SDS 4135 - Project 3

Due October 23

Tropical Cyclones

A tropical cyclone is a large storm that rotates around a low pressure center. There is system for classifying tropical cyclones based on their wind speeds, which includes the tropical storm designation and the hurricane designation, reserved for the largest storms.

There is great scientific and public interest in understanding tropical cyclones, given that they are difficult to predict far in advance, and they have the capability to produce significant damage. See for example the recent videos of homes in Buxton, NC collapsing into the ocean, as a result of waves produced by post-tropical cyclone Imelda.

We will focus on two questions that have received attention in the scientific literature:

1. Is the number of tropical cyclones (of various types) in a year over-dispersed relative to a constant Poisson distribution?
2. Can you find evidence of a "cold wake" effect, which makes it unlikely that two strong storms will appear in quick succession?

The first question is relevant for predictability. If the number of storms follows a Poisson distribution with the same rate each year, then it is unlikely that we have any chance of predicting the storm season in advance.

The second question is of both scientific and public interest, for the purpose of preparing for the unlikely but catastrophic event that the same area is hit by two strong storms in a short period of time. The second question is also quite a bit more open-ended, and you should feel free to interpret it as best you can.

I would like to see logically sound statistical analyses, complete with hypotheses, models, test statistics, sampling distributions, and inferences. Ultimately, the goal of a statistical analysis is to convince another human being that something is true or false. To this end, simple and understandable with solid logic is preferable to complex and overwhelming.

Data

You may use any data you wish, but the course github page contains the hurdat2 dataset, which is maintained by the U.S. National Hurricane Center. I believe you should be able to complete this project using only the hurdat2 dataset. It will need some cleaning, as the formatting may not be ideal for your purposes. We will talk about it in class.