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Tornadogenesis Within Hurricanes: A Study of All Tropical Cyclone Tornadoes Between 2008 & 2015

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Overview

- As a Tropical Cyclone (TC) approaches a coast line, land-surface roughness contributes to surface friction, increasing vertical motion, and tornadoes can form within the TC rainband as a result
- The research conducted in this study looks at all TCs that produced tornadoes between 2008 and 2015 and compares it to the existing database of TC tornadoes between 1950 and 2007
- This study also compares tornadic and non-tornadic cases of TCs with differing orientations of the rainband to the coastline upon landfall

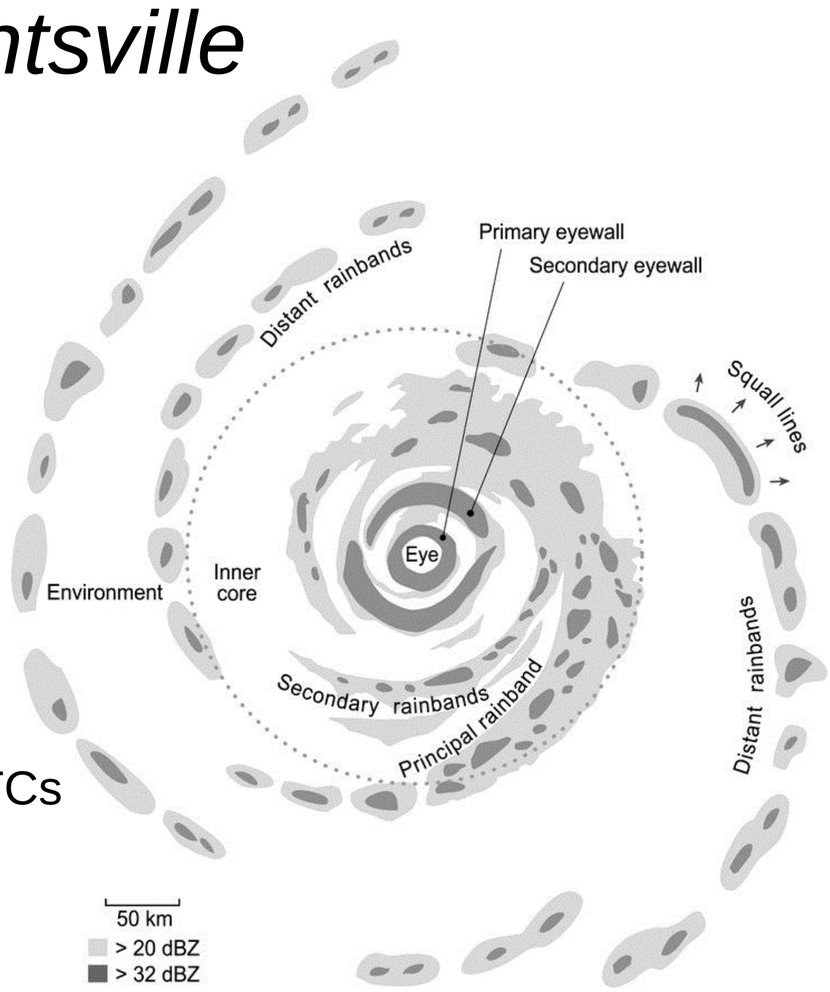

Fig. 1. Schematic showing principal, or primary, secondary, and distant rainbands within a TC.

Key Findings

- Between 2008 and 2015, 26 TCs made landfall in the continental US
- Fourteen TCs produced tornadoes & 8 TCs produced more than 10 tornadoes
- Hurricane Ike was the most prolific producing 31 confirmed tornadoes.
- The majority of the tornadoes produced in TCs between 2008 and 2015 are found in the right front quadrant

