THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

AAAS SciLine Media Briefing

Hurricane aftermath: Damage to Infrastructure, Health and the Environment

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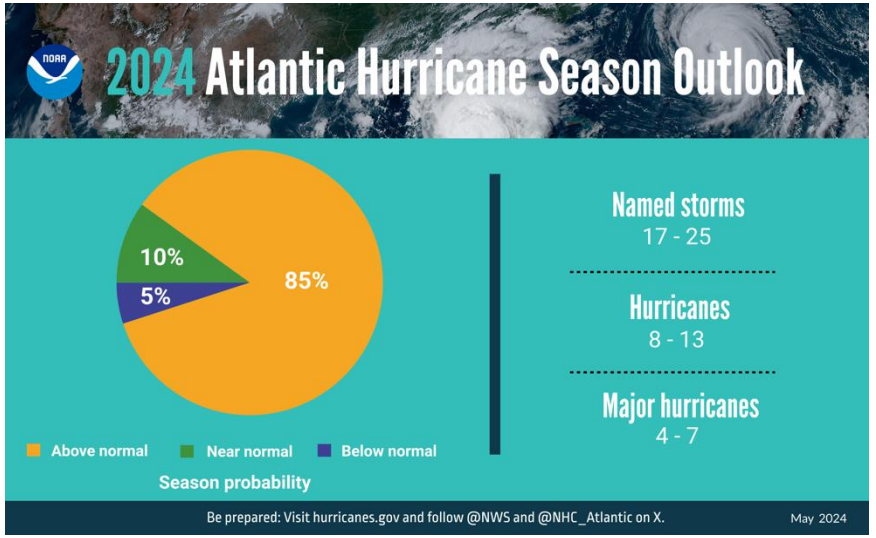
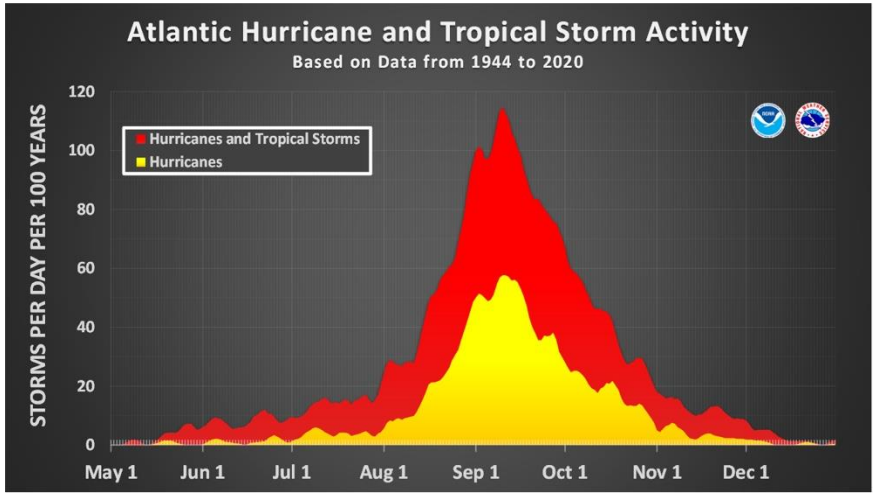
Overview of hurricane patterns in the US in the recent past and current season

- Atlantic hurricane season June 1 – November 30
- Historically, average of 14 named storms in the Atlantic basin each year (since 1990); ~2 make landfall in the U.S.
- 2024
  - Predicted to be an above average season with 20+ named storms (>39 mph)
  - Where are we now: #7 “Gordon” just dissipated
  - We may yet see more activity
- U.S. landfalls this year:
  - Beryl (June, Texas)
  - Debbie (August, Southeast)
  - Francine (September, Louisiana)
  - Potential Tropical Cyclone 8 (September, Carolinas)





What drives hurricane impacts?

Photo source: SC National Guard

HAZARDS

- Wind
- Water (Flood)
  - Storm Surge
  - Tides
  - Precipitation (how much, how fast) – localized flooding or high river levels
  - Compound processes – two or more of these interacting to exacerbate flooding

Most importantly …. the number one predictor of damage is exposure – being 'in harm's way', so the ability to accurately assess and predict exposure to hurricane hazards (wind and/or water) *now and in the future* is paramount to increasing community resilience to severe weather events.

How will climate change influence hurricane hazards?

- It is *likely* that the number of annual hurricanes will either decrease or remain unchanged, however
- there is *medium to high confidence* that the character of TCs will change (IPCC AR6) likely leading to greater hazards

  - Higher maximum wind speeds; more Cat 4-5 storms
  - More intense precipitation; more accumulated precipitation
  - Higher sea levels will lead to higher storm surge and more coastal inundation
  - Potential slowdown of translation speed (forward speed)
  - Increase in depth and extent of compound flooding due to the above
  - Poleward shift of storms
  - Increase in rapid intensification
  - TC season may be lengthening, thus timing of peak season could shift

How will climate change influence hurricane (flood) impacts?

As a result of climate change, we expect:

- Reduced capacity of existing infrastructure to accommodate or withstand floods (e.g., due to SLR or higher rain rates)
- Greater flood exposure as the extent and depth of flooding increases

…BUT… the places exposed to hurricanes tend to be prone to other types of severe weather, too.

Ultimately, its a bit unclear… one would expect more flood exposure would lead to more damage, but we don't know how much or how quickly communities will adapt. *How will vulnerability change?*

What are communities doing to adapt to or mitigate flood impacts?

- Stricter development standards (elevation/freeboard, zoning)
- Hardening utilities and critical infrastructure (hospitals, schools)
- Building hard structures (sea walls, reservoirs/dams, tunnels)
- Investing in nature-based solutions (living shorelines, bioswales)
- Protecting open spaces; creating buffers/setbacks
- Floodproofing
- Hazard Disclosure
- Flood Insurance Coverage

References (those listed on the slides)

- IPCC AR6 (Section 6.3) on Changes in Tropical Cyclones
- Sunny Day Flooding Project: https://tarheels.live/sunny/

- A few additional studies on climate change and hurricanes since AR6 was published (by no means comprehensive!):
  - On changes in hurricane precipitation (Stansfield and Reed 2023)
  - On the increase in compound hazard from hurricanes (Gori et al. 2022; Sarhadi et al. 2024; Xi et al. 2023) *more coming in this space
  - On rapid intensification of hurricanes (Lockwood et al. 2024; Balaguru et al. 2024)

Additional Links on Flood Hazard Exposure and Impacts

- On flood hazard exposure and managing flooding:
  - For every structure bought out of the floodplain, 10 new ones are built (Hino et al. 2023)
  - Over 4M residences are located in regulatory floodplains (Samoray et al. 2024)
  - Flooding happens much more often than we think (Thelen et al. 2024; Gold et al. 2023) *more to come on flood frequency in NC
- On the impacts of hurricanes (esp. repetitive exposure):
  - Florence generated $1.77B in uninsured damage and property value losses and $562M in potential default risk after Hurricane Florence (2018) (Thomson et al. 2023) *more to come on repetitive events
  - Prior-year hurricanes lead to a decrease in housing availability and higher rents (Best et al. 2023)
  - Repeat exposure increases risk of psychological morbidity during pregnancy (Herbst et al. 2024) and higher rates of asthma (Larson et al. 2021)
  - Hurricanes disrupt education, lead to lower educational attainment (Esnard et al. 2018; Segarra-Almestica et al. 2022)