



Using Community Data models for Earth Prediction Systems (CDEPS) in HAFS

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Motivation

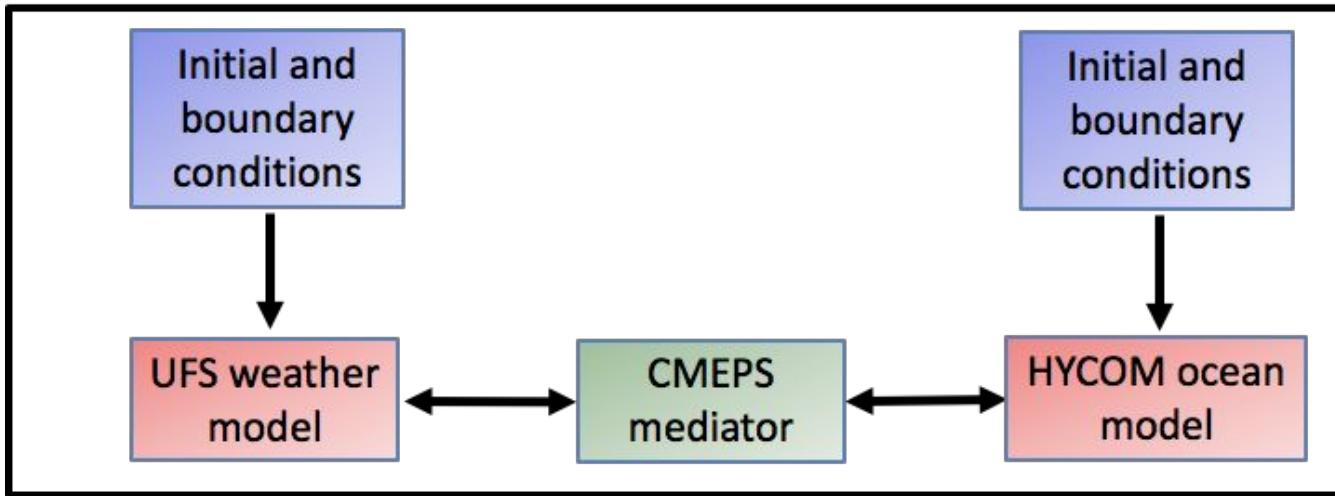
- How can we use offline datasets to selectively disable feedbacks in coupled modeling systems in HAFS?
- How might disabling these feedbacks lead to scientific insights that would be difficult to obtain in the fully-coupled system?



HAFS Overview

- In HAFS, the UFS weather model is coupled to the HYCOM ocean model using the Community Mediator for Earth Prediction Systems (CMEPS).

HAFS: UFSATM+HYCOM



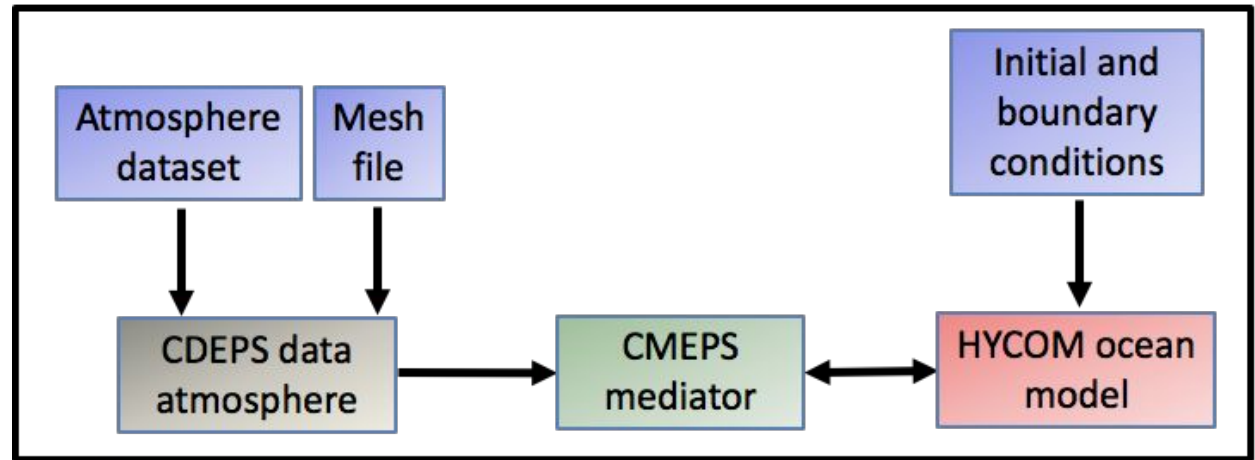
Bringing Hierarchical Testing Capabilities to HAFS

- CDEPS was developed by NCAR to allow researchers to selectively disable feedbacks in coupled modeling systems.

