

Presentation on HAFS: NESII/ESMF

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HAFS Coordination Meeting

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NOAA Hurricane Supplemental

*Disaster Related Appropriation Supplemental: Improving
Forecasting and Assimilation*

Implement coupling for the next generation hurricane forecast system at NOAA, which replaces the current operational HWRF.

Partners

NCAR/CGD, NCAR/JNT, NOAA/EMC,
NOAA/GSD, NOAA/GMTB, NOAA/GFDL



NOAA Hurricane Supplemental

Coupled FV3 - HYCOM with CMEPS HAFS Application

- Hurricane Analysis and Forecast System (HAFS)
 - Workflow + **Forecast Model** + Post Processing
- Finite-Volume Cubed-Sphere Atmosphere Model (FV3)
 - Regional North Atlantic Basin
- Hybrid Coordinate Ocean Model (HYCOM)
 - Regional North Atlantic Basin
- Community Mediator for Earth Prediction Systems (CMEPS)
 - Community developed multi-component adaptable coupler

HAFS Development Progress

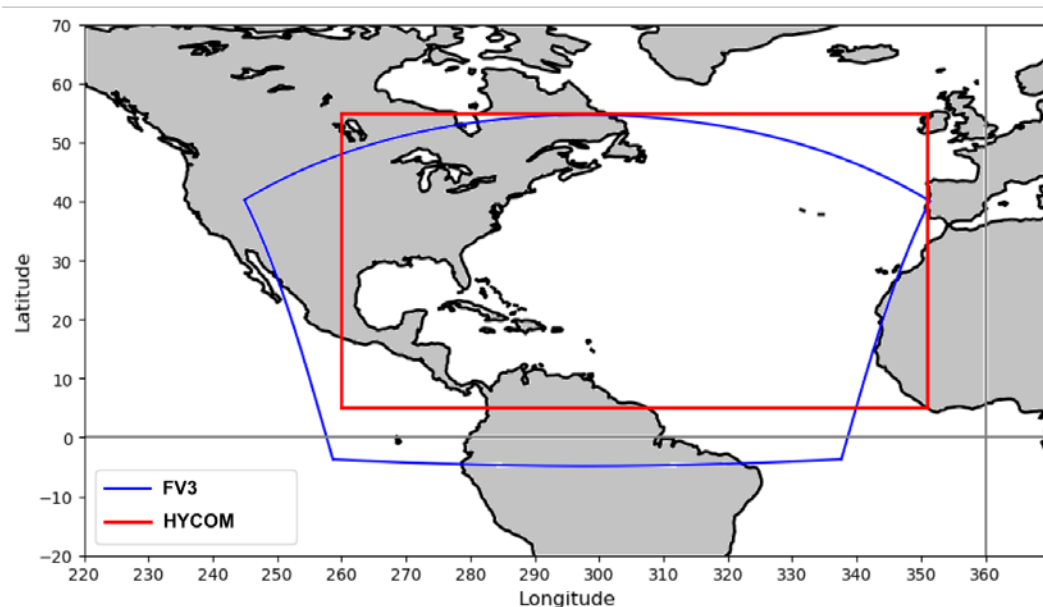
ESMF Development Plan

- ✓ Extend NAVY Earth System Prediction Capability (ESPC) HYCOM NUOPC cap
- ✓ Integrate HYCOM cap into HAFS forecast application build
- ✓ Side-by-side FV3 + HYCOM
 - Hurricane Dorian 2019 Test Case
- Coupled FV3-HYCOM
 - One-Way FV3 -> HYCOM
 - One-Way HYCOM -> FV3
 - Two-Way FV3 <-> HYCOM
- Coupled FV3 <-> CMEPS <-> HYCOM

