

TC_RE: A Global Hourly Dataset of Tropical Cyclones

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Introduction

Background: The increasing use of reanalysis of tropical cyclones (TCs) illustrates a great value to risk assessment and to detection of climatological trends. However, the available reanalysis of TCs is short, incomplete and it updates quite slowly^[1].

Contribution: We produced a novel dataset named TC_RE, taking IBTrACS (International Best Track Archive for Climate Stewardship) as a reference. Specifically, we designed a deep learning model to generate hourly data for the radius of max winds (RMW), average 34 kt wind radii (R34), and intensity in wind speed (Vmax) of global TCs from 1979 to now. The availability of TC characterisation with only a 5-day delay.

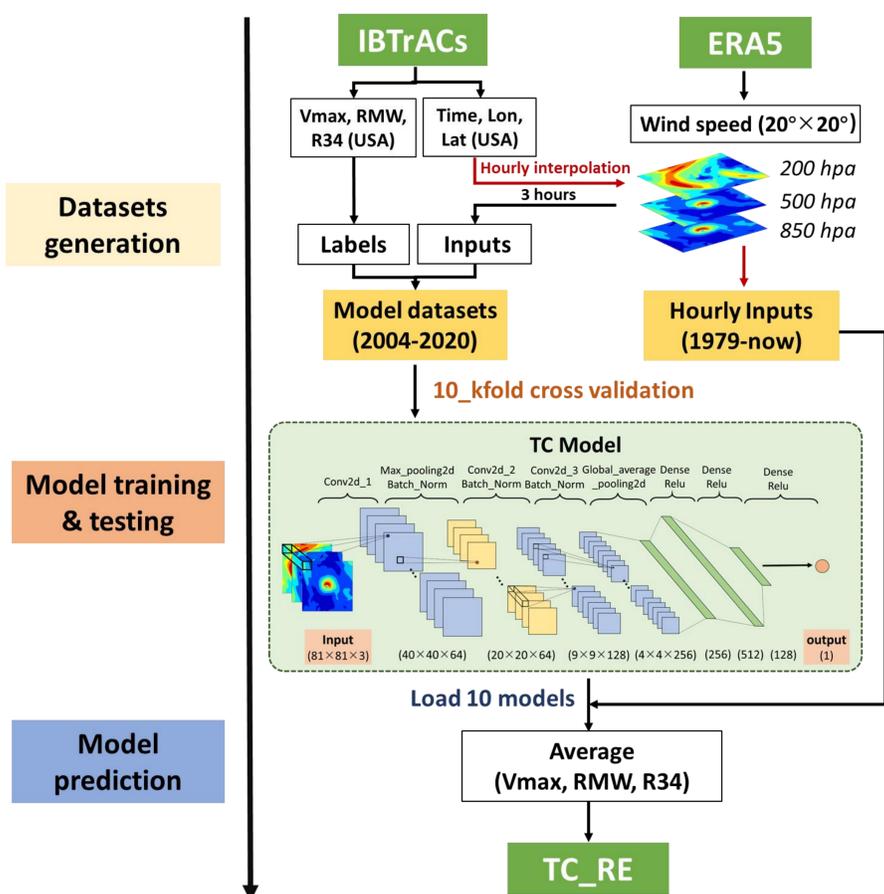
Data & Methods

Data

| IBTrACS | | ERA5 | |
|----------|-------------------------------|------------|------------------------------------|
| Period | 1979 - now | Period | 1979 - now |
| Basin | Global | Resolution | 0.25° |
| Category | > 0 (Typhoons, Hurricanes) | Variables | <i>u, v</i> (component of wind) |

