls occur on 29 Aug. at 1100 and 1445 UTC.

Results: Measuring Leading Edge and Moisture Distribution

- Composites and distributions of SLP, temperature, and moisture are created relative to the leading edge of the outermost rainband.

Examination of Environmental Moisture

- Zick and Matyas (2015 a, b) found good representation of TCs and their environments for locations close to land
- Zick and Matyas (2015) found that Katrina’s moisture convergence and precipitation fields are reasonable from NARR data changed shape 24 hours prior to landfall after reaching peak intensity, consistent with structural changes reported in Iven et al. (2008).
- Examine precipitable water in rainband regions

Rainbands are located farther from the eye (A, B) and expand outwards as they decrease in length (Fig. 4). NARR shows that precipitable water expands (Fig. 5, a, b), and ROCI increases from 555 – 650 km. This is likely due to expansion of the gale-force wind field as Katrina weakens and moves poleward. Increased convergence in the boundary layer as the forward edge of Katrina crosses land could also contribute to the expanding and increasing precipitation over land. Bands C, D, E form 180 km from the eye and maintain this distance. However, D and E grow in length towards the end. Rainbands along the MS/AL coastline move slower, then move faster once crossing the coastline. The increased friction at the coastline might play a role in slowing forward progress. Additional studies should explore jointly the roles of frictional convergence and moisture gradients.

References


Table 1. Breakpoints, day and time of rain event start, distance from TC center at that time, average rainfall, and maximum rainfall over the 6-hr period used to calculate rain event start. Landfalls occur on 29 Aug. at 1100 and 1445 UTC.