

# OU HAFS Data Assimilation Research and Development Update

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In collaboration with EMC, HRD and UMD





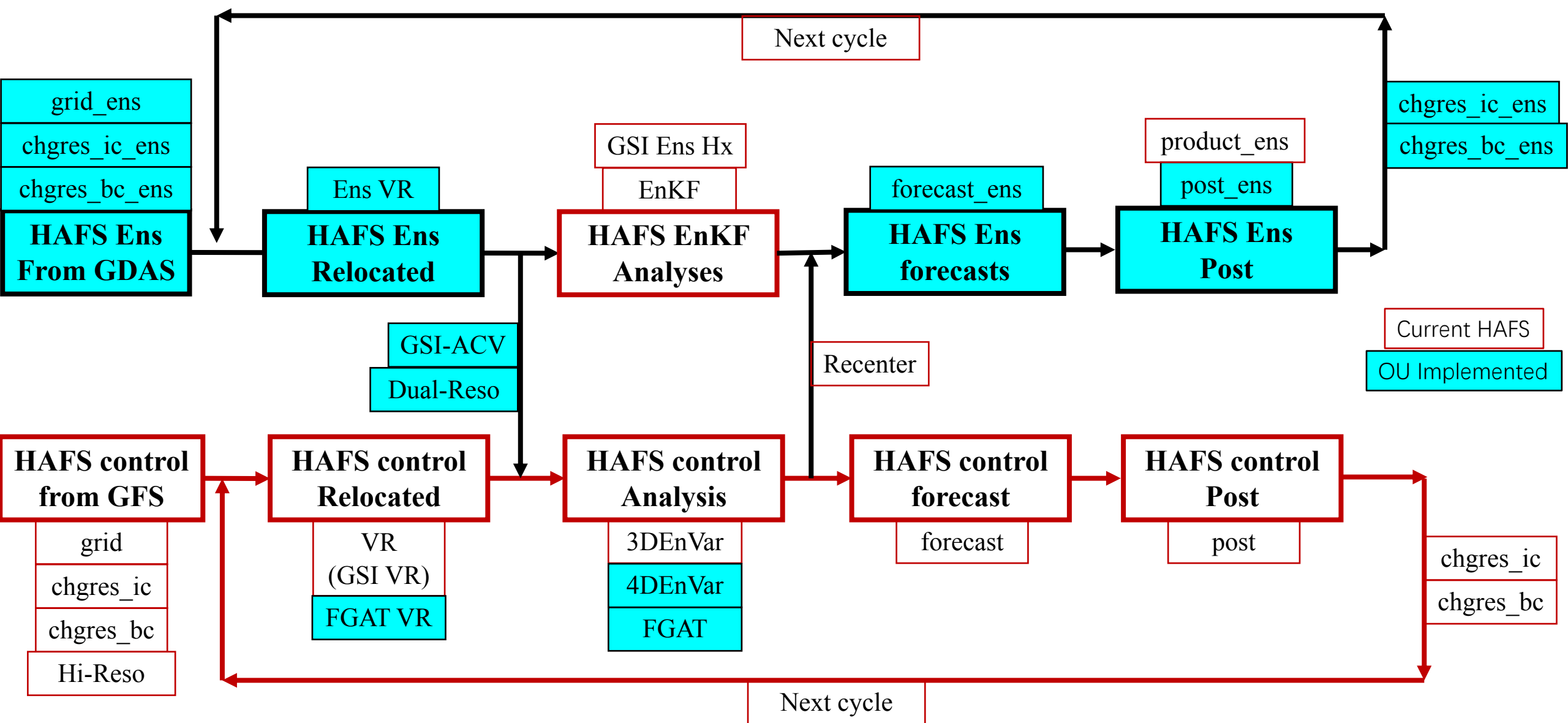
# Summary of development



- ❑ Significant efforts to develop self-cycled dual resolution HAFS hybrid EnVar DA system from both the workflow and source code levels
  - FGAT
  - Dual reso EnVar
  - 4DEnVar
  - HAFS ensemble
- ❑ Significant efforts to test/bug fixe the newly developed self-cycled dual resolution HAFS hybrid EnVar DA system
- ❑ Progress to develop GOES-16 ABI all sky radiance data assimilation in HAFS



