Advancing Model Developments & R2O (HFIP)
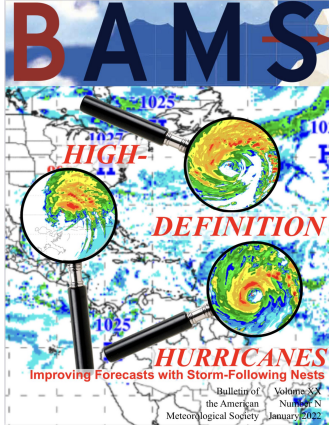
Gopal (HRD)

Gus Alaka (HRD), Bill Ramstrom (HRD/CIMAS), Lew Gramer (HRD/CIMAS), Xuejin Zhang (HRD), Andy Hazelton (Formerly HRD/CIMAS), and Zhan Zhang (EMC)*

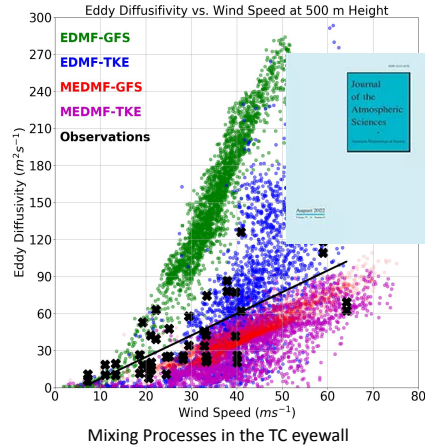Collaborators: *EMC modeling team & HFIP
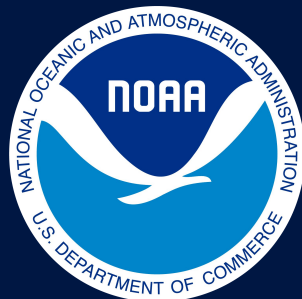
Atlantic Oceanographic & Meteorological Laboratory

National Oceanic and Atmospheric Administration
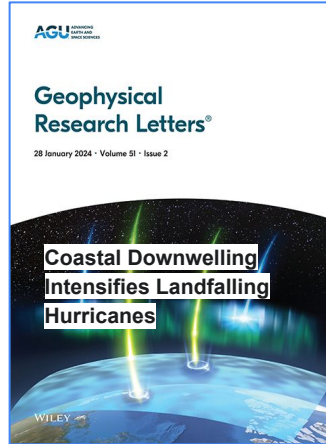
U.S. Department of Commerce

