



# HFIP Goals and Status

Frank Marks (NOAA/AOML/HRD)

HFIP Research Lead

November 17, 2020





# Weather Act Sec.104: HFIP

---

Develop an updated plan, detailing the specific research, development, and technology transfer activities necessary to sustain HFIP and achieve the 3 focus areas in [Section 104 of the Weather Research and Forecasting Innovation Act](#):

1. improve prediction of rapid intensification and track of hurricanes
2. improve forecast and communication of storm surges from hurricanes
3. incorporate risk communication research to create more effective watch and warning products

The plan details long-term HFIP goals, priorities, and approaches.





# HFIP Strategic Plan – 2019-2024



- High-level plan approved by NOAA for submission to Congress – May 2019
- [HFIP Strategic Plan](#) provides details on long-term HFIP goals (Appendix A), priorities, and strategies – June 2019



NOAA

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





# HFIP Goals aligned with Weather Act

---

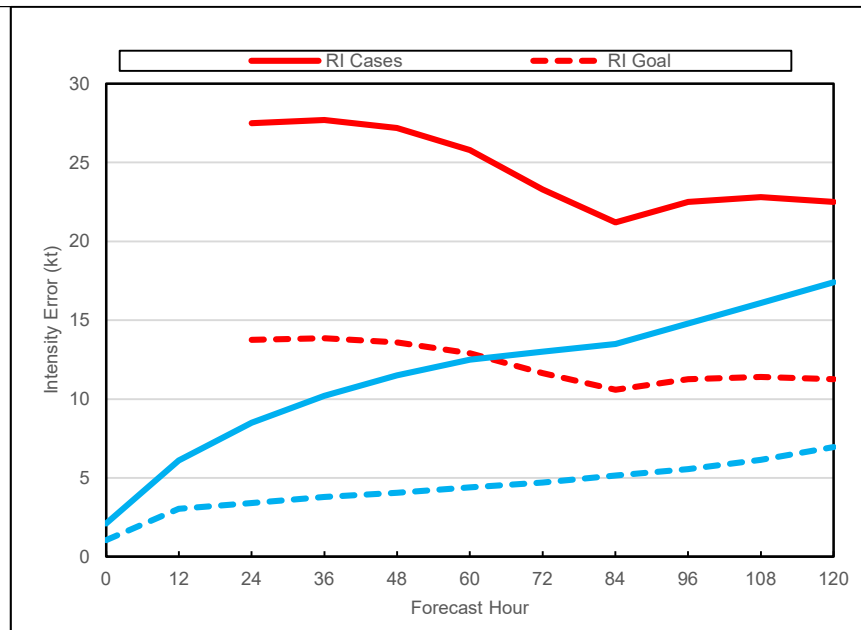
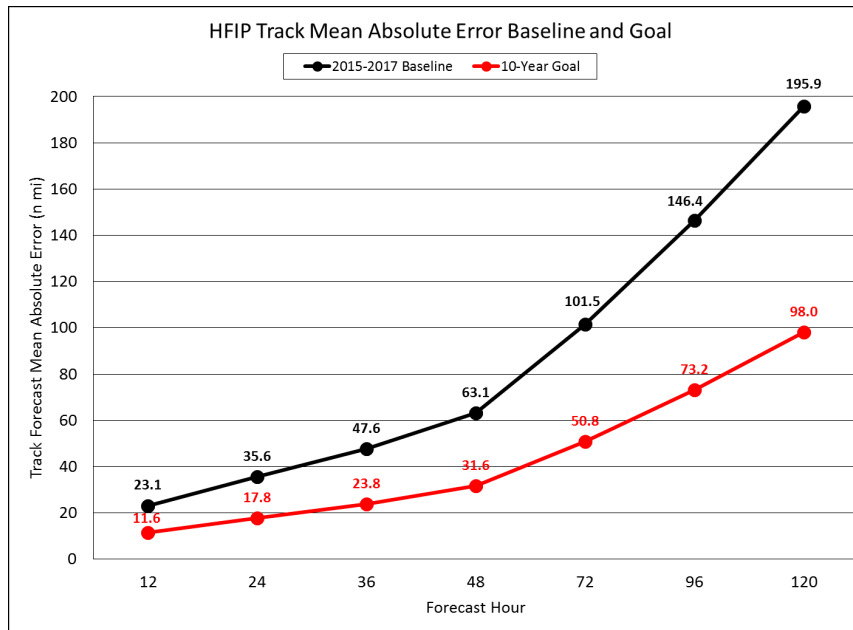