# Self cycled dual resolution hybrid EnVar for HAFS

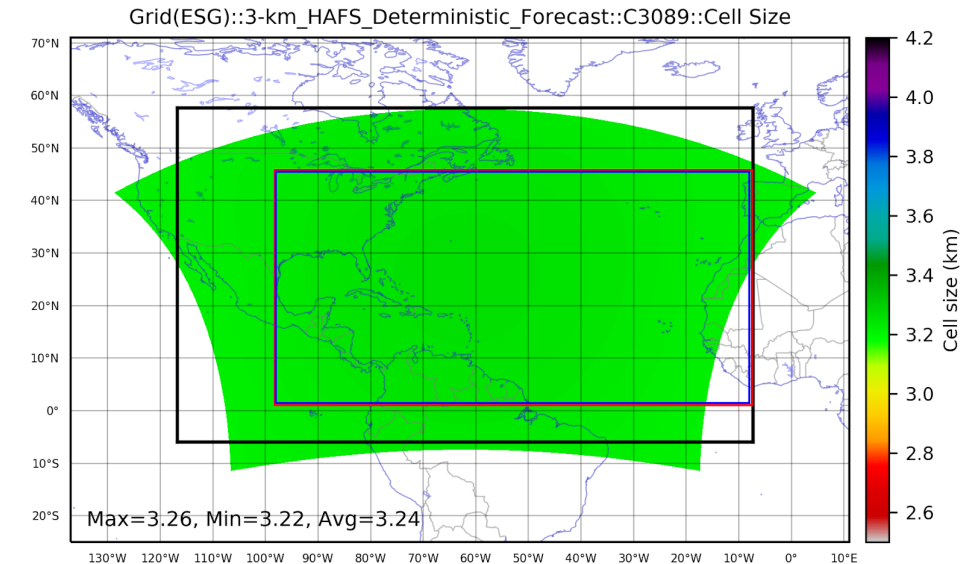




# Experiment Design



- 40-member self-cycled HAFS ensemble with the 6-km regional ESG grid
- Dual-resolution 3DEnVar with control at 3-km regional ESG grid
- Assimilating full HWRF/GFS/GDAS observations
- Cycling from 202008191800 UTC – 2020082718 UTC (Laura13L, Marco14L)

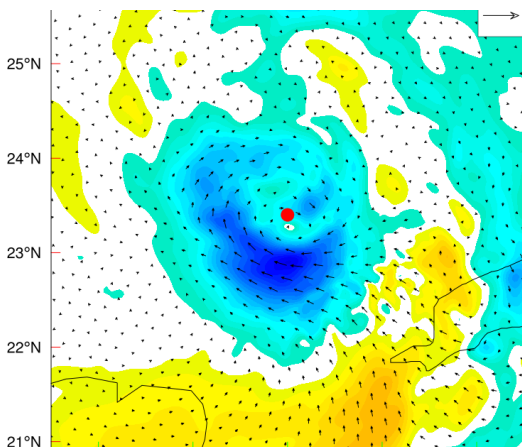




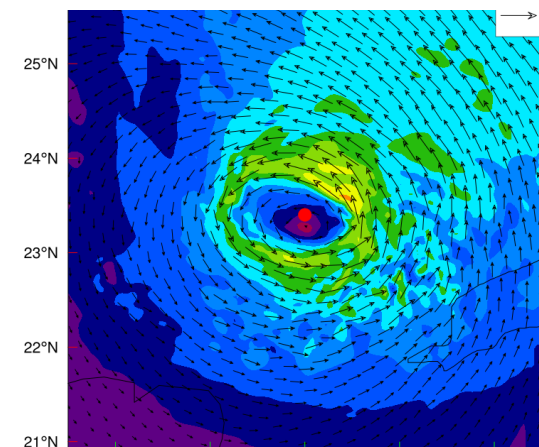
# Testing of dual reso EnVar (3km ctl/6km ens) through cycled DA for Laura (2020)



