LECTURE #17: Hurricane Monitoring & Mitigation

Date: 29 March 2021

I. Hurricane Damage:

- note: everything from here onward will appear on the final exam!

- wind damage *(from the last lecture)*

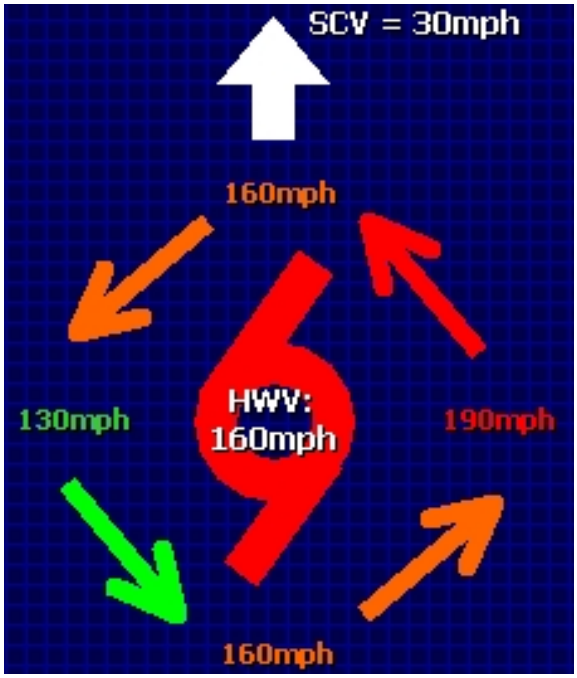
- wind types
  - hurricane wind velocity (HWV)
    - speed of the storm's counter clockwise winds
    - this value is quoted when assessing the category of the storm
    - example: 79 to >155 mph
      - category 1 - 5

  - storm center velocity (SCV)
    - speed that the storm is moving over ocean/land
    - commonly only 5 to 60 mph
    - influenced by the upper level winds, regional temperature, other weather patterns
    - example: Andrew in 1992 changed direction twice due to a high pressure system over the southeastern US and upper level winds over the Gulf of Mexico changing its SCV *(more on this next lecture)*

  - both of these can combine to cause more damage

  - **for a hurricane moving N**
    - in the NE quadrant *(upper right side)*
      - the HWV combines with the SCV
      - produces the *most* damaging winds

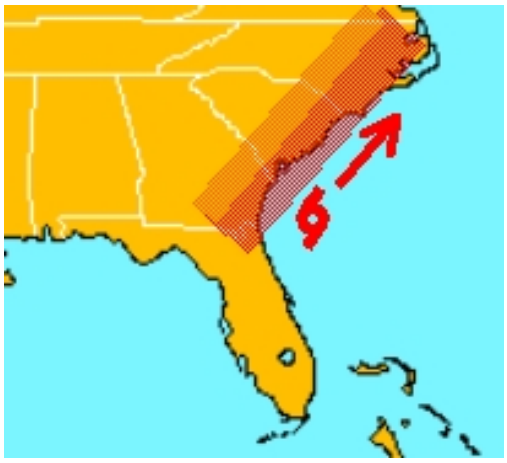
    - in the SW quadrant (lower left side) of a hurricane
      - the SCV is subtracted from the HWV
      - results in the *least* damaging winds



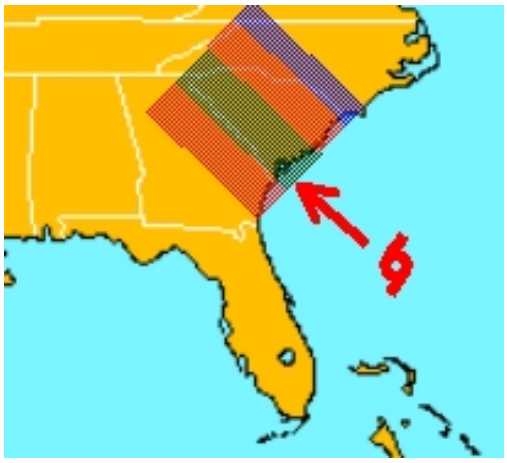
II. Landfall

- coast-parallel track:
  - storm moves along the coast
  - weaker winds over the land and stronger winds over the ocean
  - land is affected by two storm surges
    - flood surge ahead of the storm and an ebb surge behind it
  - results in moderate-heavy damage along the coast

- coast-normal track:
  - storm moves perpendicular to coast, moving from water and onto land
  - strongest winds on the right side of the storm
    - produces a zone of highest damage off center to the right of the storm track
  - can causes a large flood surge along the entire coast line



