

A satellite image of a tropical cyclone, showing a well-defined eye and spiral cloud bands over a dark ocean surface. The image is partially obscured by a blue vertical bar on the right side.

# Statistical Modeling of Tropical Cyclone Rapid Intensification

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# Motivation

**Predicting** rapid intensification (RI;  $\geq 30\text{-kt}/24\text{-h}$ ) is challenging!

Intensity errors for RI cases are nearly **2x larger** than average errors.

**Statistical probabilistic RI** models are among the **most skillful**.

## Can we do more?

- We seek to **further improve** RI prediction by **developing** an **improved** statistical probabilistic RI **model**
- Evaluation over the 2020-2024 Atlantic hurricane seasons

Improving RI forecasts is a goal of the Weather Research and Forecasting Innovation Act of 2017

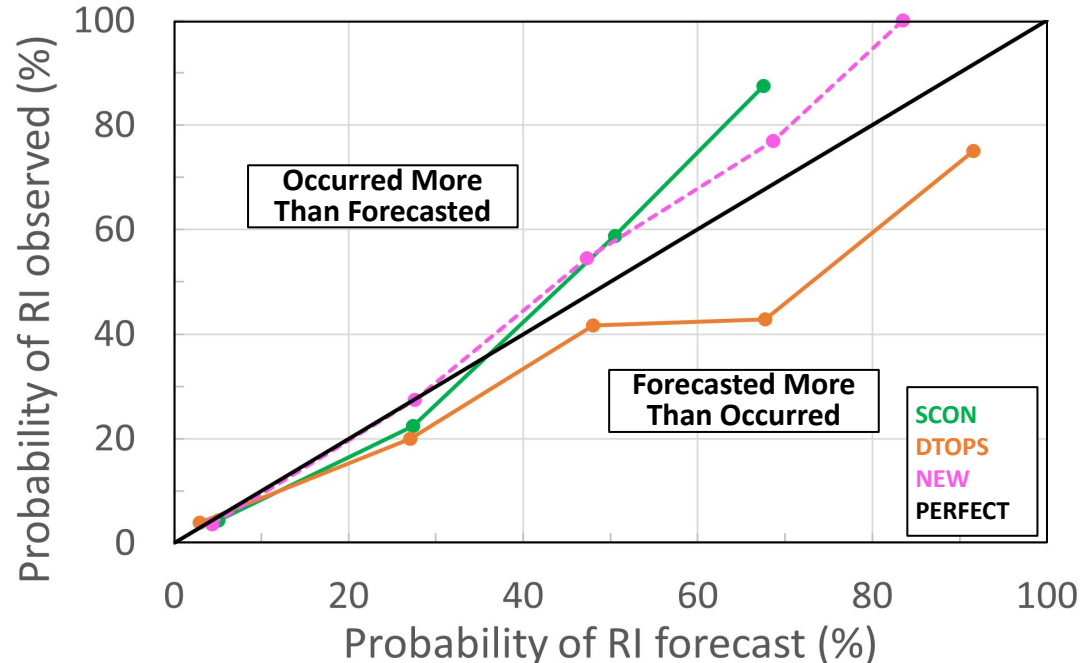


# Leveraged Two Currently-Operational RI Models

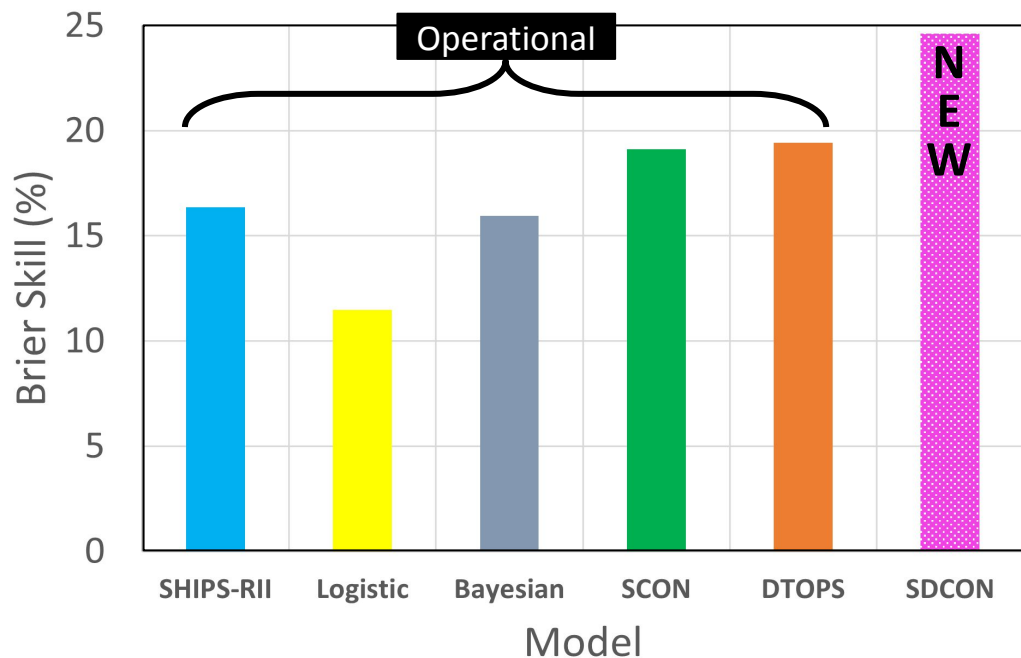
**NEW** = Average of **SCON** and **DTOPS** models