Our Objectives - Improving Hurricane Forecasts

DEVELOP
next-generation hurricane models

USE
aircraft observations to improve the model

ADVANCE
understanding of hurricanes using models

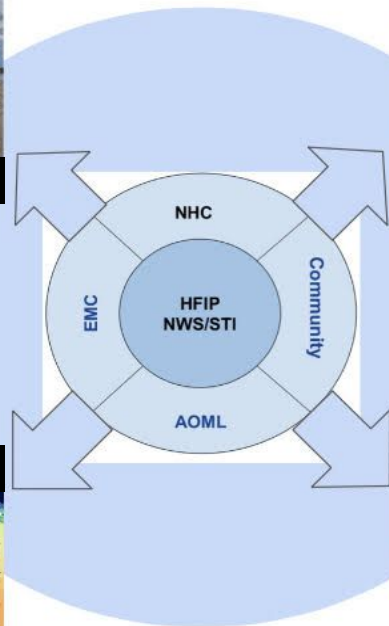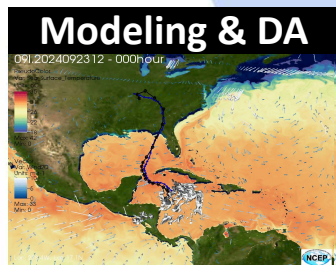**TRANSITION**
Research to operations (R2O) & support HFIP
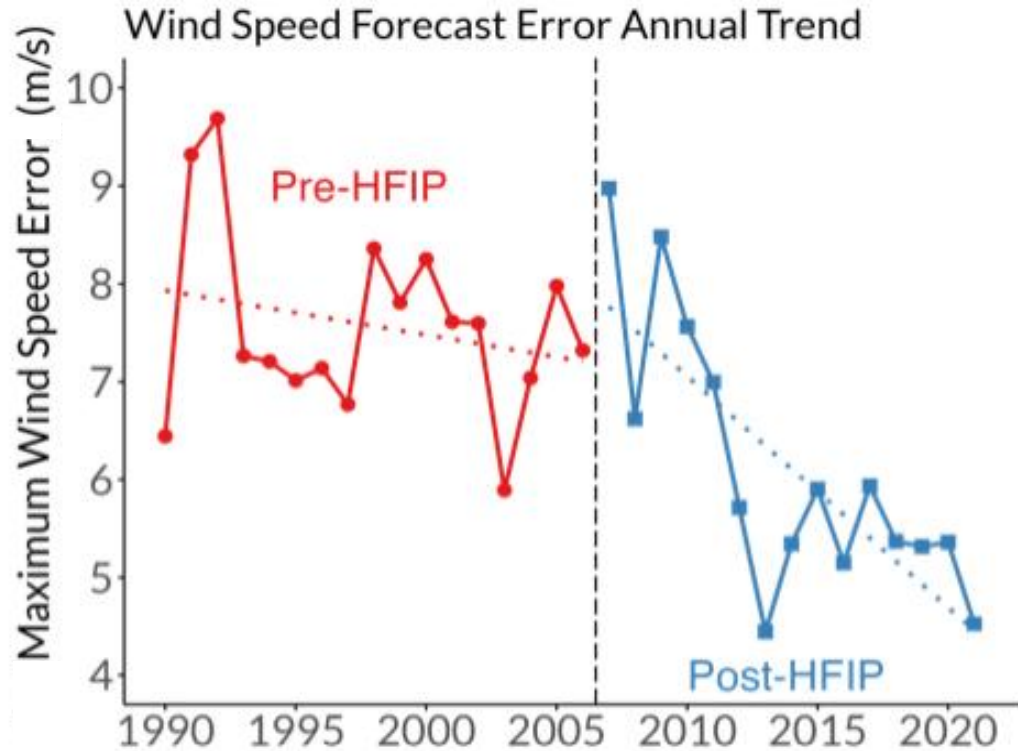
HFIP - Making Hurricane Forecasts Better