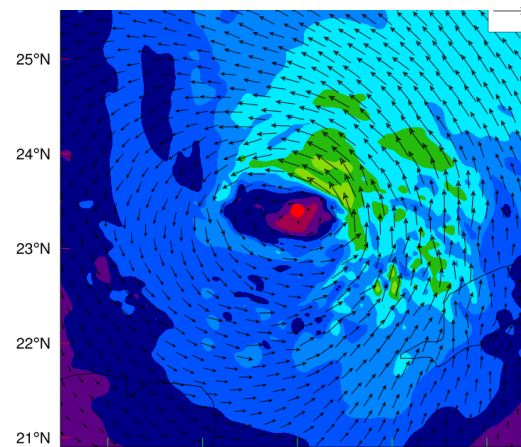
Increments @ 2512



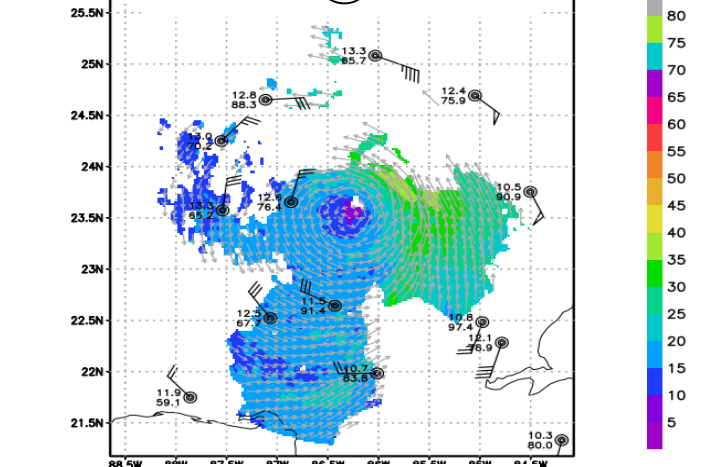
Background @ 2512



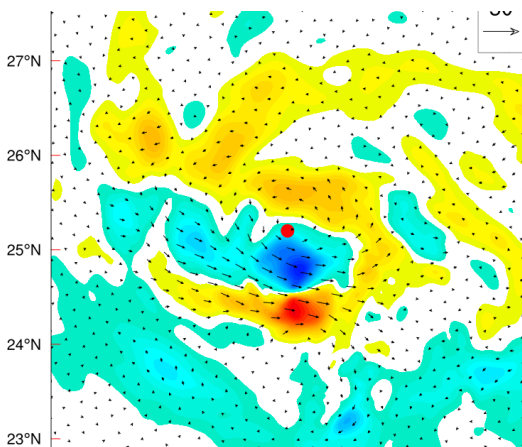
Analysis @ 2512



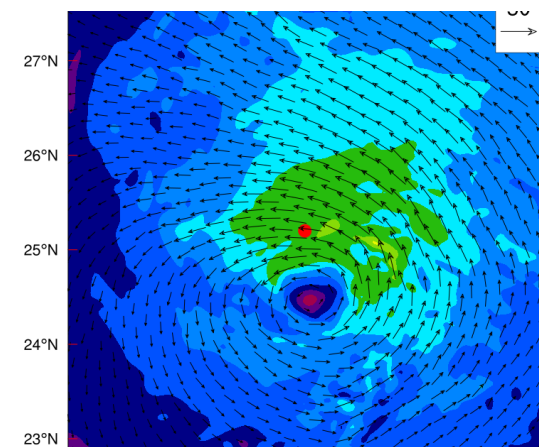
HRD @ 2513



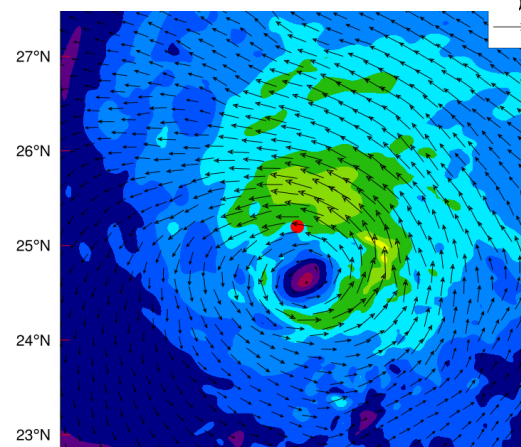
Increments @ 2600



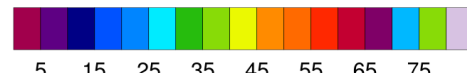
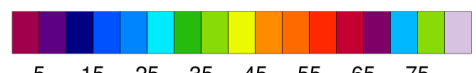
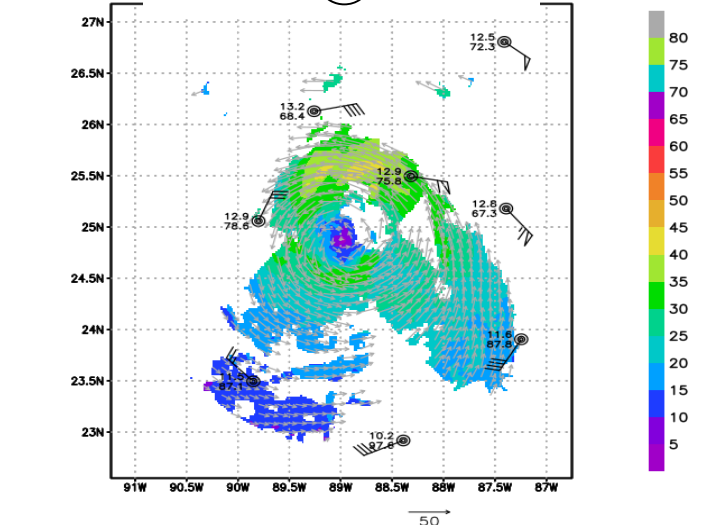
Background @ 2600