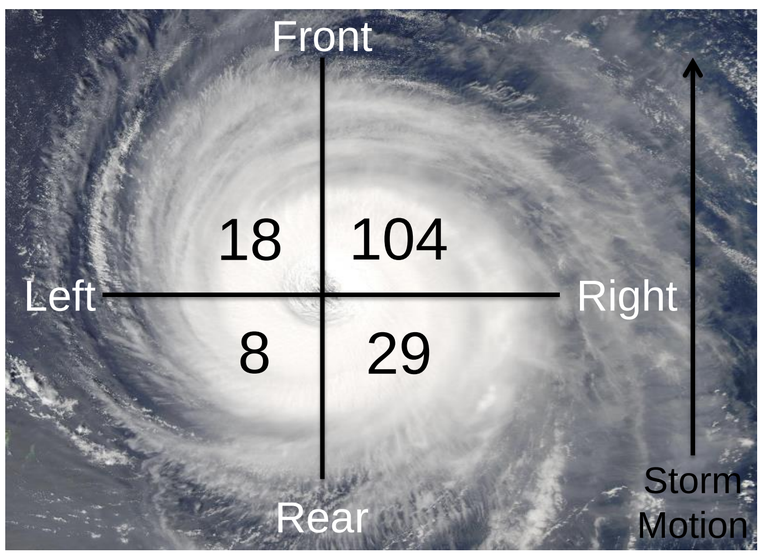

Fig. 2. Visible satellite image of a hurricane overlaid with the total number of tornadoes produced based on azimuthal distribution relative to storm motion for each quadrant between 2008 and 2015.

Explanation

This project's end-goal is to further understand why tornadoes are produced within specific TCs rather than others. This is in junction with the AAS who is committed to enhancing human understanding of the universe.

Impact

Forecasters and researchers need to be able to understand and predict TC tornadoes, especially prolific cases, such as Hurricane Ike or Tropical Storm Fay, so that people are more aware and have a greater chance of staying safe.

Ongoing/Future Research

- Continue to build the database of the tornadic TCs between 2008 and 2015
  - Find the spatial distribution and the time from landfall.
- Using GIS, map out the spatial distribution of the TC tornadoes & paths in junction with radar & satellite imagery