1. Reduce numerical forecast guidance errors, **including during rapid intensification**, by 50% from 2017;
2. Produce 7-day forecast guidance similar to 2017 5-day forecast guidance;
3. Improve guidance on pre-formation disturbances, including genesis timing, track and intensity forecasts, by 20% from 2017; and
4. Improve hazard guidance and risk communication, based on **social and behavioral science**, to modernize TC product suite for actionable lead times for storm surge **and all other threats**.





# HFIP Goals aligned with Weather Act





# Key Strategies:

---

1. Advance an operational Hurricane Analysis and Forecast System (HAFS)
2. Improve probabilistic guidance
3. Enhance communication of risk and uncertainty
4. Support dedicated high performance computing allocation
5. R2O Enhancement
6. Broaden expertise and expand interaction with external community



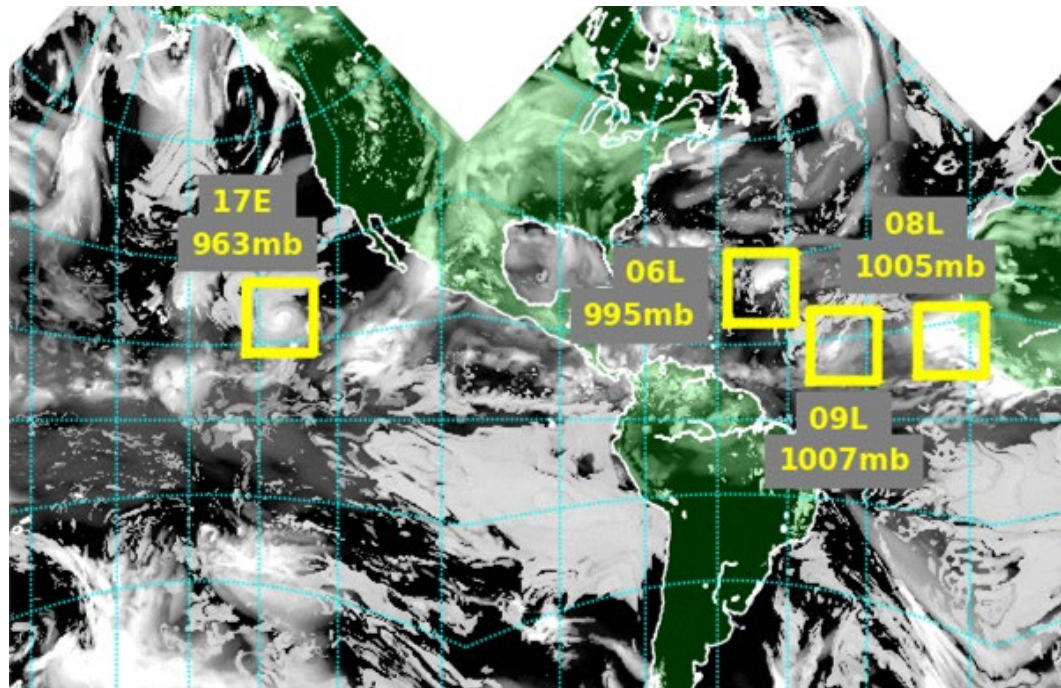


# Key Strategies: HAFS



## 1. Advance operational HAFS

- R&D for HAFS to advance deterministic and ensemble prediction capabilities
- R&D for fusion of modeling, data assimilation and observations to produce an Analysis of Record
- R&D for ensemble post-processing to extract guidance and uncertainty information



Moving nests in global FV3 to track all hurricanes







# Key Strategies: HAFS



## Coordinating six 2018 and one 2019 Hurricane Supplemental Plans to Accelerate Improvements in Hurricane Intensity Forecasting