Analysis @ 2600

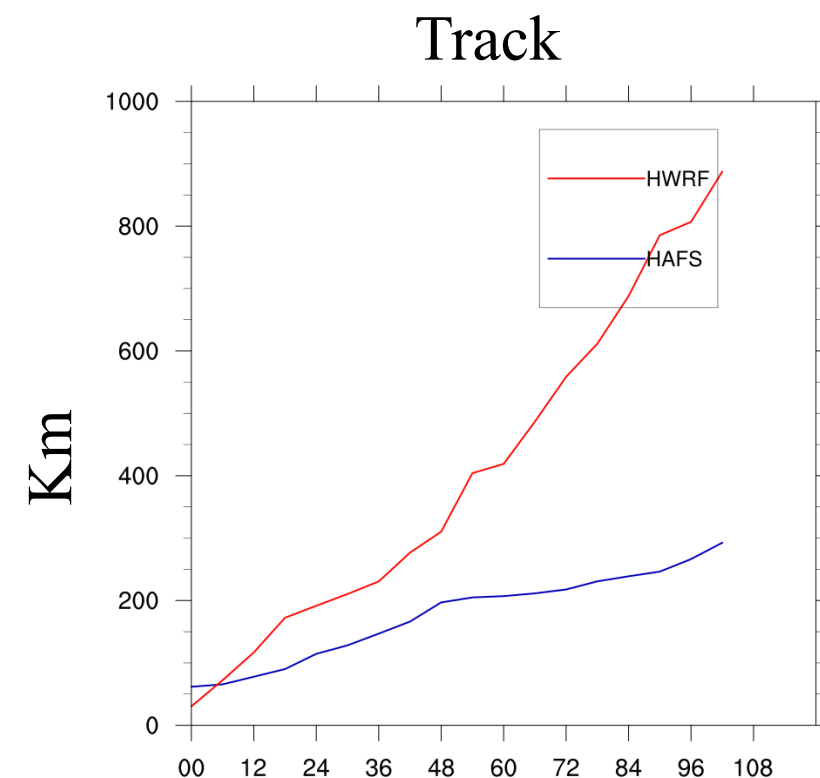