HAFS Test Case

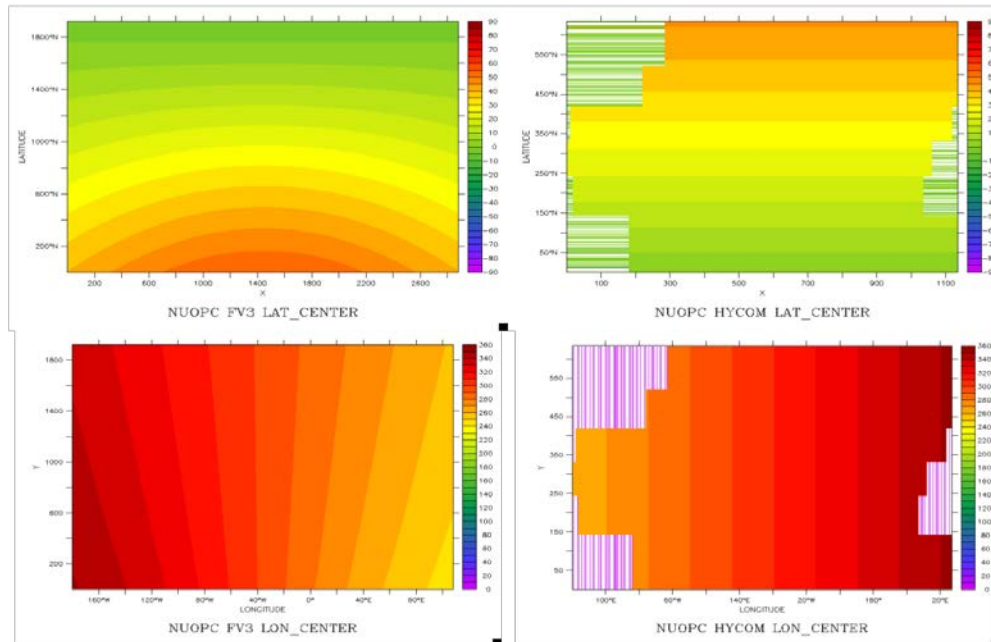
Hurricane Dorian

- North Atlantic Basin
- August 29th, 2019 @ 00z
- 126 hours
- HYCOM grid 1135x633
- FV3 grid 2881x1921



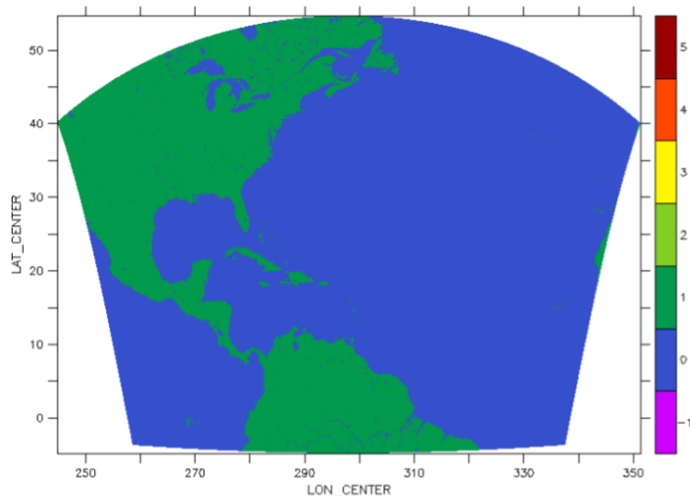
HAFS Remapping Coordinates

- Missing HYCOM coordinates in land cells (mask = 0)
- Missing FV3 and HYCOM corner coordinates in regional grids

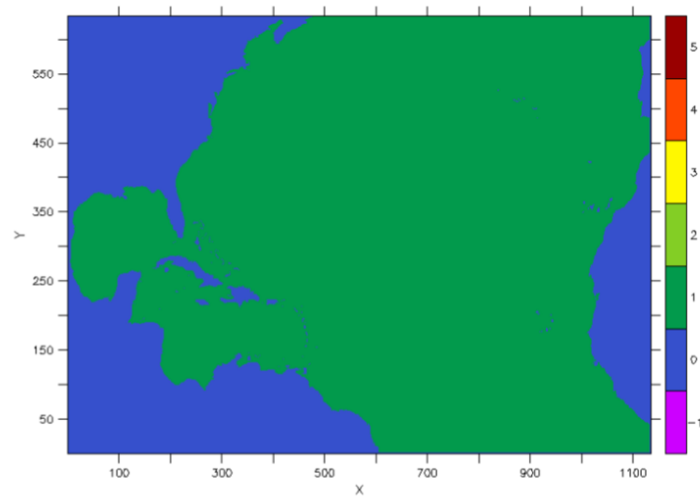


HAFS Remapping Masks

- Missing FV3 data in land cells, specified fields (mask = 1)
- Missing HYCOM data in land cells (mask = 0)



