Assessing exposure to hurricanes and other tropical storms for epidemiological research

Drexel University Environmental and Occupational Health Research Seminar

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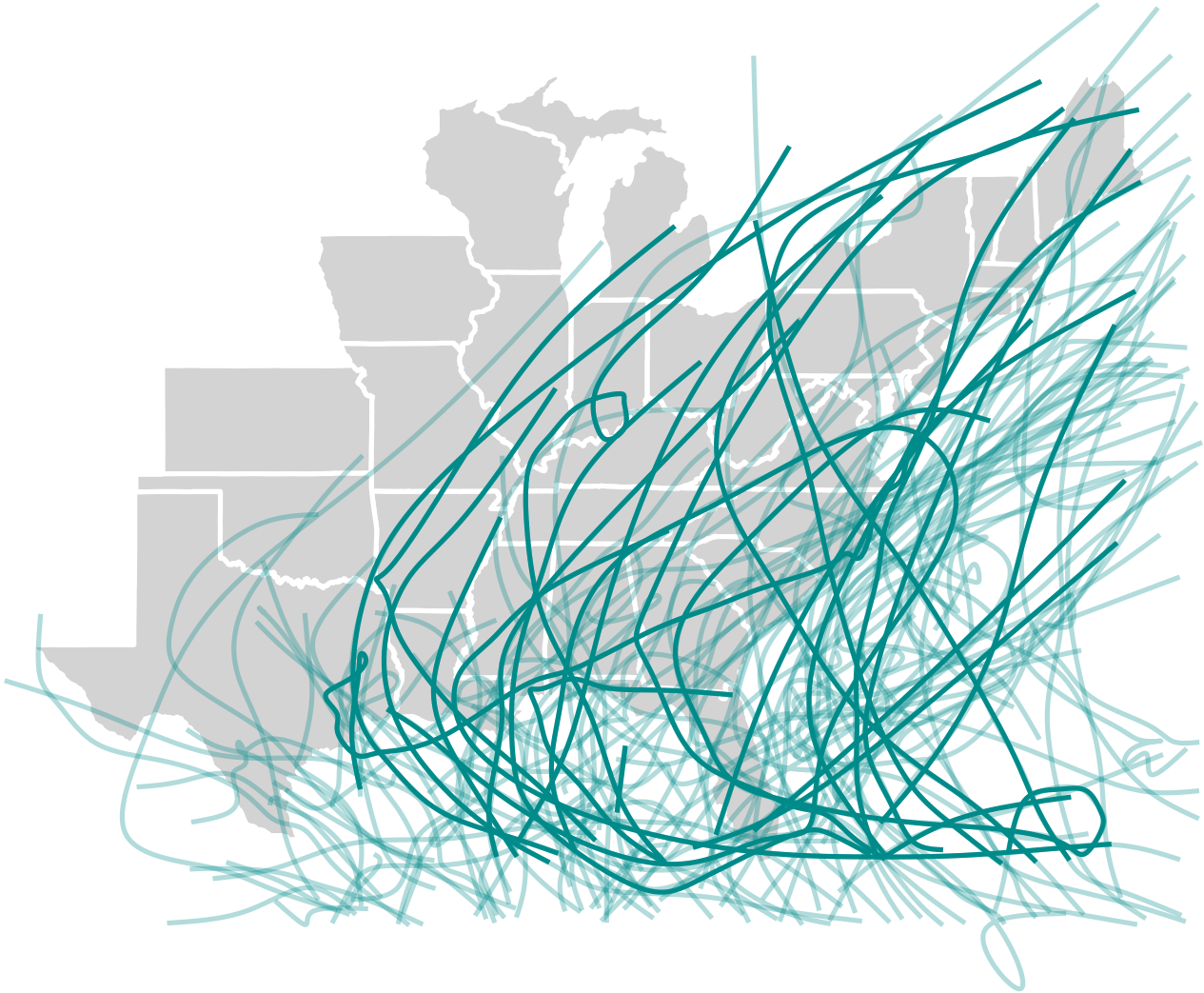
Motivation

Assessing exposure

Study data



Hazard-specific metrics

- Distance from the storm
- High winds
- Rainfall
- Flood events
- Storm events

Distance from storm

[Intro to best tracks]

Distance from storm

[Importance of interpolating tracks]

Wind exposure

[Reminder of best tracks, intro to Willoughby model]

Wind exposure

[Factors of doing the modeling (transfering from surface to gradient and back, etc.), other applications of the model]

