CLIM 796

Tropical Cyclones (1-credit reading course)
Instructor: James Kinter
Fall 2021

Objective:
Review a series of papers on the topic of tropical cyclones, particularly relating to the dynamics and prediction of tropical cyclone tracks. The state of the art of tropical cyclone track forecasting has greatly improved in recent years. The papers listed provide sufficient background to gain a rudimentary understanding of tropical cyclone formation and the factors controlling tropical cyclone movement.

Requirements:

1. Read the papers from the peer-reviewed literature listed below.
2. Produce a short summary of each paper (~1 page) that describes the hypothesis or problem addressed, the data and methods and the major results and conclusions.
3. Meet weekly with the instructor to review recent readings and discuss implications.
4. Produce a summary review (~5 pages) that describes the main take-away messages of the papers and synthesizes the impact of these papers on the thesis research plan.

Classes:
The class will meet once per week for one hour (1 credit).

Student learning outcomes:

- Gain an understanding of how tropical cyclones form and what determines their longevity and movement.
- Gain an understanding of the current state of the art in predicting tropical cyclones, including both tracks and intensity.
- Develop an appreciation for how to analyze numerical model output to assess tropical cyclones.

Papers for review:

1. Background reading
    a. https://www.metoffice.gov.uk/research/weather/tropical-cyclones/facts#What%20is%20a%20TC
    b. https://www.aoml.noaa.gov/hrd-faq/#tc-formation
    c. https://www.aoml.noaa.gov/hrd-faq/#causes-and-effects
    d. https://www.aoml.noaa.gov/hrd-faq/#tc-movement
    e. https://www.aoml.noaa.gov/hrd-faq/#tc-rightside-winds
2. Storm Intensity: Emanuel, K. A. (1988). The Maximum Intensity of Hurricanes, *J. Atmos. Sci.*, 45, 1143-1155. https://journals.ametsoc.org/view/journals/atsc/45/7/1520-0469_1988_045_1143_tmioh_2_0_co_2.xml
3. Storm Motion: Holland, G. J. (1983). Tropical Cyclone Motion: Environmental Interaction Plus a Beta Effect, *J. Atmos. Sci.*, 40, 328-342. https://journals.ametsoc.org/view/journals/atsc/40/2/1520-0469_1983_040_0328_tcmeip_2_0_co_2.xml

4. Storm Tracking:
    a. Hodges, K. I. (1995). Feature Tracking on the Unit Sphere, *Mon. Wea. Rev.*, 123, 3458-3465. https://journals.ametsoc.org/view/journals/mwre/123/12/1520-0493_1995_123_3458_ftotus_2_0_co_2.xml
    b. Heming, J. T., et al., 2019: Review of recent progress in tropical cyclone track forecasting and expression of uncertainties. *Trop. Cyclone Res. Rev.*, **8**, 181–218, https://doi.org/10.1016/j.tcrr.2020.01.001.
5. Storm Prediction: Leroux, M.-D., et al., 2018: Recent advances in research and forecasting of tropical cyclone track, intensity, and structure at landfall. *Trop. Cyclone Res. Rev.*, **7**, 85–105, https://doi.org/10.6057/2018TCRR02.02.
6. Seasonal Outlooks: Vitart, F., & Stockdale, T. N. (2001). Seasonal Forecasting of Tropical Storms Using Coupled GCM Integrations, *Mon. Wea. Rev.*, 129, 2521-2537. https://journals.ametsoc.org/view/journals/mwre/129/10/1520-0493_2001_129_2521_sfotsu_2.0.co_2.xml