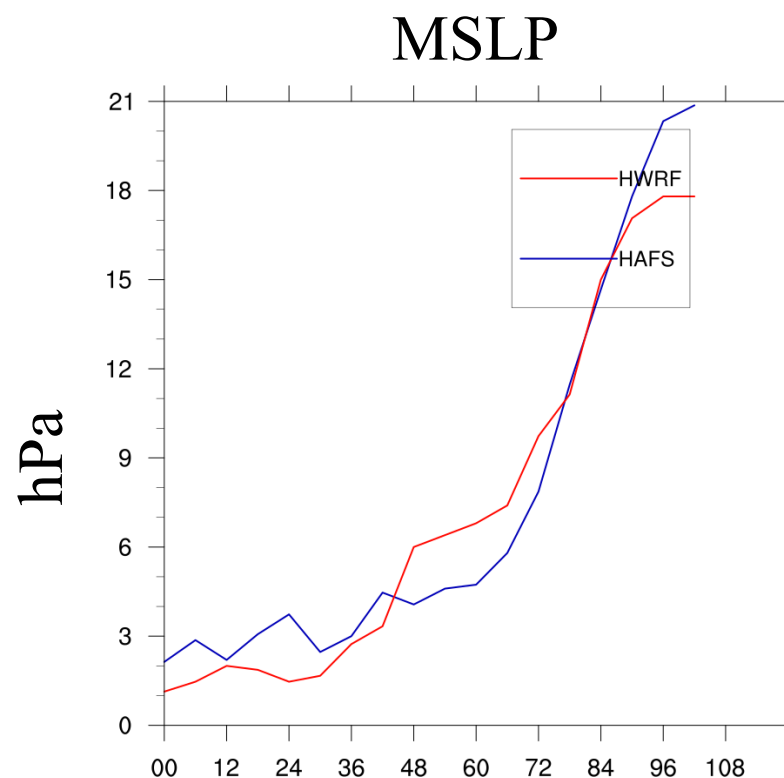
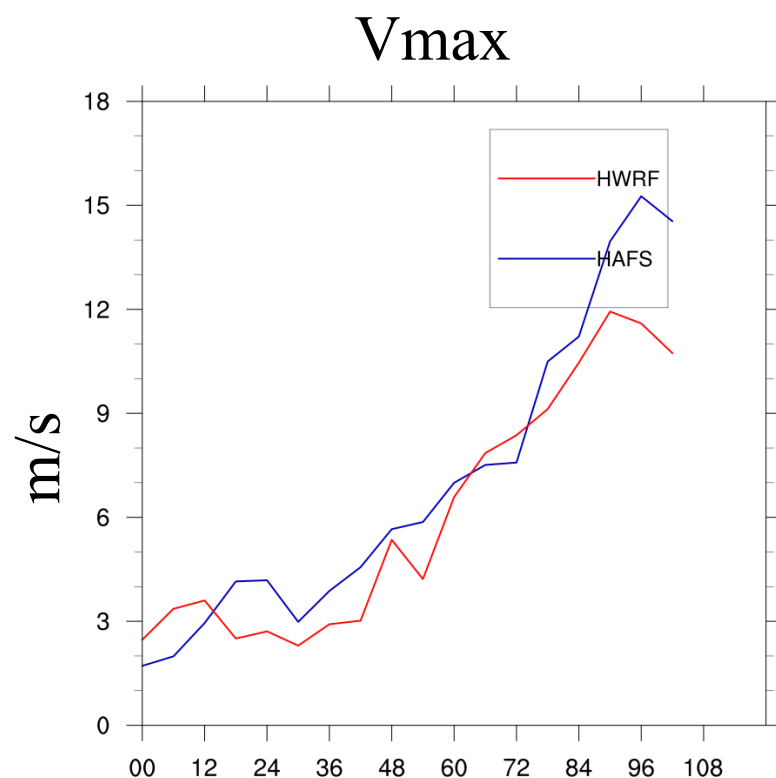