Rain exposure

[Intro to NLDAS-2 data]

Rain exposure

[Showing how to ID date of closest approach]

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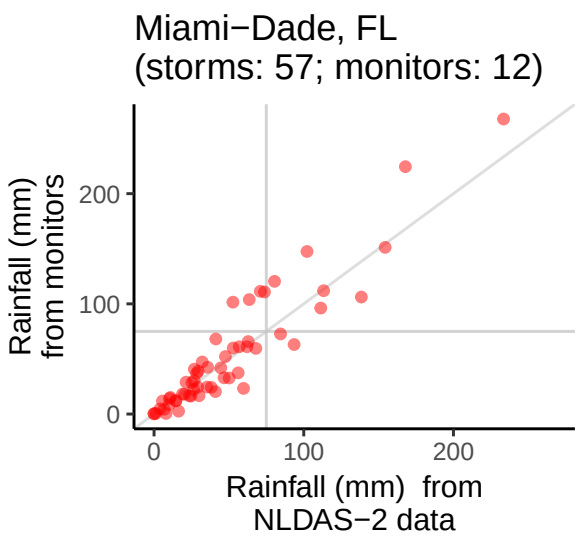
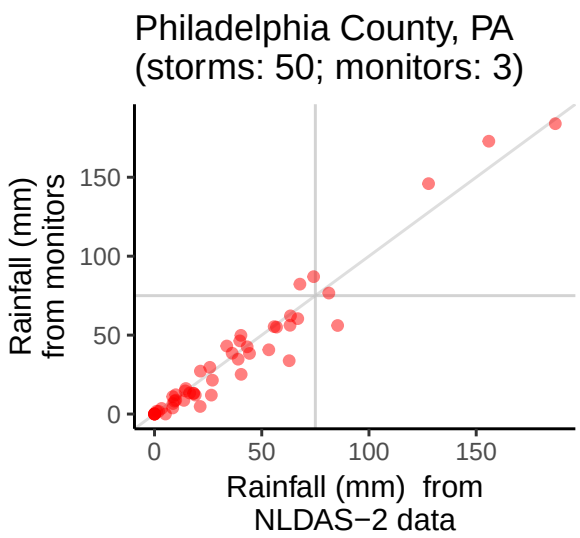
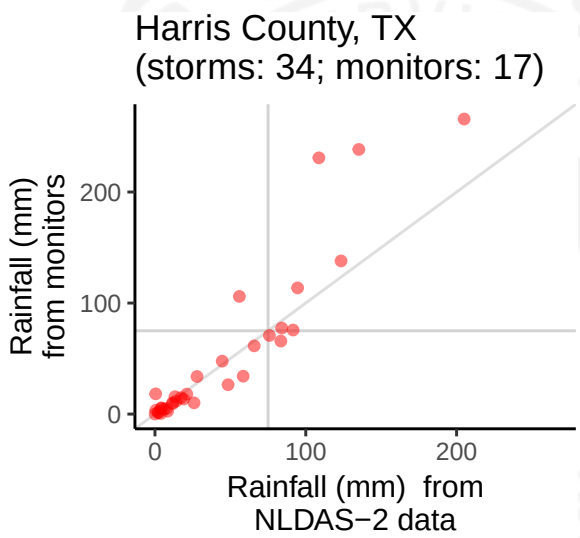
Rain exposure