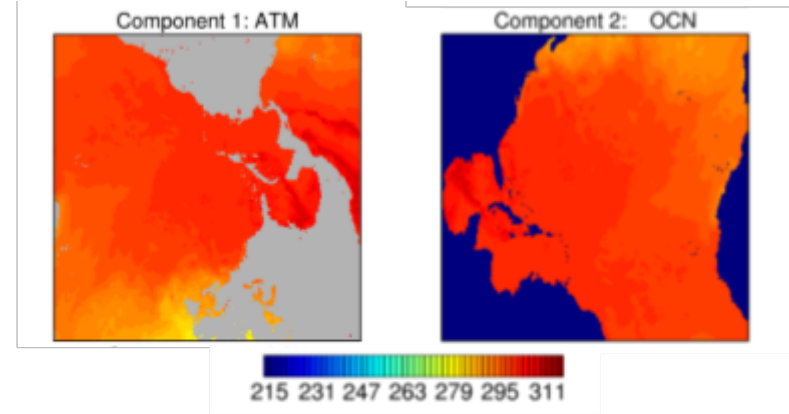
NUOPC FV3 Mask



NUOPC HYCOM Mask

HAFS Field Exchanges

FV3 to HYCOM Field Exchanges			HYCOM to FV3 Field Exchanges		
Standard Name	HYCOM Synonym	Units	Standard Name	HYCOM Synonym	Units
mean_zonal_moment_flux	u10	N m-2	sea_surface_temperature	sst	K
mean_merid_moment_flux	v10	N m-2			
inst_temp_height2m	airtmp	K			
inst_spec_humid_height2m	airhum	kg kg-1			
mean_prec_rate	prcp	kg m-2 s-1			
wind_speed_height10m	wndspd10	m s-1			
mean_net_sw_flux	swflxd	W m-2			
mean_net_lw_flux	lwflxd	W m-2			
inst_pres_height_surface	mslprs	Pa			
inst_temp_height_surface	gt	K			



FV3 -> HYCOM Field Exchange:
inst_temp_height_surface

HAFS Status

Side-by-side FV3 + HYCOM

- Bit-for-bit results

One-way FV3 -> HYCOM

- Nearest neighbor test
- Unreasonable surflx
- FV3 restarts to zero

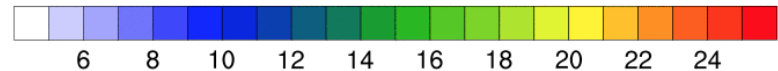
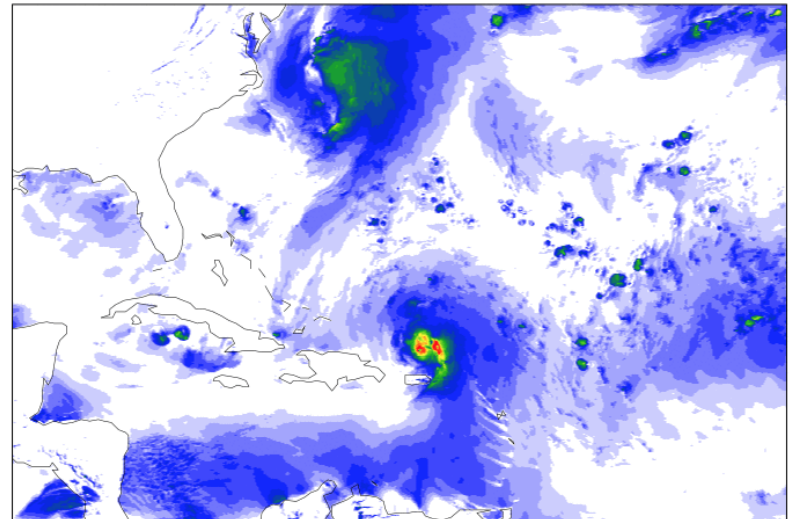
Two-way FV3 <-> HYCOM

- Pending one-way results

HAFS Workflow

- HYCOM added

HOURLY MAXIMUM WIND SPEED (m/s) @006h



HAFS Development - Next Steps

- Resolve unreasonable surflx in HYCOM
- Run and analyze two-way coupled FV3-HYCOM test cases
- Add CMEPS to forecast application
- Run and analyze coupled FV3-CMEPS-HYCOM test cases
- Implement FV3 and HYCOM cap best practices

Conclusions

Missing corner coordinates limits remapping

- Cannot run conservative remapping
- Cannot convert grid to mesh for CMEPS

One-way diagnostic testing is proving to be useful

- Discovered missing FV3 surface temperatures
- Diagnosing FV3 to HYCOM exchanges without feedback cycle

Best practices speed up development and testing

- Standardized NUOPC cap architecture
- Including NUOPC cap diagnostics