- **1A.4:** Accelerate HAFS moving nest development (Gopal)
- **3A.1:** Accelerate implementation of Updated HFIP Plan (Marks)
- **3A.2:** Accelerate re-Engineering of HAFS (Mehra)
- **3B:** Sustained Ocean Observations - “picket fence” gliders (Goni)
- **4A.1:** Optimize current observing system to improve prediction of extreme weather (Cucurull)
- **4A.2:** Data Impact Studies (OSE) (Cucurull)
- **HU-2:** Accelerate development of HAFS DA (Marks)







# HAFS Yearly Milestones



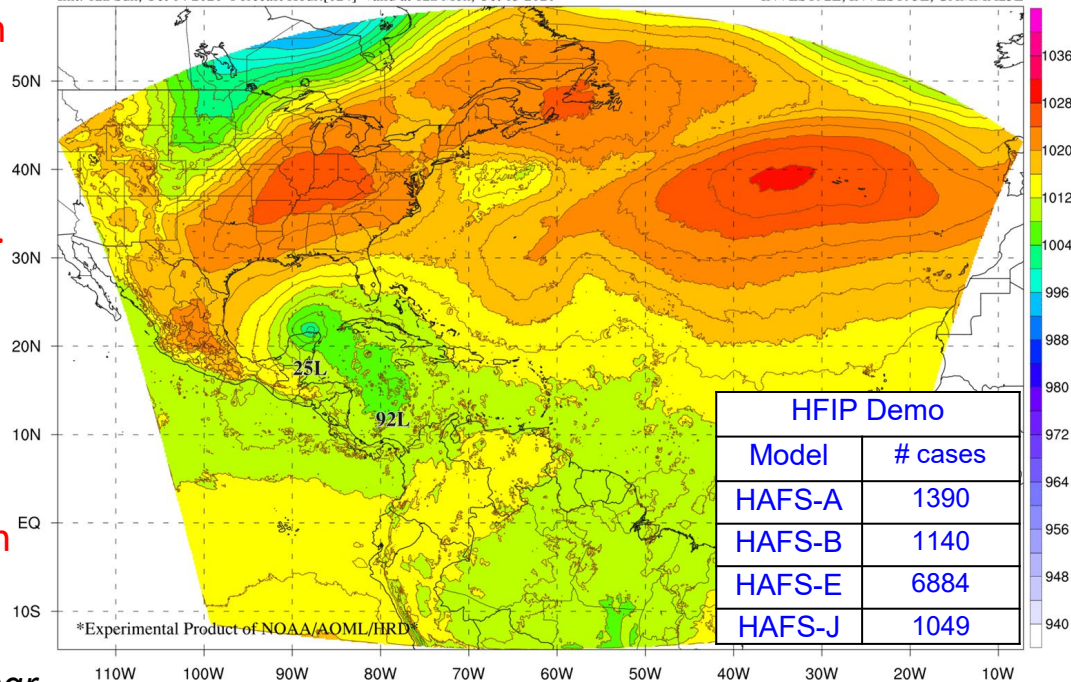
- ✓ **HAFS v0.1A:** stand-alone regional (SAR) nest configuration over NATL basin, 3 km hor. res, 91L, mod. HWRF physics, VI, DA & ocean coupling
- ✓ **HAFS v0.1B:** Global-regional nest configuration over NATL basin, 3-km hor. res, 78L, mod. GFS physics & VI
- ✓ **HAFS v0.1J:** SAR nest ESG configuration over NATL & EPAC, 3 km hor. res, 64L, HWRF physics
- ✓ **HAFS v0.1E:** 17-member ensemble of HAFS v0.1A, 6-km hor. res, 64L, No ocean coupling, SKEB, SPPT, SHUM
- **HAFS v0.2:** Fully-coupled SAR nest configuration *with moving nest & DA - Year*

## Hurricane Analysis and Forecast System V0.1A

Mean Sea-Level Pressure (mb; shaded, lines)