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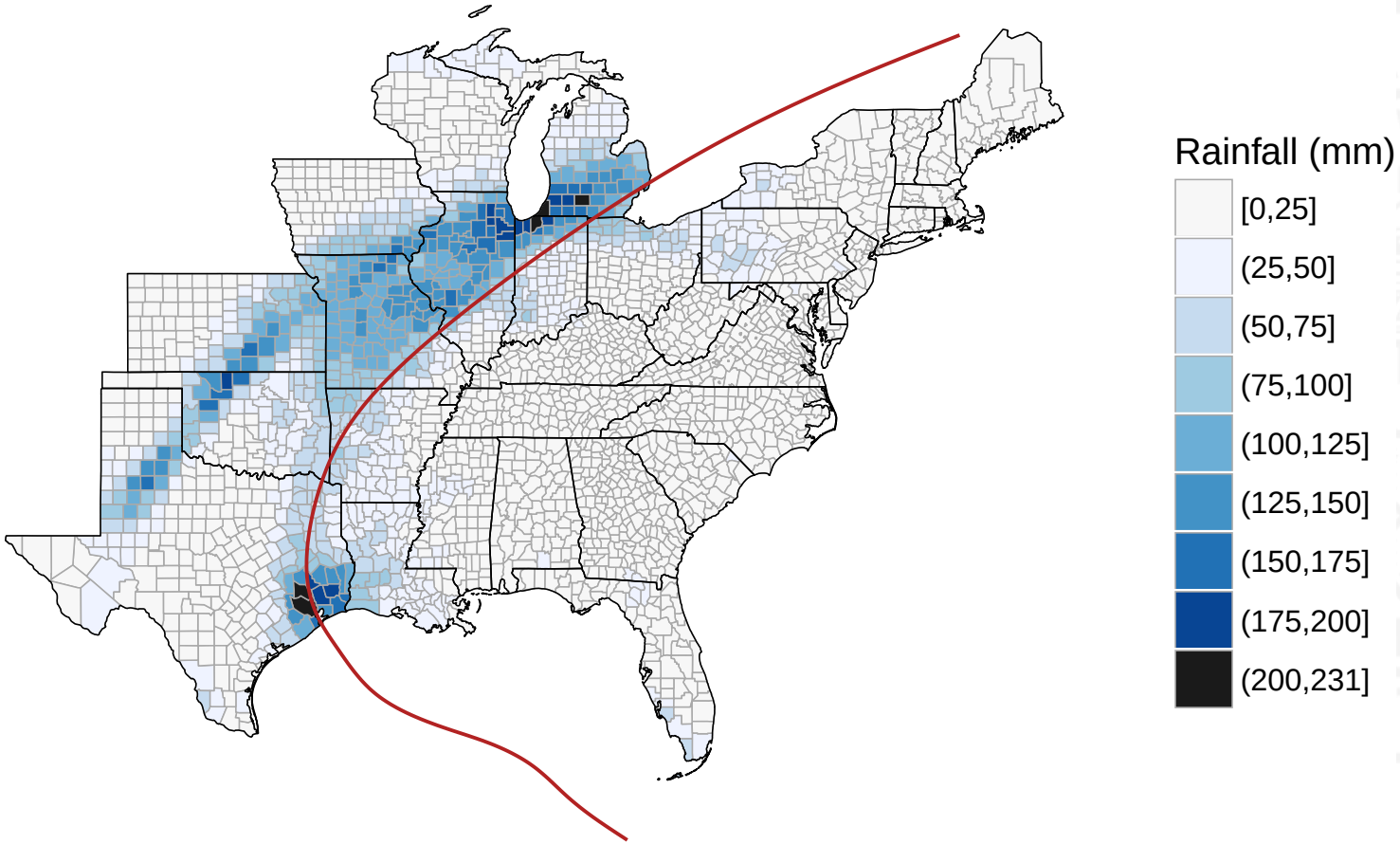
