Hurricane Matthew: An Ideal Setup for Catastrophic Flooding in Central North Carolina

Keith D. Sherburn
Department of Marine, Earth, and Atmospheric Sciences
North Carolina State University, Raleigh, NC

Jonathan Blaes
National Weather Service
Raleigh, NC Forecast Office

NC STATE UNIVERSITY

Matthew's Record Rainfall

Multi-Sensor Precipitation Estimates (MPE)
October 4-10, 2016 (12Z-12Z)
Hurricane Matthew Storm Total Rainfall

Precipitation accumulation (inches)

Notable 1-day Rainfall Totals associated with Hurricane Matthew (2016)

- Wilson, NC 1-day rainfall: 9.22" *2nd all-time* (Records extend to 1916)
- Norfolk, VA 1-day rainfall: 7.44" *4th all-time* (Records extend to 1948)
- Louisburg, NC 1-day rainfall: 6.10" *4th all-time*
- Tarboro, NC 1-day rainfall: 9.50" *Record* (Tied record set 10/25/1872)
- Elizabeth City, NC 1-day rainfall: 8.22" *2nd all-time* (Records extend to 1948)
- Raleigh, NC 1-day rainfall: 6.45" *Record* (Previous record: 5.64", 6/14/2006) (Records extend to 1944)
- Edenton, NC 1-day rainfall: 8.50" *2nd all-time* (Records extend to 1872)
- Dunn, NC 1-day rainfall: 5.72" *6th all-time* (Records extend to 1962)
- Plymouth, NC 1-day rainfall: 9.10" *2nd all-time* (Records extend to 1945)
- Fayetteville, NC 1-day rainfall: 14.00" *Record* (Previous record: 5.13", 9/29/2016) (Records extend to 1908)
- Williamston, NC 1-day rainfall: 9.07" *3rd all-time* (Records extend to 1930)
- Lumberton, NC 1-day rainfall: 12.53" *Record* (Previous record: 7.62", 1948) (Records extend to 1948)
- Kinston, NC 1-day rainfall: 8.45" *4th all-time* (Records extend to 1899)
- Washington, NC 1-day rainfall: 8.00" *3rd all-time* (Records extend to 1893)
- Dillon, SC 1-day rainfall: 17.22" *Record* (Previous record: 7.65", 9/5/1979) (Records extend to 1904)
- Florence, SC 1-day rainfall: 11.74" *Record* (Previous record: 6.08", 10/15/1954) (Records extend to 1948)
- North Myrtle Beach, SC 1-day rainfall: 8.90" (Records extend to 1999)
- Greenville, NC 1-day rainfall: 9.07" *3rd all-time* (Records extend to 1875)