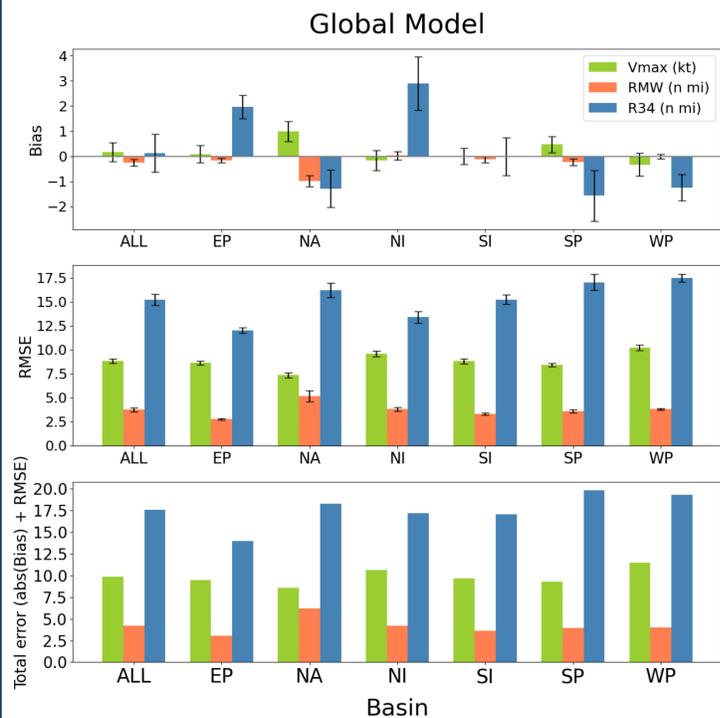
- IBTrACS^[2] (International Best Track Archive for Climate Stewardship) is a global tropical cyclone best track dataset.
- ERA5^[3] is the newly updated reanalysis from ECWMF.

Methods



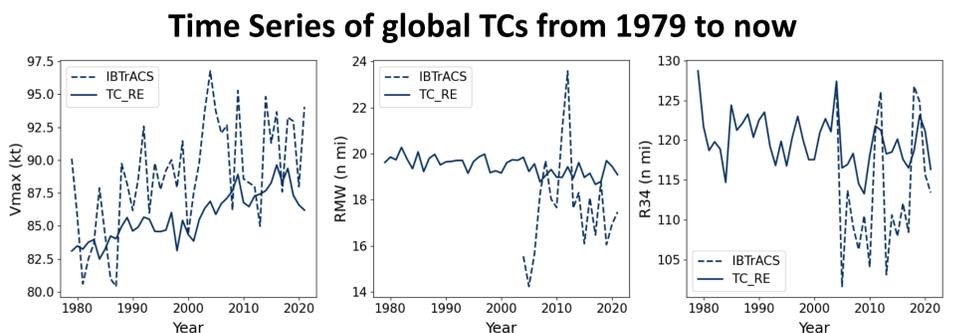
Results

Model Performance

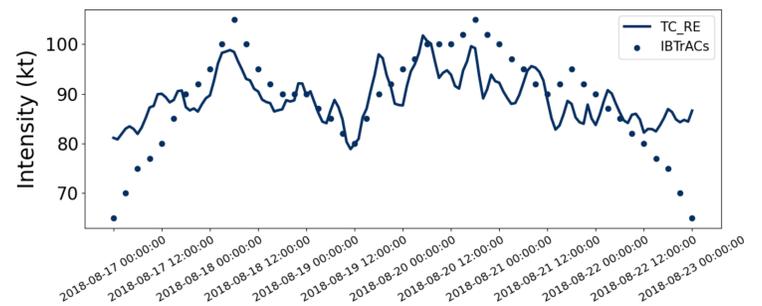


- The global model shows a test error with 9 kt of Vmax globally, less than the intensity uncertainty of IBTrACS (10 kt), as well as accurate test results of RMW, R34, and Vmax in different basins.

TC_RE Evaluation



Time Evolution of Typhoon SOULIK (2018)



- The tropical cyclones size (both RMW and R34) are found to be stable from 1979 to now.

Next steps

Improve the model

Publish the dataset

Analyze the Fail Cases

References

- [1] Emanuel, Kerry, et al. "On the desirability and feasibility of a global reanalysis of tropical cyclones." *Bulletin of the American Meteorological Society* 99.2 (2018): 427-429.
- [2] Knapp K R, Kruk M C, Levinson D H, et al. The international best track archive for climate stewardship (IBTrACS) unifying tropical cyclone data[J]. *Bulletin of the American Meteorological Society*, 2010, 91(3): 363-376.
- [3] ERA5: data documentation (<https://confluence.ecmwf.int/display/CKB/ERA5%3A+data+documentation>)