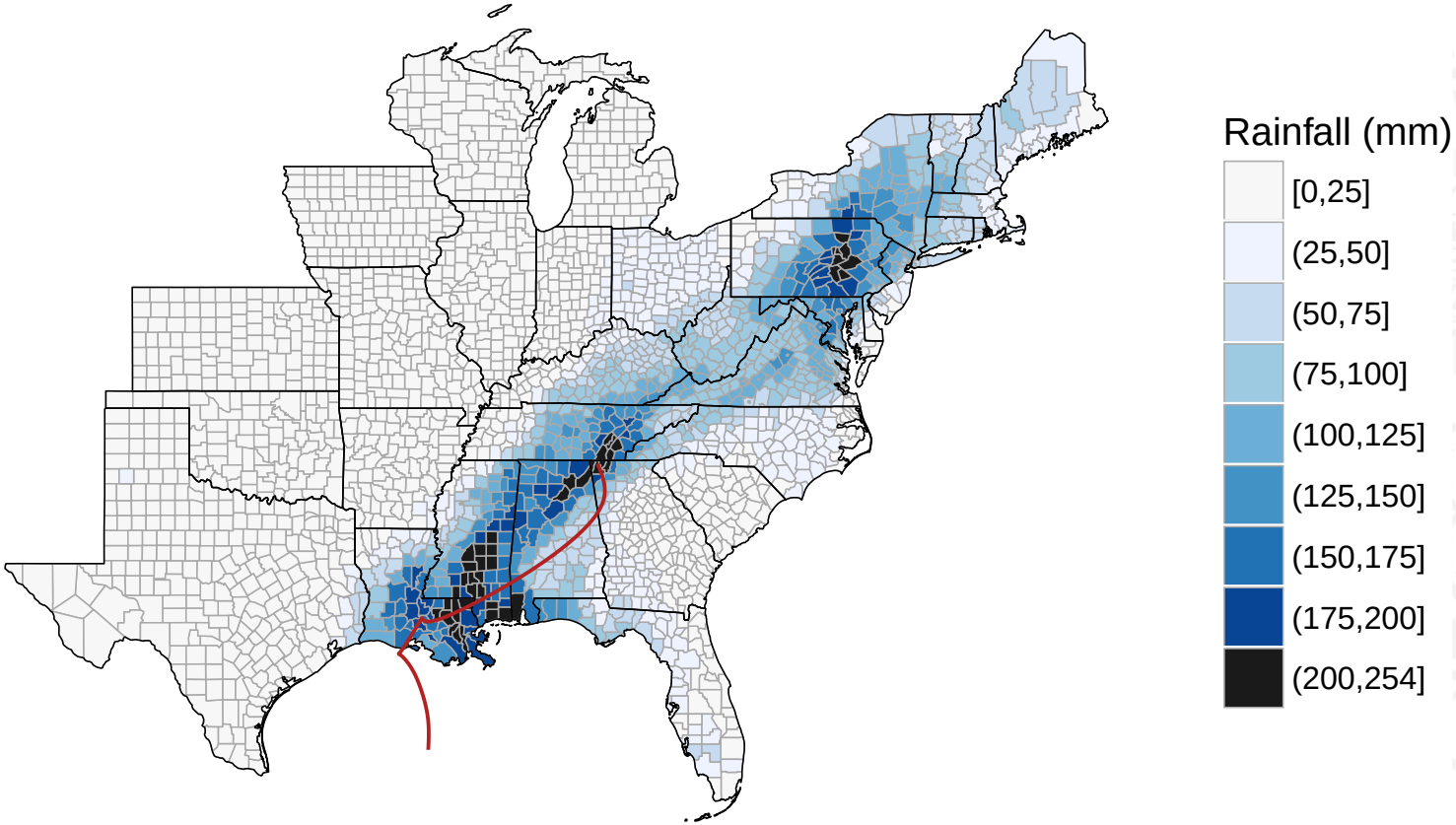
Rain exposure