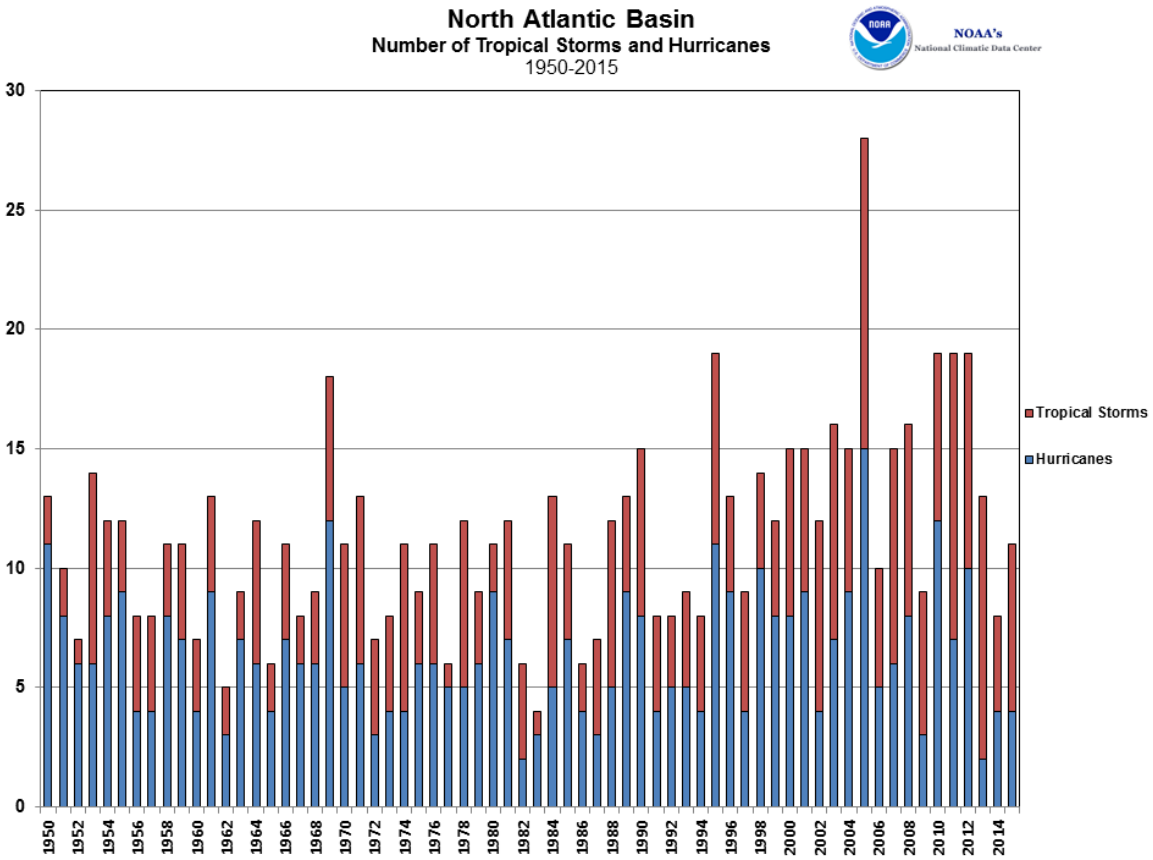
coast-parallel



coast-normal

III. Hurricane Statistics:

- yearly averages
  - number of named Atlantic storms since 1995: 13
    - compared to an average of 8.6 per year since 1970
  - an average of 7.7 hurricanes and 3.6 major hurricanes per year since 1995
    - compared to an average of:
      - 5 hurricanes since 1970
      - 1.5 major hurricanes since 1970



- Costliest US Hurricanes:

Name	**Season**	**Cost *(2017 US$)***
Katrina	2005	$160 billion
Harvey	2017	$125 billion
Maria	2017	$90 billion
Sandy	2012	$75 billion
Irma	2017	$65 billion
Ike	2008	$38 billion
Wilma	2005	$28 billion
Andrew	1992	$27 billion
Ivan	2004	$26 billion