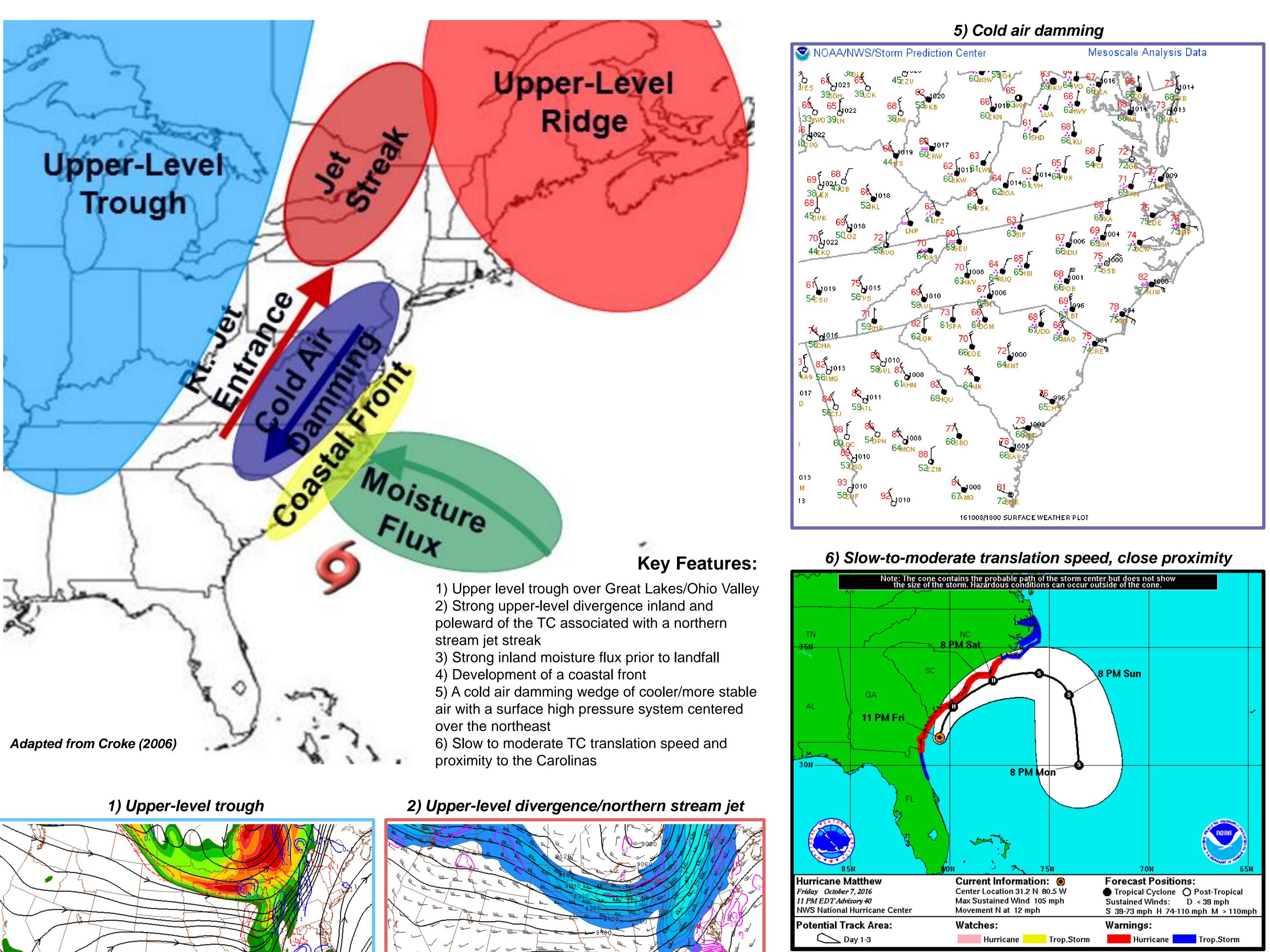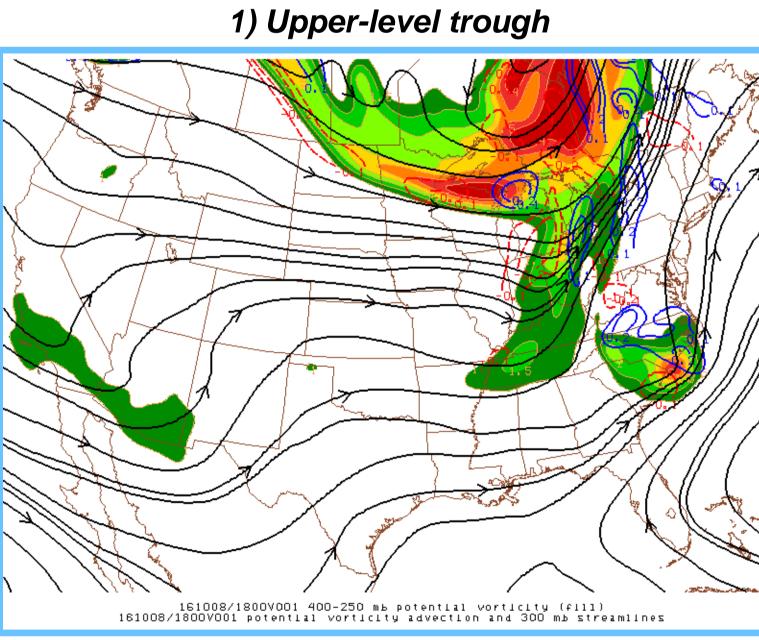Created by the Raleigh, NC National Weather Service Forecast Office, 10/27/16