HFIP - Making Hurricane Forecasts Better

Observations

MSU ORION, 2018
R20 Computing

Modeling & DA

Community
HAFS Developers Colloquium, 2024

NHC

EMC

Community

HFIP
NWS/STI

AOML

HFIP - Making Hurricane Forecasts Better

Wind Speed Forecast Error Annual Trend

Track Error

Intensity Error

IMPROVEMENT!
30-40%

IMPROVEMENT!
50-60%
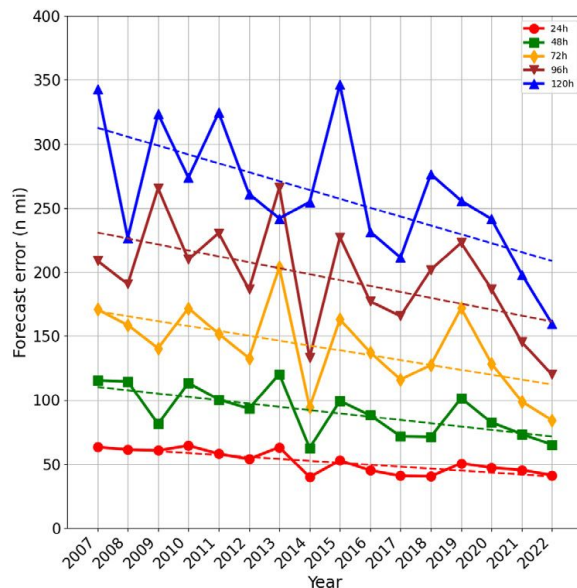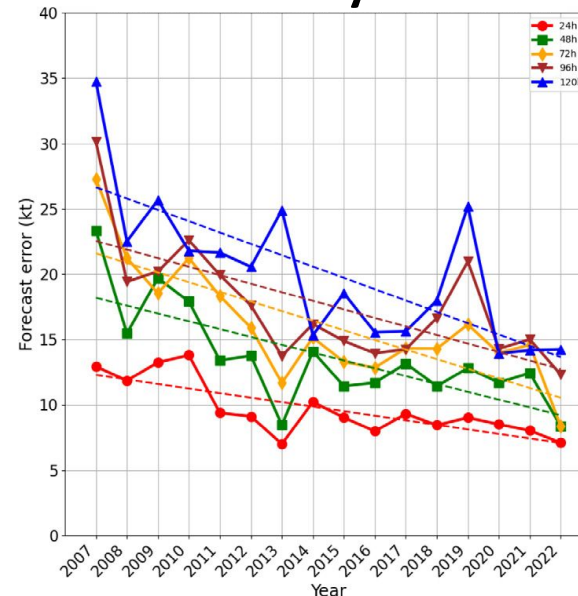
Quiz: HWRF or Reality?

HWRF

Reality

IR BT (C)
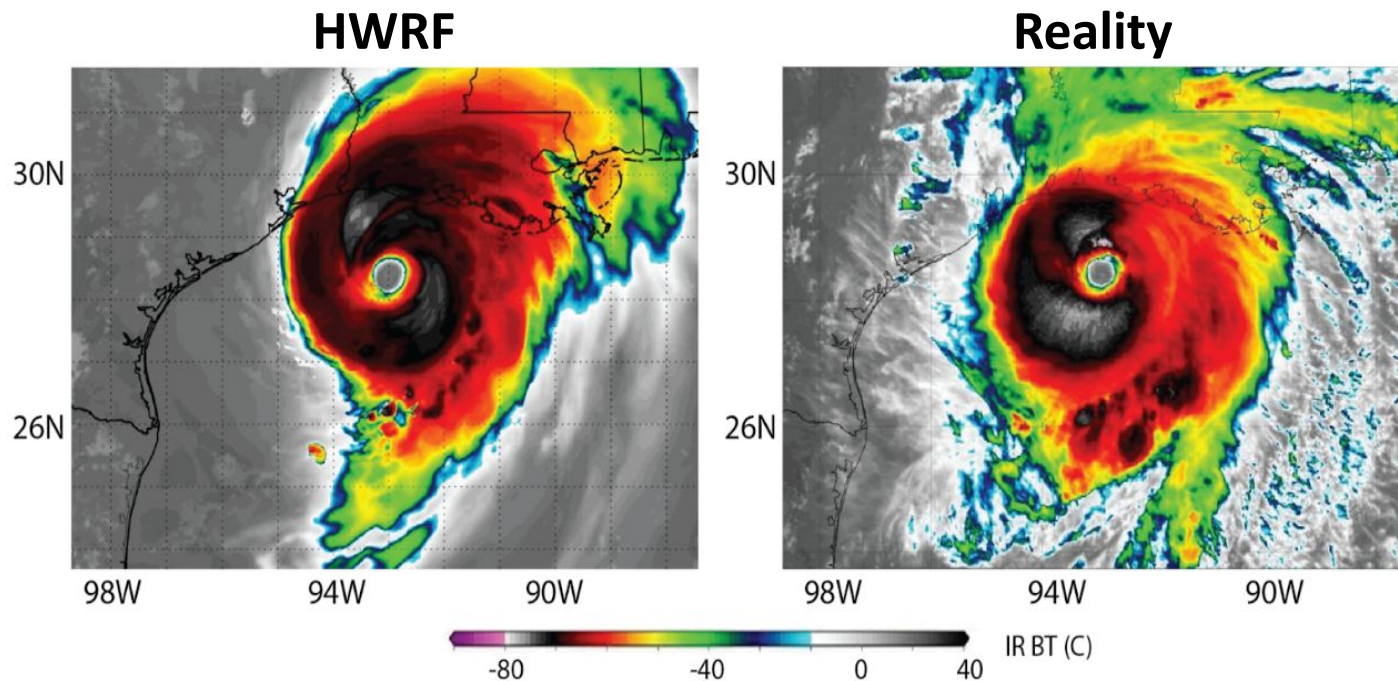
NO MAGIC BULLET!