Tornadic Case: Tropical Storm Fay

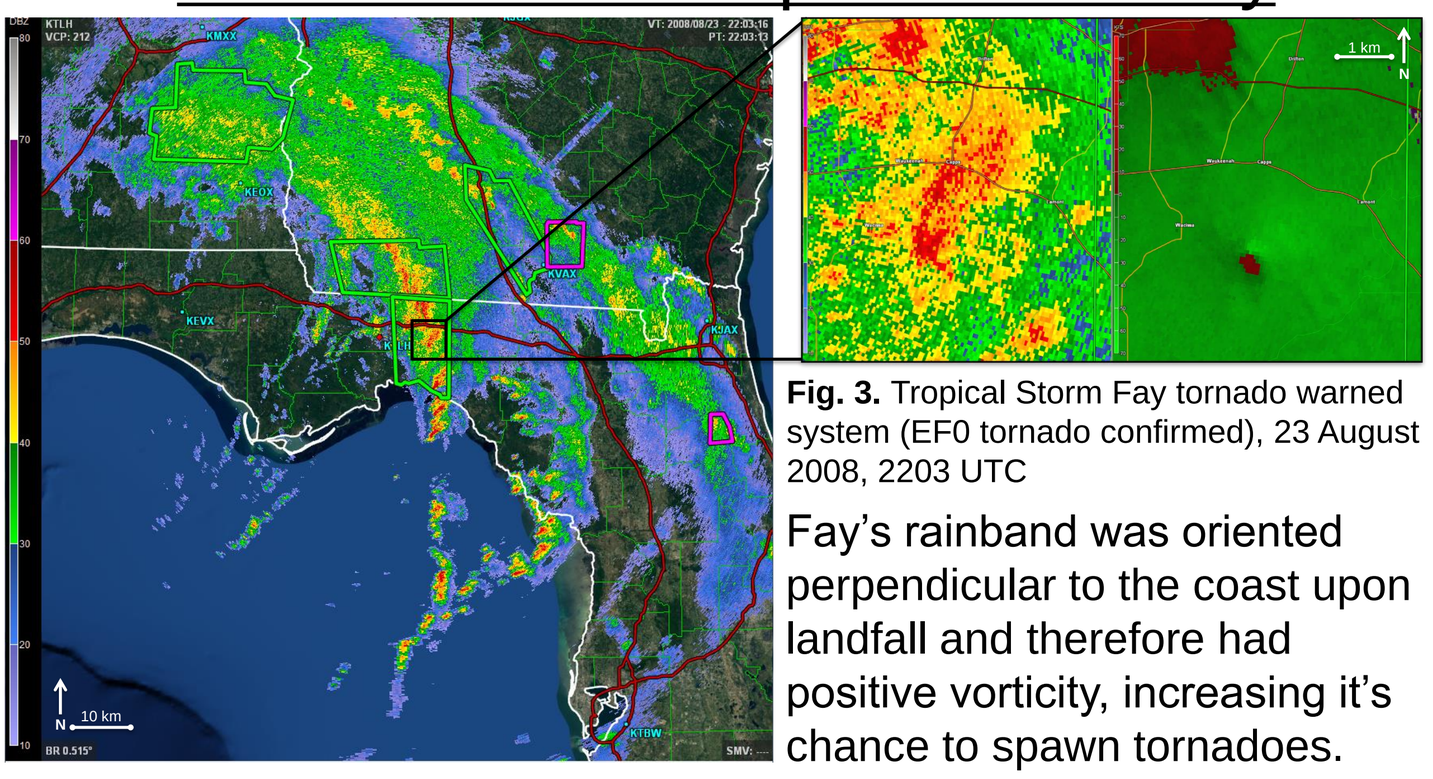

Fig. 3. Tropical Storm Fay tornado warned system (EF0 tornado confirmed), 23 August 2008, 2203 UTC

Fay's rainband was oriented perpendicular to the coast upon landfall and therefore had positive vorticity, increasing it's chance to spawn tornadoes.

Non-Tornadic Case: Hurricane Isaac

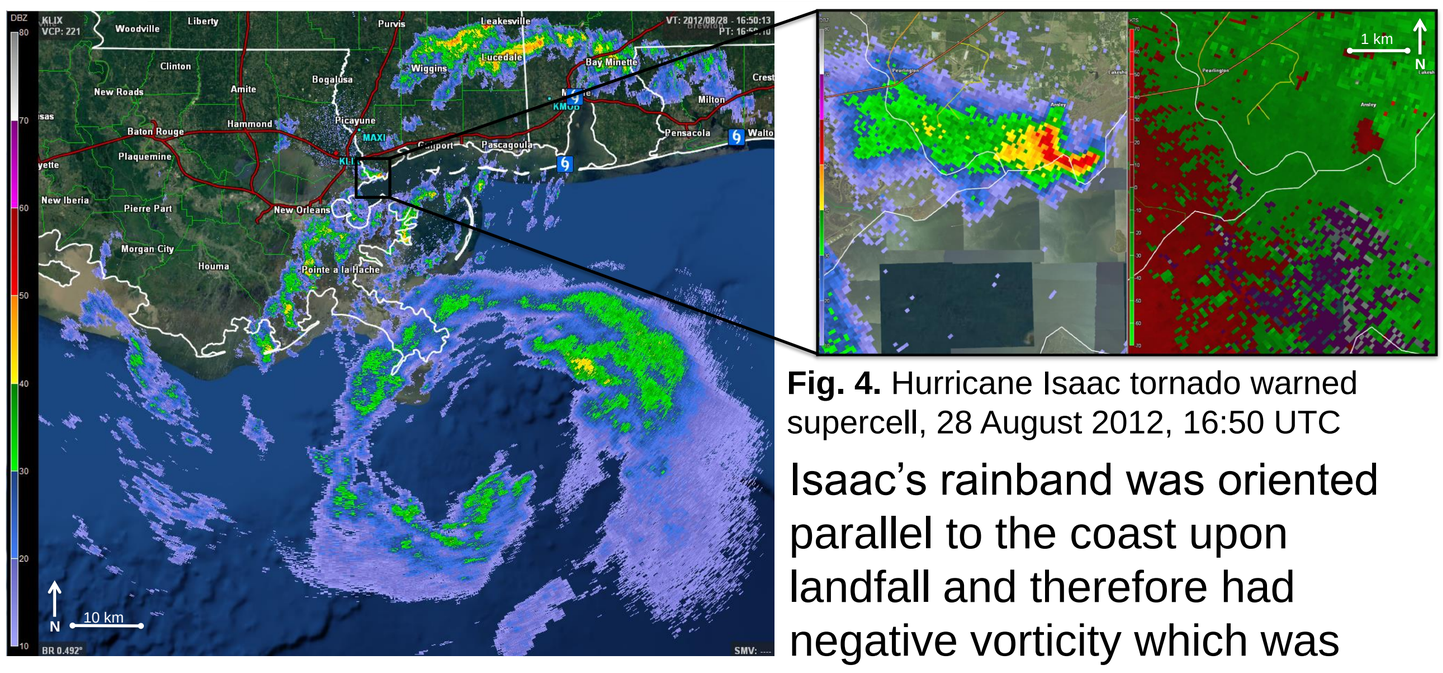

Fig. 4. Hurricane Isaac tornado warned supercell, 28 August 2012, 16:50 UTC

Isaac's rainband was oriented parallel to the coast upon landfall and therefore had negative vorticity which was hypothesized to cause these supercells to be non-tornadic.

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