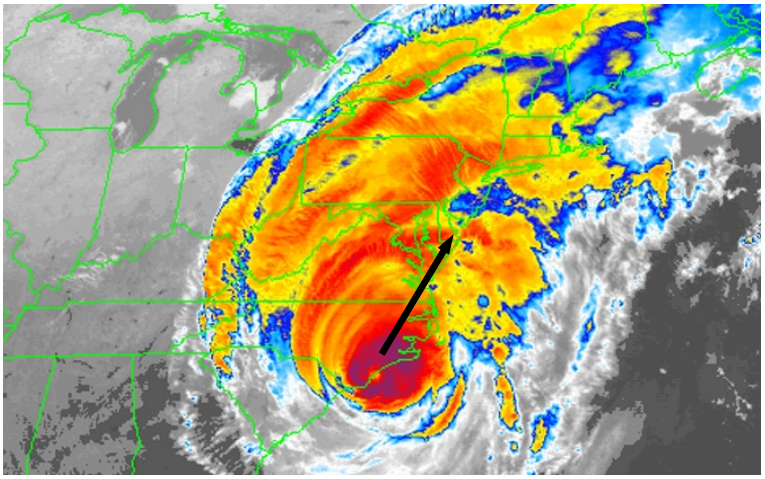
- Category-5 hurricanes since 2005:

Name	**Date**	**Sustained Wind Speed**
Iota	2020	160 mph
Lorenzo	2019	160 mph
Dorian	2019	185 mph
Michael	2018	160 mph
Maria	2017	175 mph
Irma	2017	180 mph
Matthew	2016	160 mph
Felix	2007	175 mph
Dean	2007	175 mph
Wilma	2005	185 mph
Rita	2005	180 mph
Katrina	2005	175 mph

IV. Monitoring & Prediction

- can monitor a storm much better because of satellites
  - watch it spawn and develop
    - days to weeks timescale

- Doppler radar
  - examine the final movements prior to landfall
    - hours to days timescale

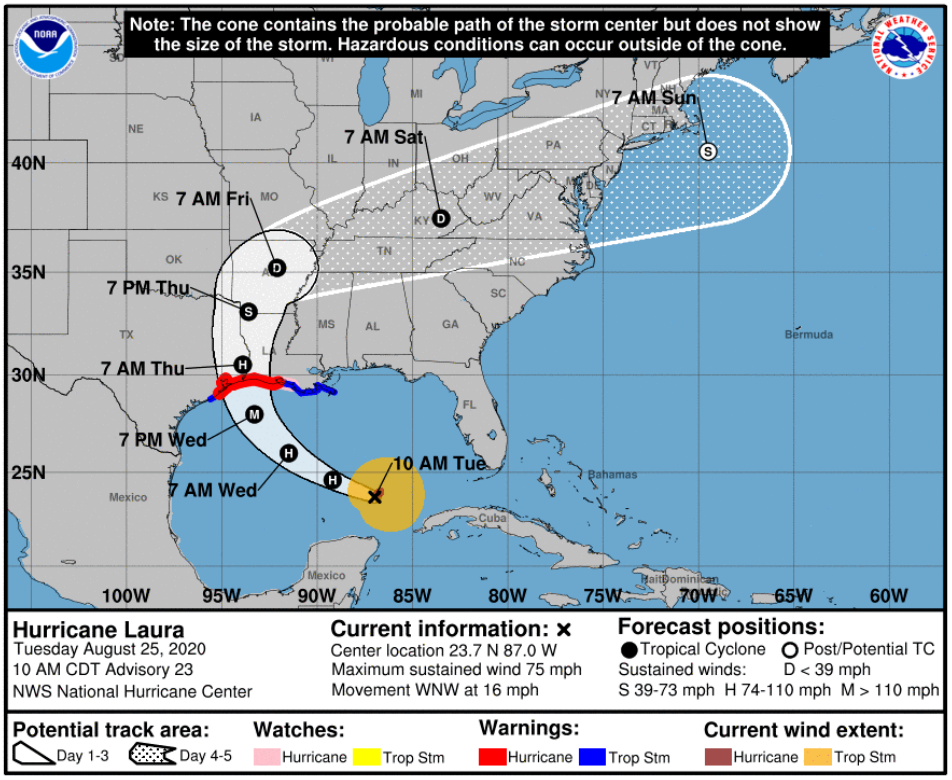


coast-normal track of Floyd
(colorized thermal infrared satellite image)

- satellite data (visible and infrared images) every few minutes to every 15 minutes over the tropical regions

- planes that fly though the storm center
  - measure vertical structure, wind speeds, pressure and temperatures
  - use drop-sondes to relay information regarding the change with height
  - used to create the future storm track maps

- data are used to create storm track maps
  - show the cone of uncertainty several days into the future
  - poor data and/or larger times in the future lead to larger cones



storm track map