High-Res. Moving Nests | Physics | Inner-Core DA | Ocean Coupling | Science | Rigorous T&E

HAFS: The Hurricane Analysis and Forecast System

NATIONAL OCEANIC AND
ATMOSPHERIC ADMINISTRATION
United States Department of Commerce

Hurricane Forecast Improvement Program
Five-Year Plan: 2019-2024

Proposed Framework for Addressing Section 104 of the
Weather Research Forecasting Innovation Act of 2017

22 June 2018
Updated 25 June 2019

HAFS FACTS
- Unified Forecast System (UFS)
- AOML-EMC-GFDL collaboration
- Developed in Record Time
- Community Model
- Two Versions: HAFS-A & HAFS-B
- 15% Track Improvements -vs- HWRF
- 2-3% Wind Improvements -vs- HWRF
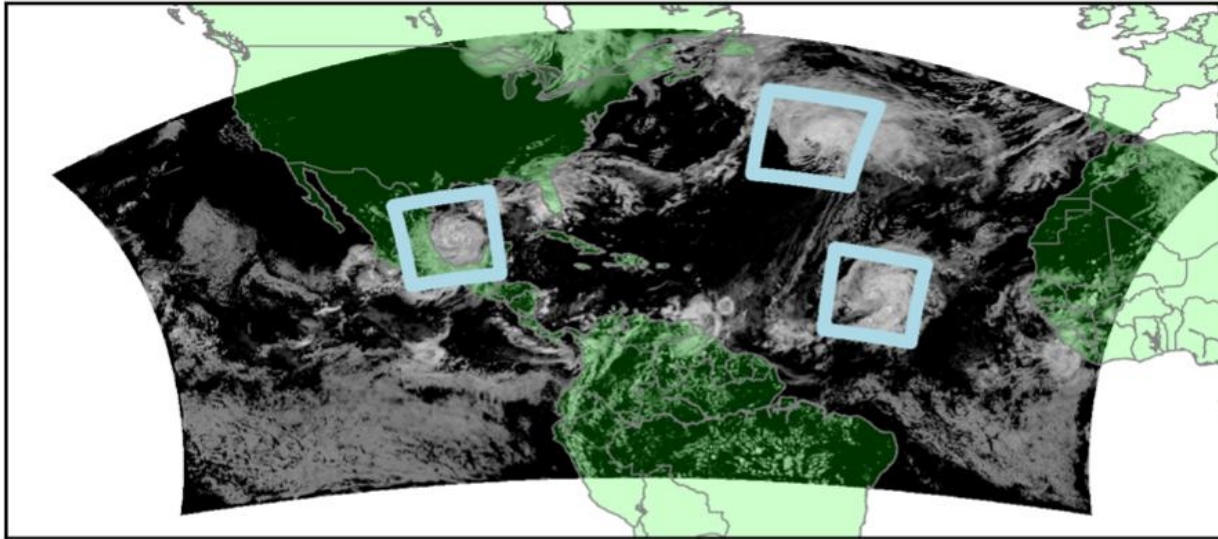
Helene 09L
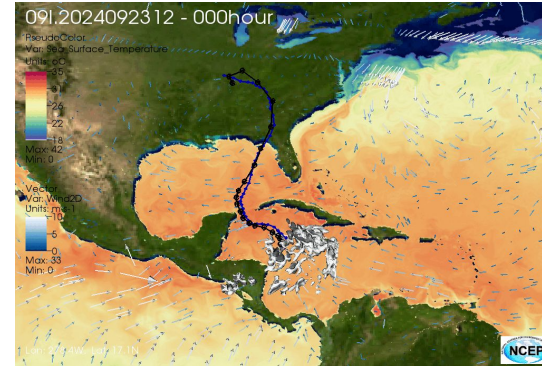
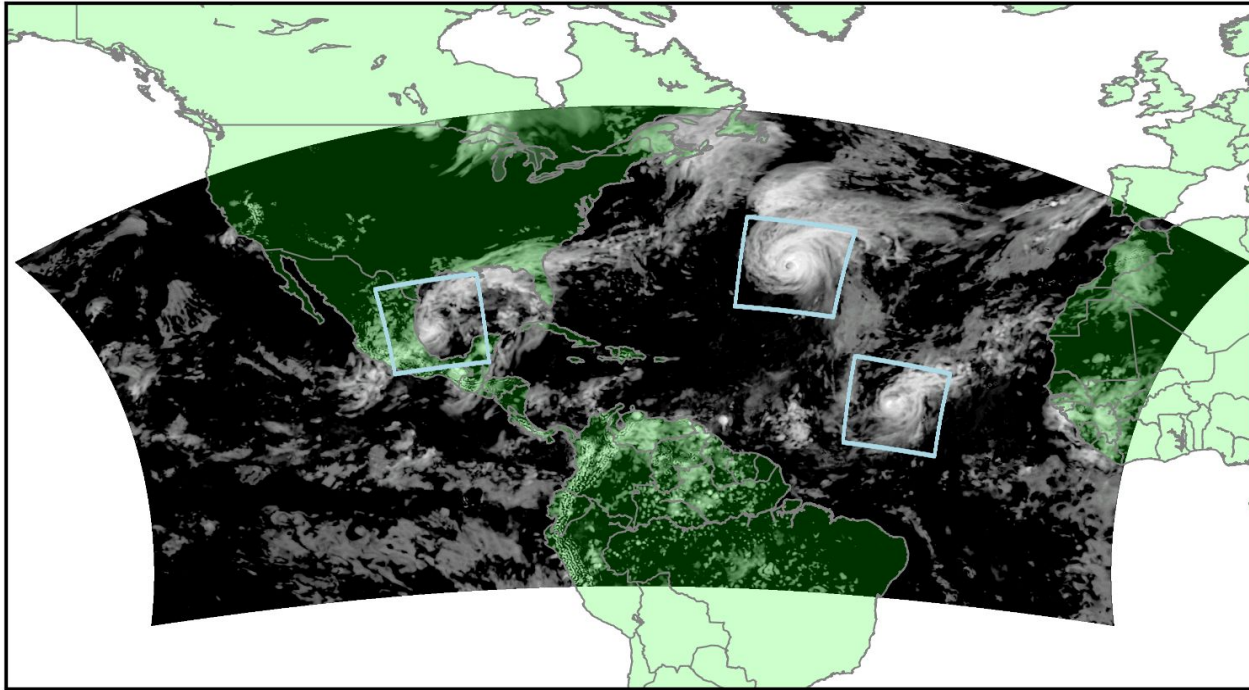### Milton 14L

Multi-Storm HAFS (HAFS-M)

Simulated Satellite Hour 18 VIS

HFIP Real-Time forecast from HAFS-M:
Milton (west), Kirk (northeast), Leslie (southeast)