Init: 12z Sun, Oct 04 2020 Forecast Hour:[024] valid at 12z Mon, Oct 05 2020

INVEST92L, INVEST95E, GAMMA25L



3





- Incorporate dynamically-based uncertainty into hazard models & products
- R&D for hazard-specific products from

**Tropical Roadmap Goal**

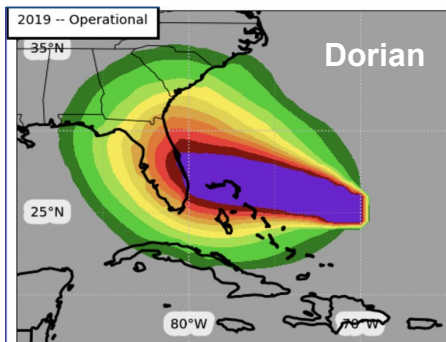
*A suite of highly accurate, scientifically validated tropical products and services that is efficiently produced, clearly communicated, consistent, and effective in providing actionable forecast and impact information that is relevant to partners and the public.*

Photo by Vidler/North-Nebraska on Unsplash

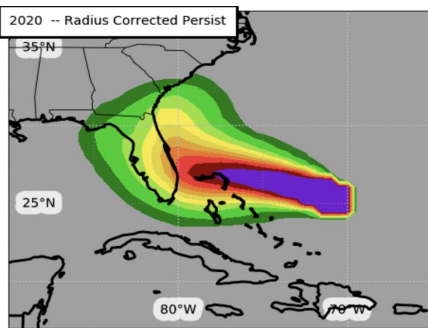
## Tropical Roadmap Goal

*A suite of highly accurate, scientifically validated tropical products and services that is efficiently produced, clearly communicated, consistent, and effective in providing actionable forecast and impact information that is relevant to partners and the public.*

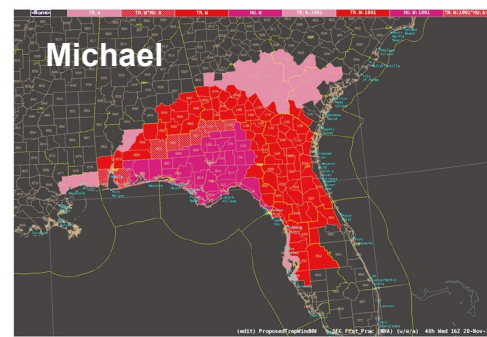
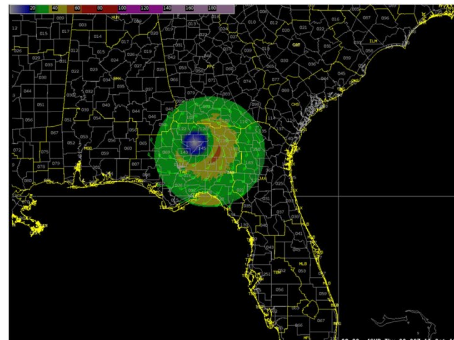
## Wind Speed Probability



2020 -- Radius Corrected Persist



## TC Wind Hazard Recommender





# Key Strategies: Enhance Communications of Risk



## 3. Enhance communication of risk and uncertainty

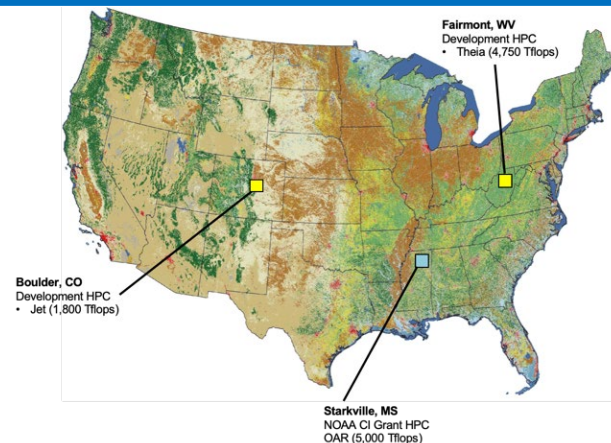
- Evaluate TC products for effective communication of risk using **FACETs**
- Modernize TC products as informed by social & behavioral science
- Coordinating **9 OAR & Hurricane Supplemental Projects** using social & behavioral science research to evaluate TC products