Top: Observed rainfall estimates from Hurricane Matthew from the Southeast Regional Climate Center. Note the broad swaths of over ten inches of precipitation stretching from southern Virginia through the Carolinas and into Florida.
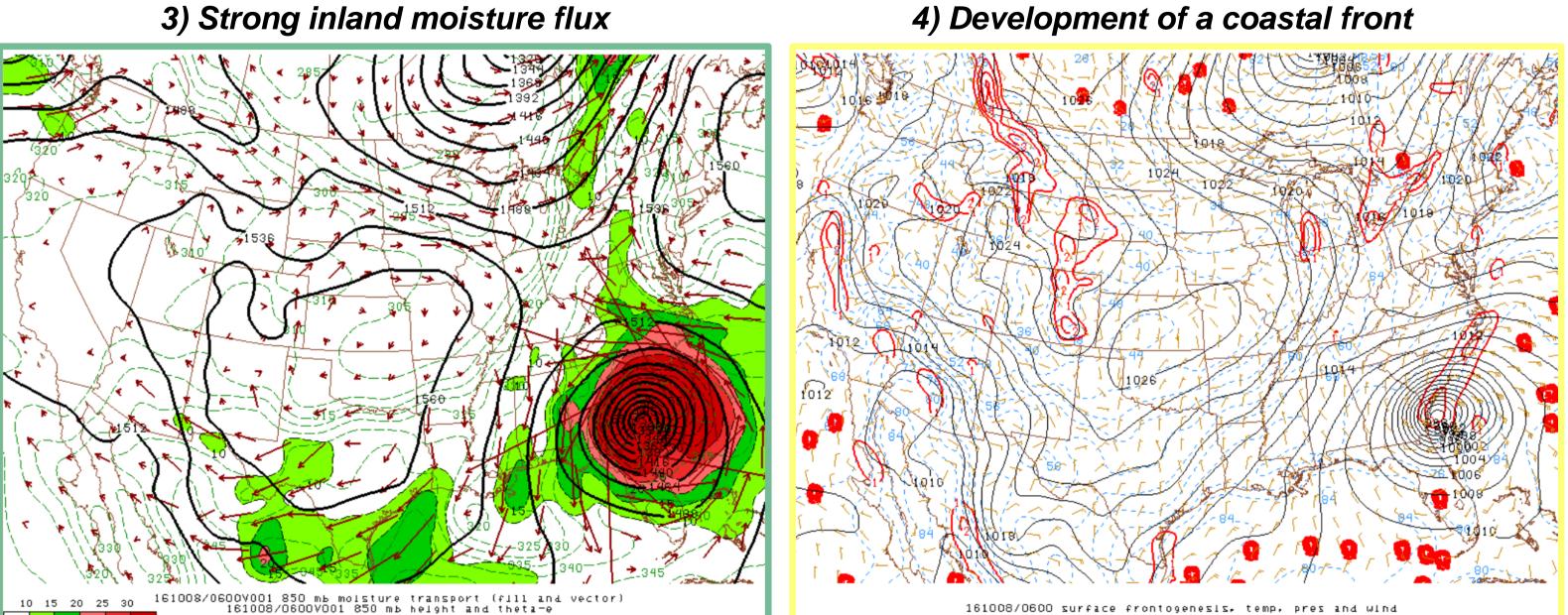**Bottom:** Record and near-record single-day precipitation amounts observed central and eastern North Carolina and northeastern South Carolina due to Matthew. Several locations across this area received over 15 inches of storm-total rainfall.