Multi-Storm HAFS (HAFS-M)
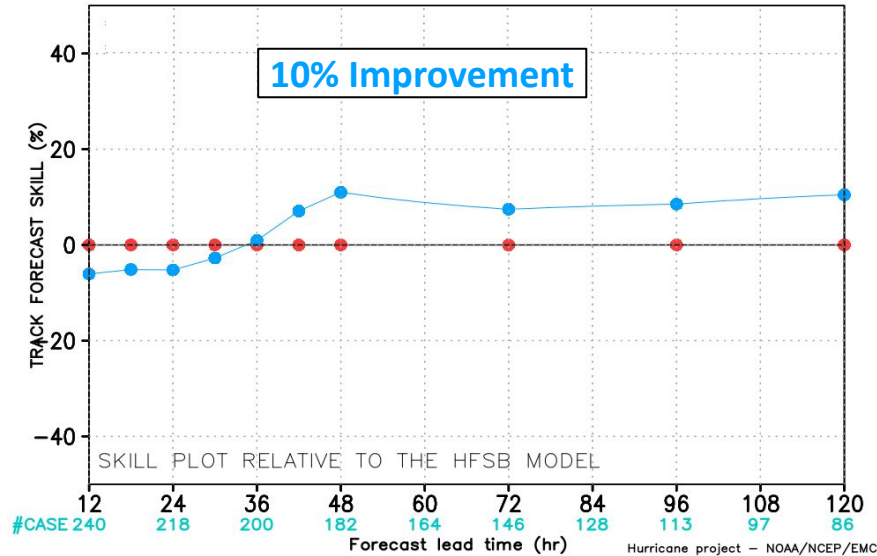
The Next Generation of TC Prediction!
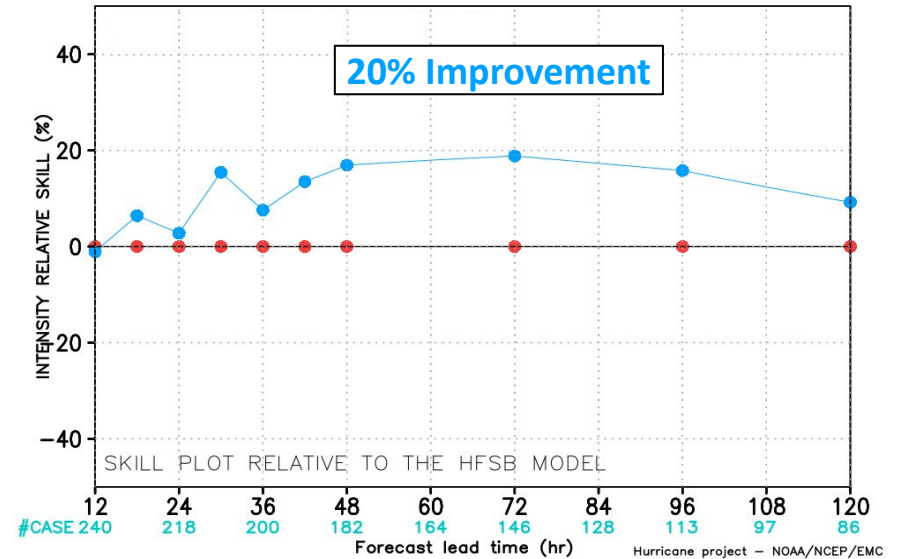