# Key Strategies: HPC & R2O

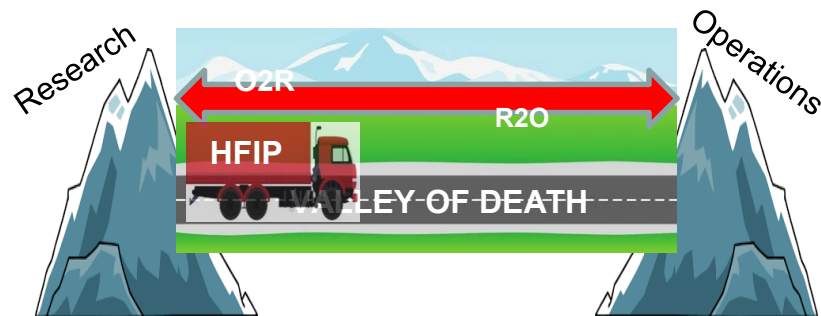
## 4. Increase HPC Capacity

- NOAA R&D and **operational** computing to support HAFS development
- Hurricane Supplemental will provide R&D HPC **~24M core h/month** for HAFS development (**Hera & Orion**)



## 5. Research to Operations (R2O) Enhancements

- Accelerate transition to operations by following NOAA's best practices for promoting readiness levels (RLs)
- Develop a process to prioritize research targeted for operational improvements
- Integrated use & support of Testbeds (JHT, DTC, JCSDA, HWT, HMT, & EPIC)







# Key Strategies: Outreach to Community



## 6. Broaden expertise and expand interaction with external community

- Re-invigorate grants program
- Maintain a visiting scientist program at research and operational centers
- Advisory committees, community workshops
- Collaborate/coordinate with social and behavioral sciences
- Outreach to America's Weather Industry (AWI)

### HFIP Collaborative Awards Round VI (2020-2022)

PI Name	PI Institution	Project Title
Alan Brammer	CSU-CIRA	Extending the Tropical Cyclone Genesis Index to Global Ensemble Forecasts
Enrique Curchitser	Rutgers	Developing Regional Ocean Modeling Capabilities with MOM6 for use in the UFS
Ryan Torn	SUNY Albany	Application of Innovation Statistics to Diagnose Biases in the HAFS System





# EISWG HFIP Recommendations to NOAA SAB



To achieve the increasingly urgent goals of the Weather Act, Section 104 in a reasonable time, NOAA will need to continue to support HFIP, plus:

- 1) invest in additional physical, social and behavioral science research, motivated and targeted by an expanded set of success metrics;
- 2) leverage scientific and technological advances enabled by other line offices, testbeds, agencies, organizations and industry; and
- 3) entrain a broader network of expert personnel external to NOAA for convergent research and workforce development.

[Provided 5 Specific Recommendations](#) - HFIP response will be required





# Questions

---







# HFIP Recommendations to NOAA SAB



1. **Expanded HFIP scope must be mapped to necessary resources & timelines.**  
(Supplemental \$ run out in FY22)
2. Expand participation **through dedicated science campaigns that cross the atmosphere-ocean interface to improve model physics and data assimilation** and increase the use of probabilistic forecasts to quantify uncertainty. Continue HAFS development and entrain more external researchers. **(GOMO & IOOS can help)**
3. Communicating storm-surge risk should be prioritized and account for uncertainty from multiple sources and address diversities of human perception, behavior, and needs. **Evaluation and improvement of operational storm surge models should also be prioritized.** (NOS?)
4. Severe weather can evoke subsequent hazards; warning and watch products need to address risk from multiple threats. **Developing a strategic plan for social and behavioral research with milestones and metrics should be a high priority** to ensure forecasts and forecast products address diverse societal needs and impacts. **(AFS Roadmap & FACETs can help)**
5. **Increase internal coordination across OAR, NWS, & NOS and expand science and technology partnerships.** (HFIP strategic plan, FACETs, AFS Roadmap, ?)