Rainfall during Lee, 2011



Rain exposure

Rainfall during Lee, 2011



Flood and tornado events

[Intro to NOAA Storm Events]

Flood and tornado events

[Figure from `hurricaneexposure`]

Agreement between exposure metrics

Storm exposure

Exposure metric	Criterial for exposure
Distance	County population mean center within 100 km of storm track
Rain	County received 75 mm or more rain over the period from two days before to one day after the storm's closest approach and the storm passed within 500 km of the county
Wind	Modeled wind speed at county's population mean center met or exceeded 15 m / s during the storm
Flood	Flood event listed with a start date within two days of the storm's closest approach and county within 500 km of storm track
Tornado	Tornado event listed with a start date within two days of the storm's closest approach and county within 500 km of storm track

Storm exposure

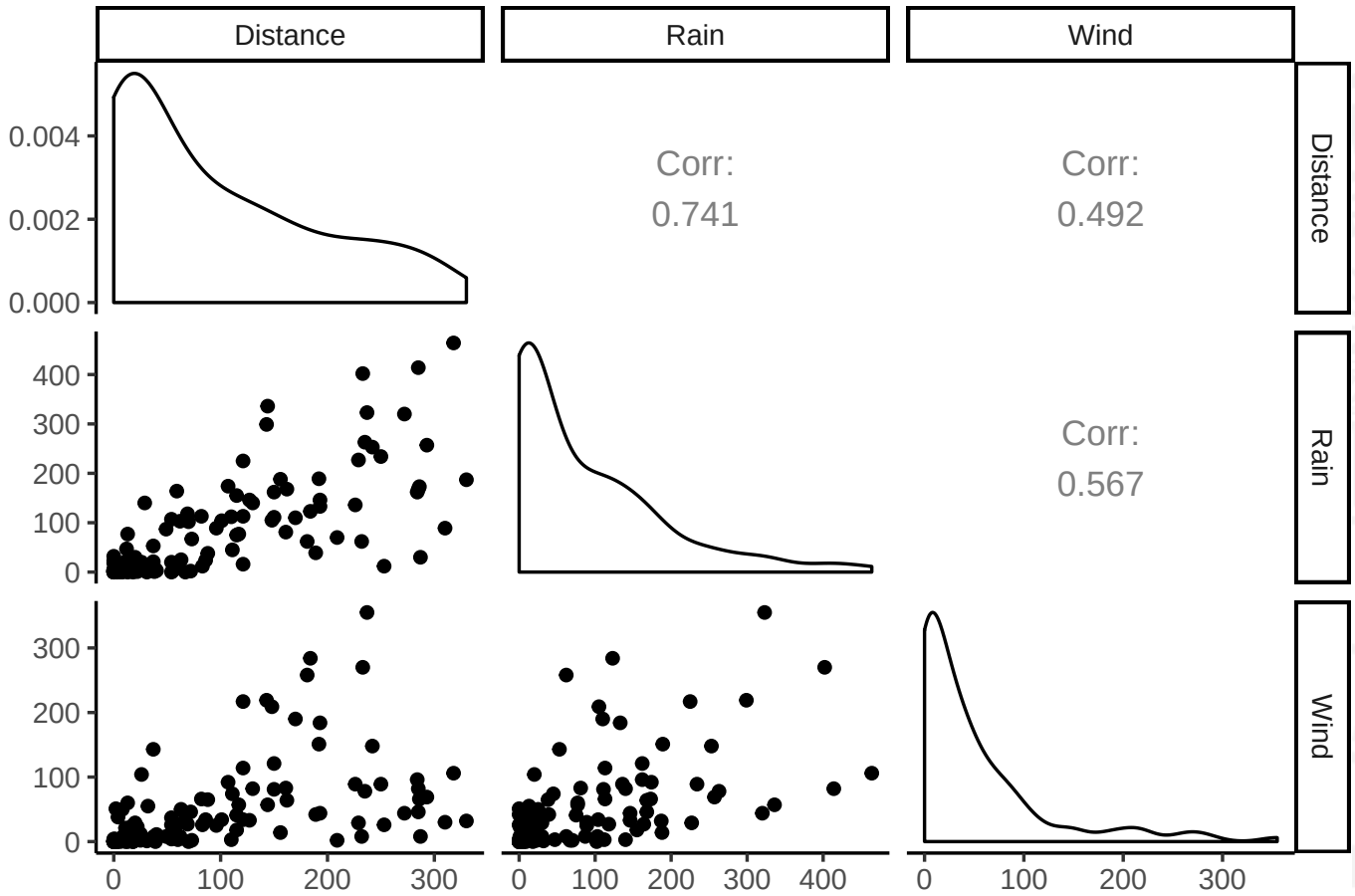
Exposure metric	Median number of exposed counties (IQR)	Storm with most counties exposed
Distance	62 (12, 156)	Beryl, 1994 (330)
Rain	32 (4, 133)	Frances, 2004 (464)
Wind	26 (3, 65)	Ike, 2008 (355)
Flood	9 (0, 39)	Ivan, 2004 (317)
Tornado	1 (0, 9)	Ivan, 2004 (91)

*Note: Flood and Tornado events only include storms in 1996–2011. All other event listings cover storms in 1988–2011.

Storm-specific severity

[How we measured this: Spearman's rank correlation]

Storm-specific severity



Storm-specific severity

	Distance	Rain	Wind	Flood	Tornado
Distance	-	-	-	-	-
Rain	0.79	-	-	-	-
Wind	0.71	0.69	-	-	-
Flood	0.46	0.54	0.44	-	-
Tornado	0.43	0.50	0.45	0.78	-

County-specific classification

We measured agreement in county-specific exposure classifications for different storm hazards using **Cohen's Kappa**:

$$\kappa = \frac{p_o - p_e}{1 - p_e}$$

where:

- p_o: Observed agreement between two hazard classifications
- p_e: Expected agreement between two hazard classifications if ratings were independent

County-specific classification

[What we found]

Discussion

Software

Software as a research product

[Open science, ROpenSci, influence of example packages]

Software as a research product

[Coursera specialization, book]

Project software

[list of software, availability through CRAN, GitHub]

Sharing exposure data

[`hurricaneexposure`, `hurricaneexposuredata`, web page]

Modeling storm winds

`[stormwindmodel]`

Working with NOAA Storm Events

[noaastormevents]

Dealing with time zones

`[countytimezones]`