Ramstrom et al, 2024

HAFS-M Forecast Performance

2024 Atlantic Hurricane Season
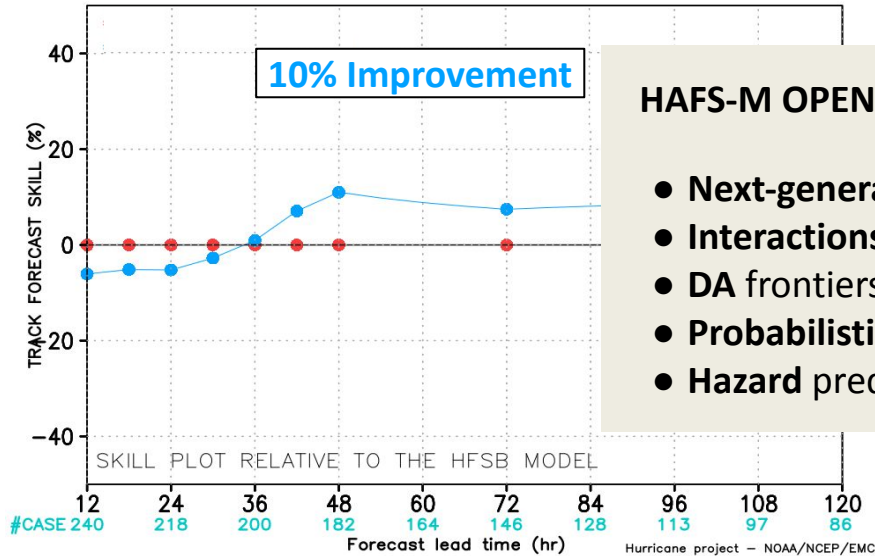
Track Percent Improvement

10% Improvement

Intensity Percent Improvement

20% Improvement

Operational HAFS-B
Experimental HAFS-M

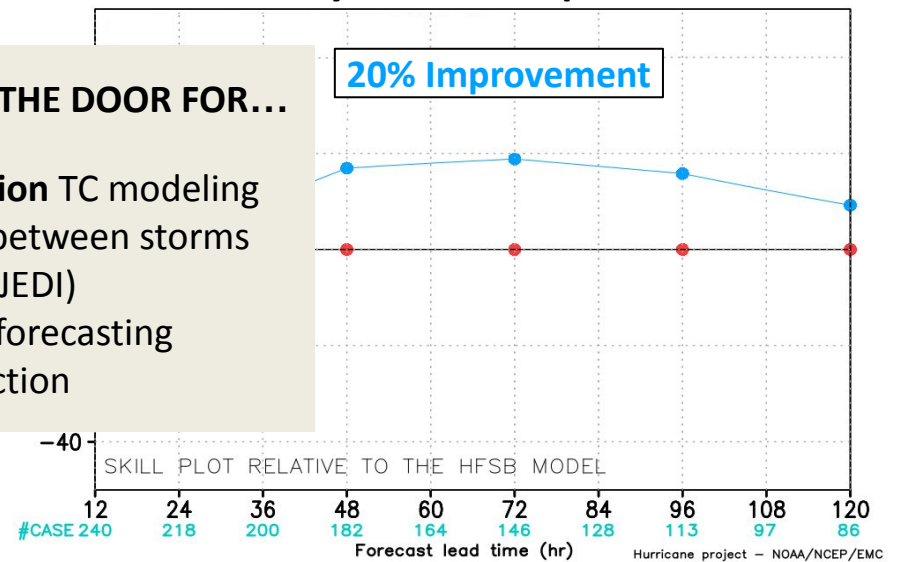# HAFS-M Forecast Performance

2024 Atlantic Hurricane Season

Track Percent Improvement
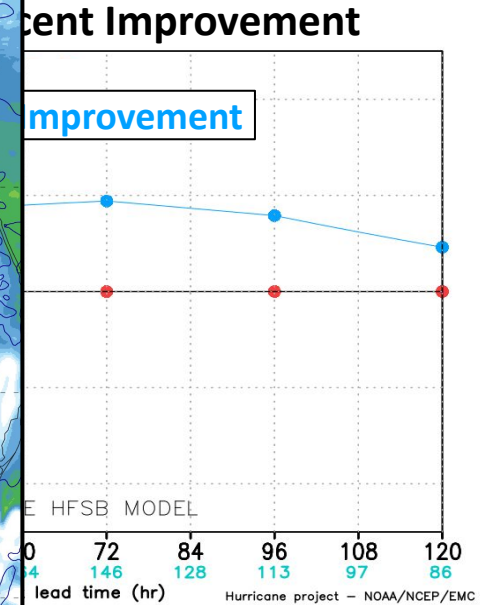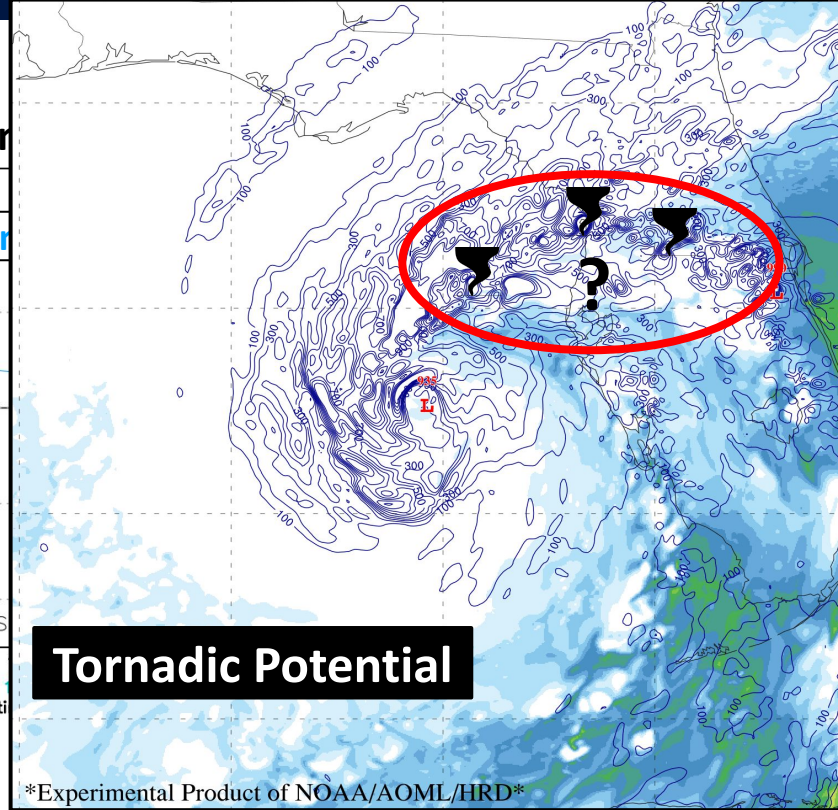

10% Improvement

SKILL PLOT RELATIVE TO THE HFSB MODEL

Intensity Percent Improvement