HRD @ 2600





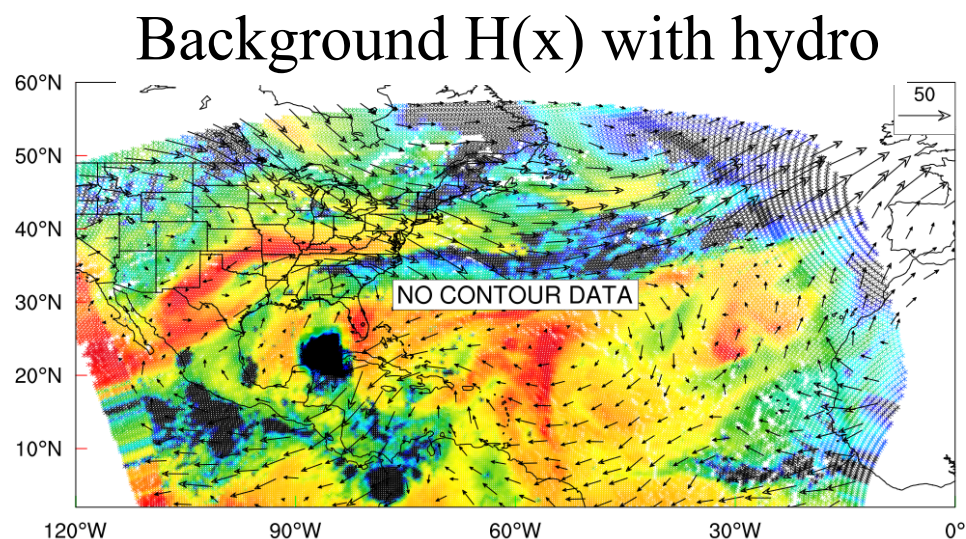
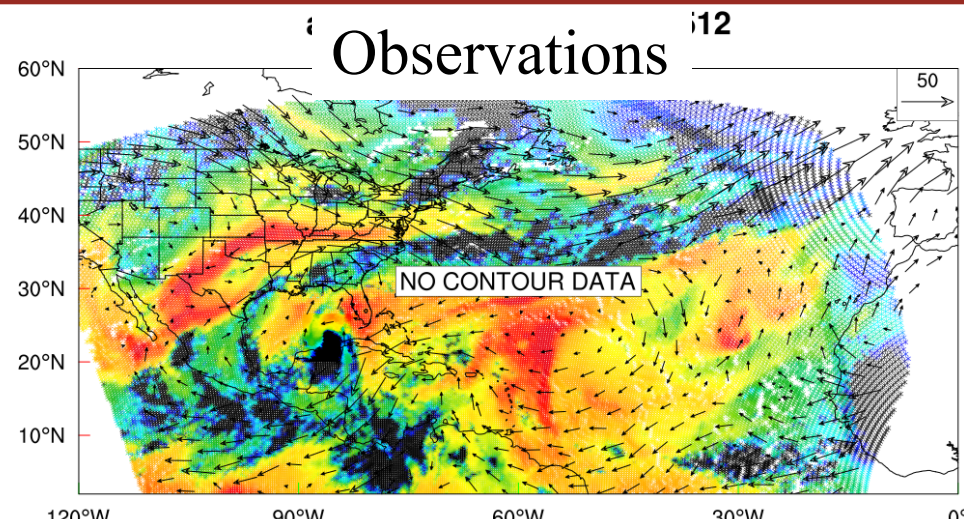
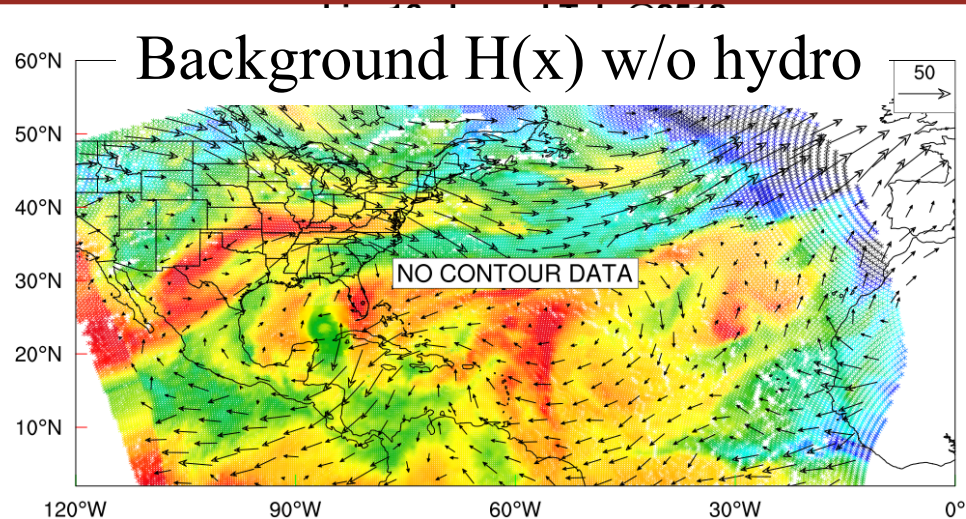
# Preliminary results with limited cycles (Laura 202008191800 – 202008231200 UTC)