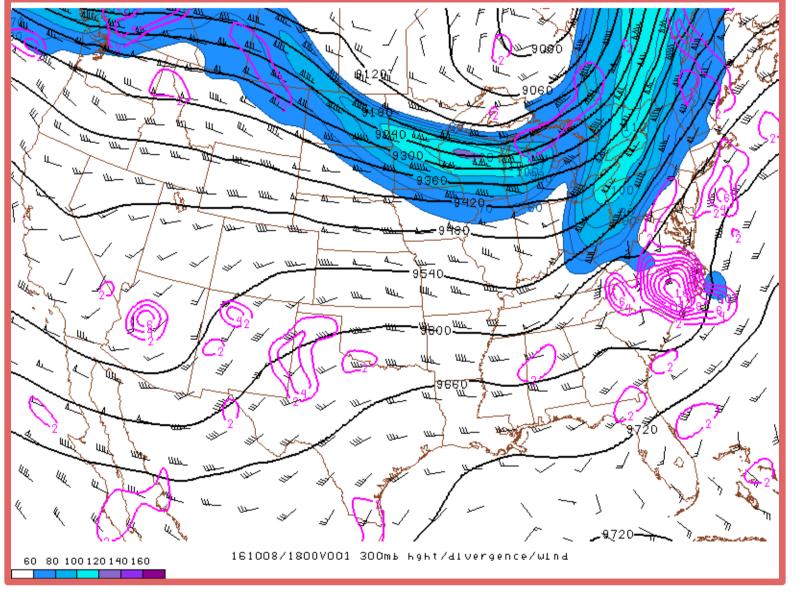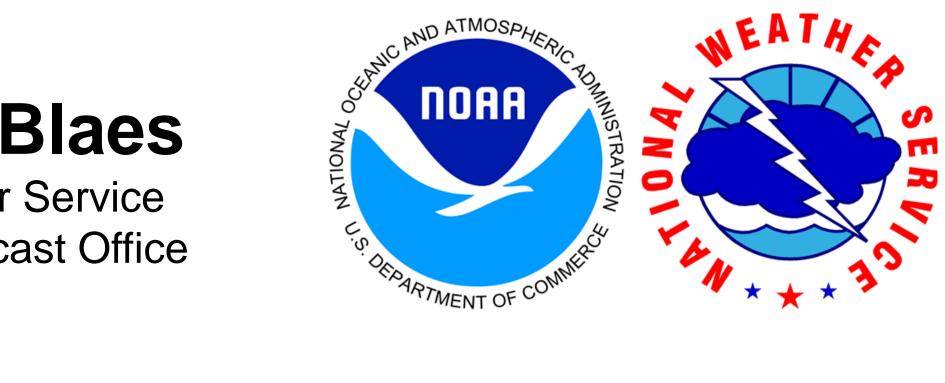## Conceptual Model for Heavy Rainfall Events and Matthew's Setup

Adapted from Croke (2006)

Key Features:
1) Upper level trough over Great Lakes/Ohio Valley
2) Strong upper-level divergence inland and poleward of the TC associated with a northern stream jet streak
3) Strong inland moisture flux prior to landfall
4) Development of a coastal front
5) A cold air damming wedge of cooler/more stable air with a surface high pressure system centered over the northeast
6) Slow to moderate TC translation speed and proximity to the Carolinas

5) Cold air damming

6) Slow-to-moderate translation speed, close proximity

1) Upper-level trough

2) Upper-level divergence/northern stream jet

3) Strong inland moisture flux

4) Development of a coastal front

Summary

➤ Hurricane Matthew exhibited all six key features identified by Croke (2006) exemplifying tropical cyclones associated with particularly heavy rainfall across the Carolinas.

➤ Many locations across northern South Carolina and central and eastern North Carolina received record-breaking or record-approaching one-day rainfall totals. Several locations received over 15 inches of rainfall on October 8th, with localized storm-total amounts exceeding 18 inches.