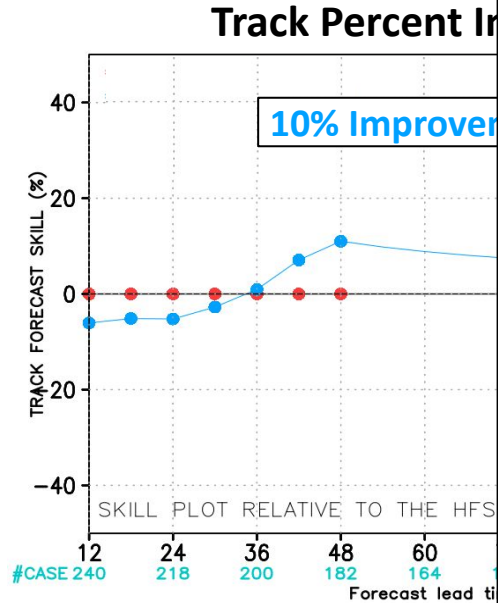20% Improvement

SKILL PLOT RELATIVE TO THE HFSB MODEL

HAFS-M OPENS THE DOOR FOR…

- **Next-generation** TC modeling
- **Interactions** between storms
- **DA** frontiers (JEDI)
- **Probabilistic** forecasting
- **Hazard** prediction

Operational HAFS-B
Experimental HAFS-M

HAFS-M Forecast Performance

Track Percent Improvement

10% Improvement

Tornadic Potential

Experimental Product of NOAA/AOML/HRD

Improvement

Hurricane project – NOAA/NCEP/EMC

Future Direction - Global HAFS