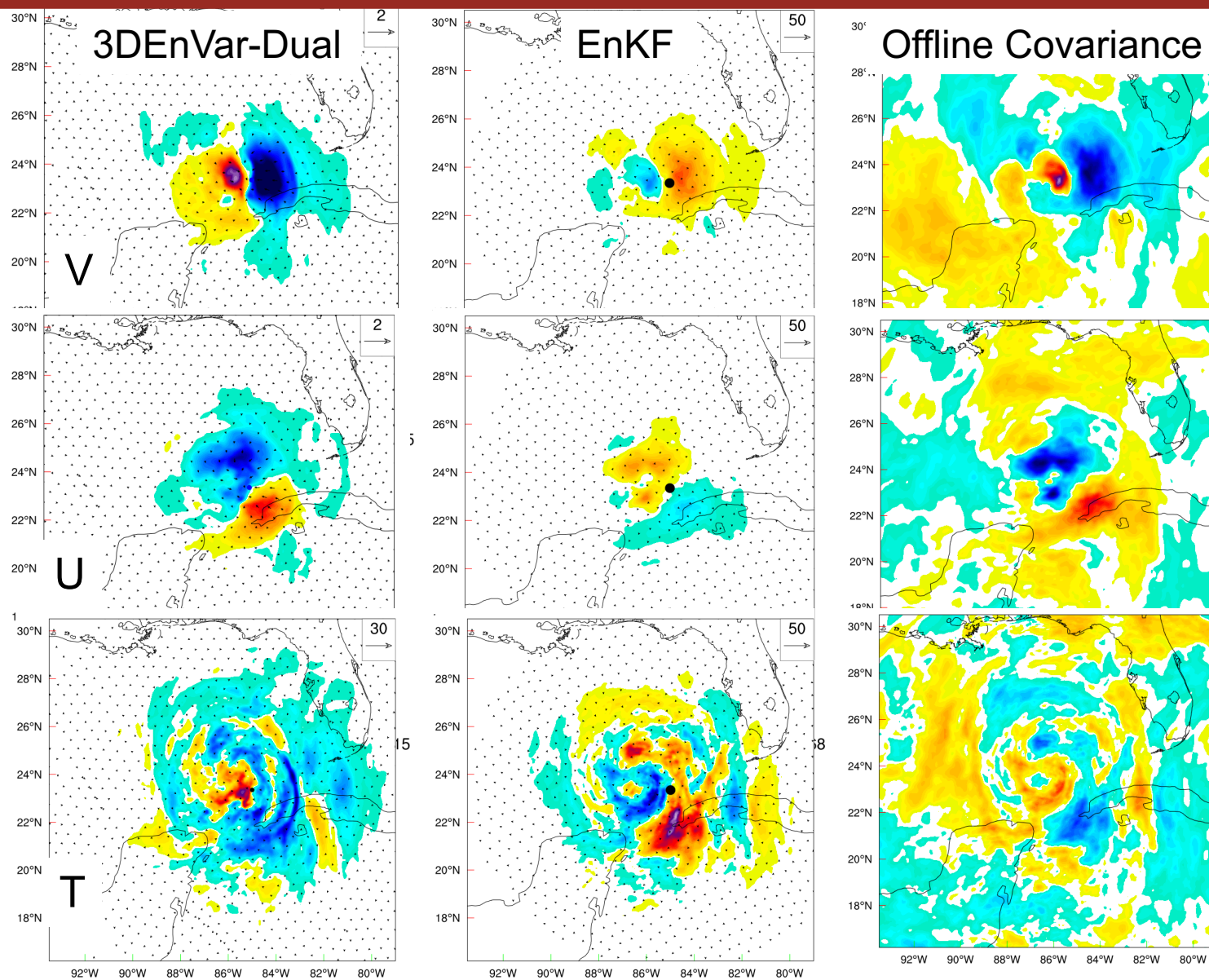
Limited HAFS cycles show comparable intensity predictions and better track forecasts against the HWRF.