Here, an external atmospheric dataset is used to force the HYCOM ocean model.

Later, we will see an example using the ERA5 reanalysis (hourly, 0.25 degrees).

HAFS: DATM+HYCOM



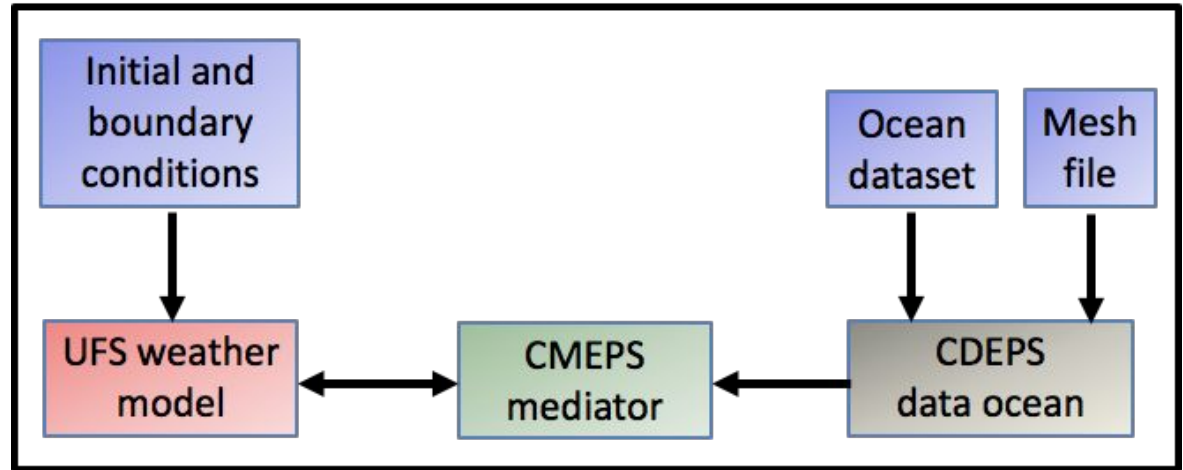
Bringing Hierarchical Testing Capabilities to HAFS

- CDEPS was developed by NCAR to allow researchers to selectively disable feedbacks in coupled modeling systems.

Here, an external ocean dataset is used to force the UFS weather model.

The workflow supports the Optimally-Interpolated SST (OISST) dataset (daily, 0.25 degrees).

HAFS: UFSATM+DOCN





Building and running with CDEPS DATM

- Use the feature/hafs_couplehycom_cdeps branch on Orion
- To build and run the CDEPS data atmosphere with ERA5 in HAFS:
 - Edit *sorc/build_forecast.sh* to include these flags:
 - Run the model like this in *rocoto/cronjob_hafs.sh*:

```
HYCOM=Y CMEPS=Y CDEPS_DATM=Y CDEPS_DOCN=N CDEPS=Y
```

```
{PYTHON3} ./run_hafs.py -t {dev} 2019082900 05L HISTORY \  
config.EXPT={EXPT} \  
../parm/hafs_regional_static.conf \  
../parm/hafs_hycom.conf \  
../parm/hafs_datm.conf
```



Building and running with CDEPS DOCN

- Use the feature/hafs_couplehycom_cdeps branch on Orion
- To build and run the CDEPS data ocean with OISST in HAFS:

- Edit *sorc/build_forecast.sh* to include these flags:

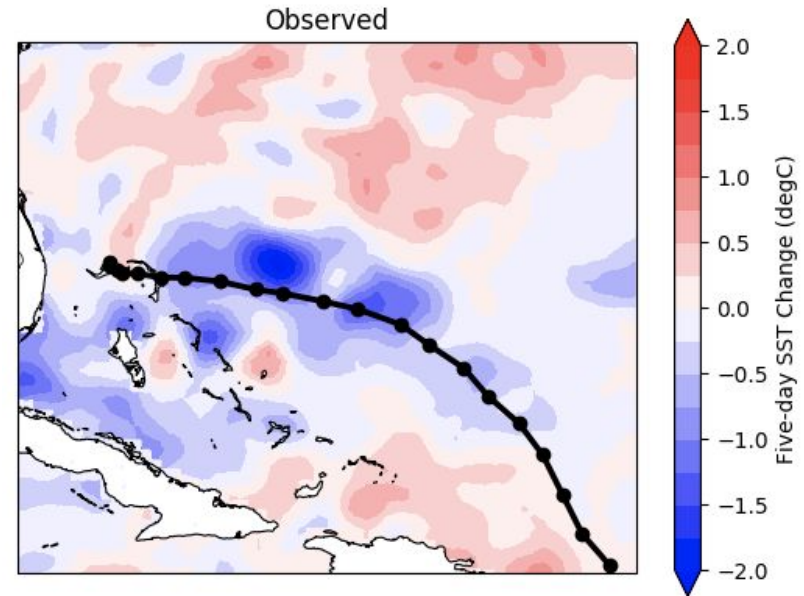
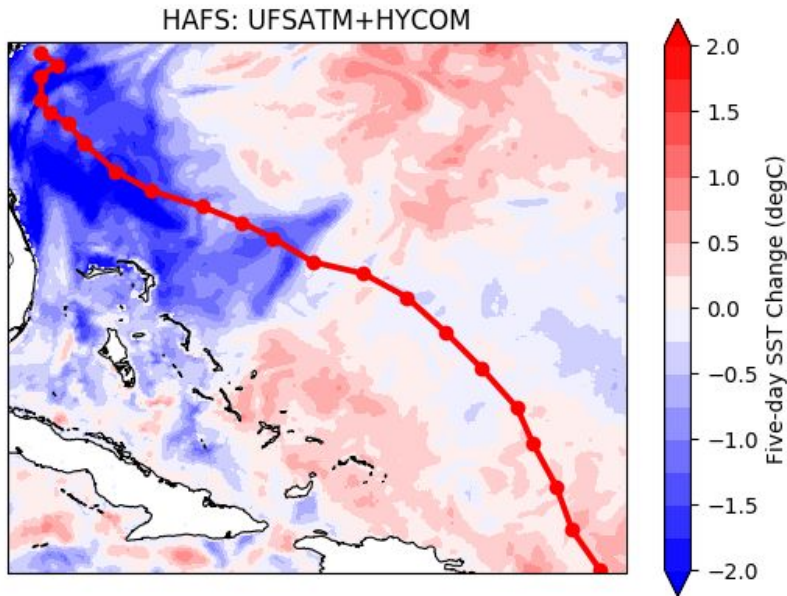
```
HYCOM=N CMEPS=Y CDEPS_DATM=N CDEPS_DOCN=Y CDEPS=Y
```

- Run the model like this in *rocoto/cronjob_hafs.sh*:

```
{PYTHON3} ./run_hafs.py -t {dev} 2019082900 05L HISTORY \  
  config.EXPT={EXPT} \  
  ../parm/hafs_regional_static.conf \  
  ../parm/hafs_hycom.conf \  
  ../parm/hafs_docn.conf
```

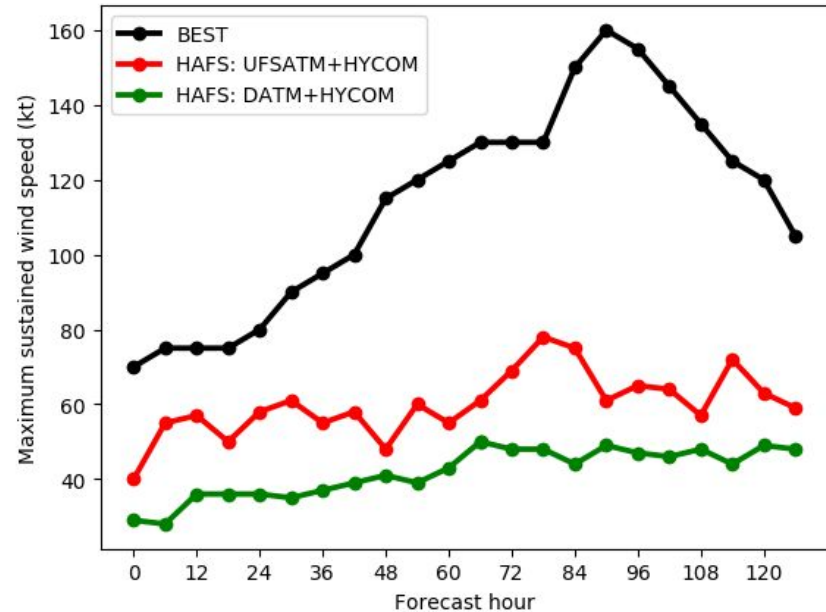
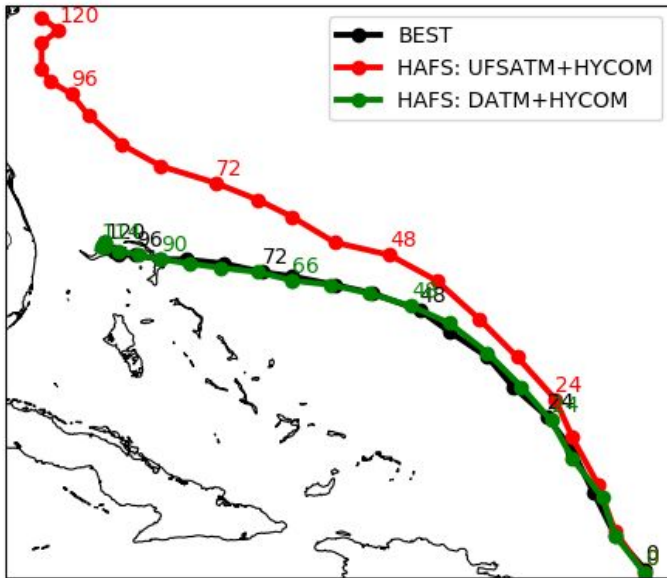
Hurricane Dorian (2019082900): A use case for HAFS DATM+HYCOM