- **SCON**: Operational consensus (average) of statistical SHIPS-RII, Bayesian, and Logistic probability of RI forecasts
- **DTOPS**: Operational Deterministic to Probabilistic RI model
- **NEW**: Consensus (average) of operational SCON and DTOPS probabilistic forecasts.

Ref: DeMaria, M, J.L. Franklin, M.J.Onderlinde, and J. Kaplan, (2021). Operational forecasting of tropical cyclone rapid intensification at the National Hurricane Center. Atmosphere, 12 (6): 683. <https://doi.org/10.3390/atmos12060683>



# Assessing the Reliability of RI Model Forecasts



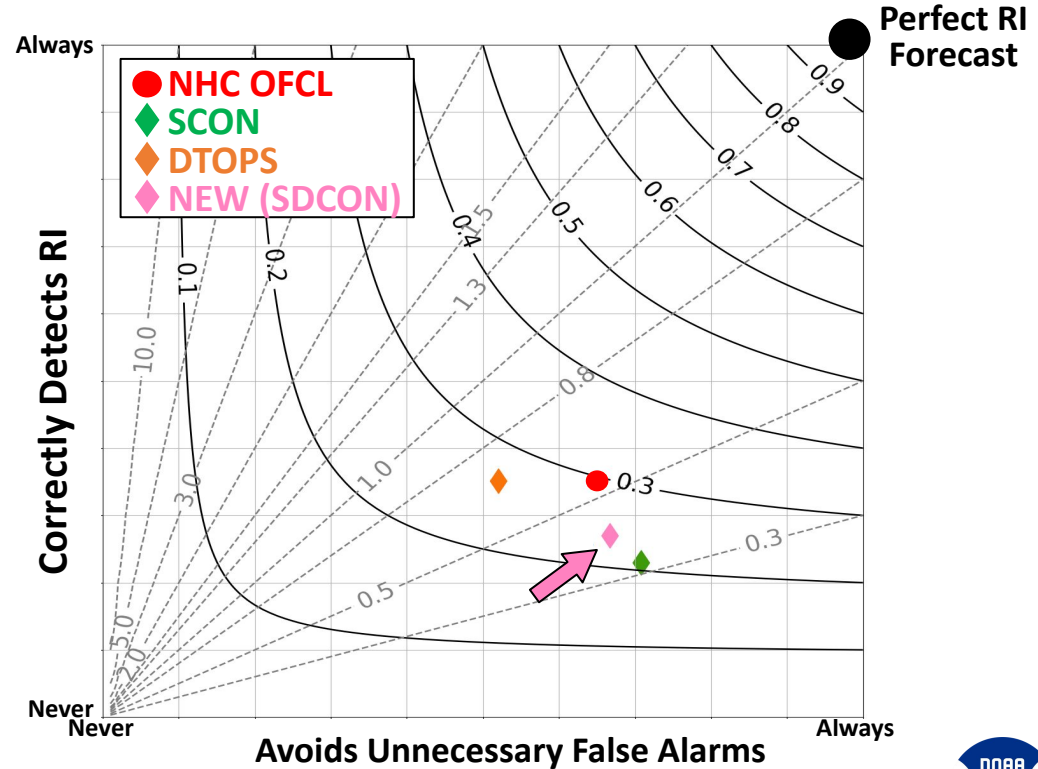
**NEW (SDCON) outperforms currently-operational RI models!**

# Performance Diagram for RI Model Forecasts

- NHC OFCL: National Hurricane Center Official forecast
- SCON: Operational consensus (average) of the SHIPS-RII, Bayesian, and Logistic probability of RI forecasts
- DTOPS: Operational Deterministic to Probabilistic RI model
- SDCON: Consensus (average) of operational SCON and DTOPS probabilistic forecasts
- Probability of RI cutoff to forecast RI  $\geq 40\%$

Ref: DeMaria, M, J.L. Franklin, M.J.Onderlinde, and J. Kaplan, (2021). Operational forecasting of tropical cyclone rapid intensification at the National Hurricane Center. Atmosphere, 12 (6): 683.

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# Summary

New model (**SDCON**) is **more skillful** than other probabilistic RI models.

**SDCON** transitioned to operations prior to the 2024 season.

**Future Work:** include additional **oceanic** (sub-surface, salinity) and **structure** (wind radii) predictors in RI models.