# Development of ABI all sky radiance data assimilation capabilities



- Develop interface to read in and preprocess the GOES-16 ABI radiance observations
- Include hydrometeors during CRTM radiance calculation
- Develop capabilities to update hydrometeors in both EnVar EnKF assimilation.

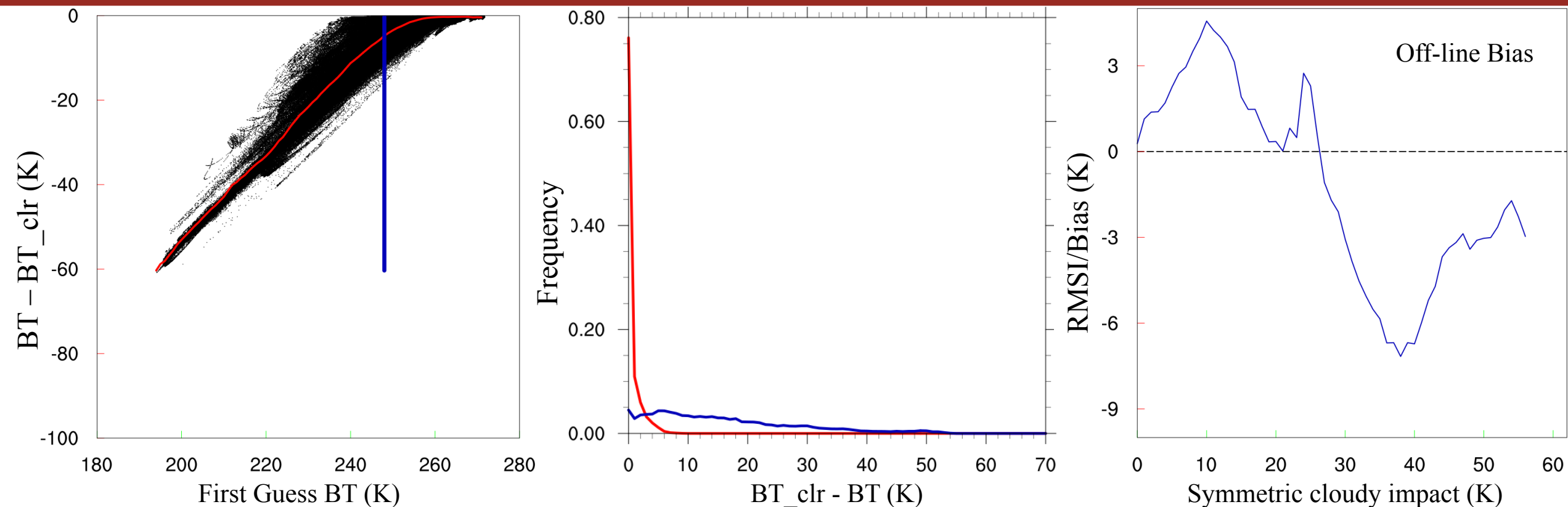


- Dual reso EnVar shares the same increment pattern as the EnKF. Both are consistent with the offline covariance calculation.





# Development of bias correction methods for ABI all sky radiance assimilation



a) Off-line bias is calculated following Johnson et al. 2021 of MAP lab.

Johnson, A., X. Wang, T. Jones, 2021: Impacts of assimilating GOES-16 ABI channels 9 and 10 clear air and cloudy radiance observations with additive inflation and adaptive observation error in GSI-EnKF for a case of rapidly evolving severe supercells. Mon. Wea. Rev., submitted



## Ongoing and future work



- Continue developing and testing the ABI all sky radiance assimilation (e.g., bias correction, adaptive ob error, adaptive inflation, etc)
- Continue R&D for **multiscale 4DEnVar** for HAFS