A researcher wants to use HAFS to study the upper-ocean response to Hurricane Dorian. But, the track forecast from this cycle is poor, leading to unrealistic forcing from the atmosphere.



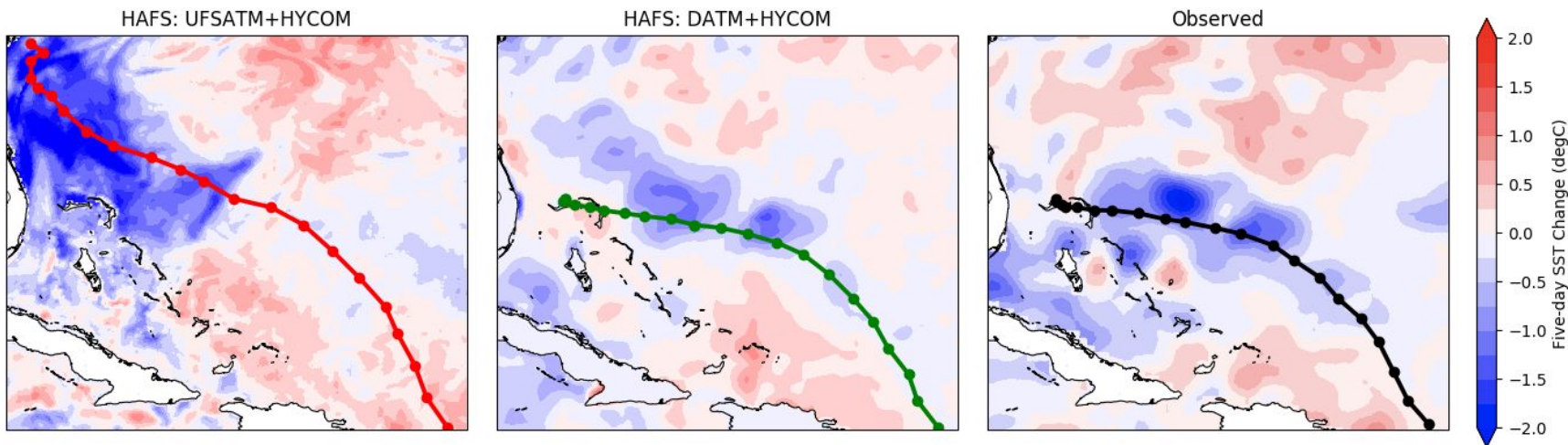
Hurricane Dorian (2019082900): A use case for HAFS DATM+HYCOM

Using the CDEPS DATM to force the ocean with the ERA5 reanalysis (hourly, 0.25 deg), the researcher can obtain an accurate storm track (green line in left figure).



Hurricane Dorian (2019082900): A use case for HAFS DATM+HYCOM

With the track bias removed, HAFS: DATM+HYCOM induces a much more realistic upper-ocean response, despite the weak intensity bias shown on the previous slide.





Summary

- CDEPS adds hierarchical testing capabilities to the HAFS workflow by providing support for data models.
- Next, we plan to add support for using CDEPS in the workflow on Jet and Hera and merge it back to the main HAFS development branch.
- More details will be provided in our upcoming AMS talk:
 - [2B.8 Leveraging Community Tools to Improve the Usability, Portability, and Testing Capabilities of HAFS](#)
Monday, May 10, 2021 at 12:10–12:15 PM EDT