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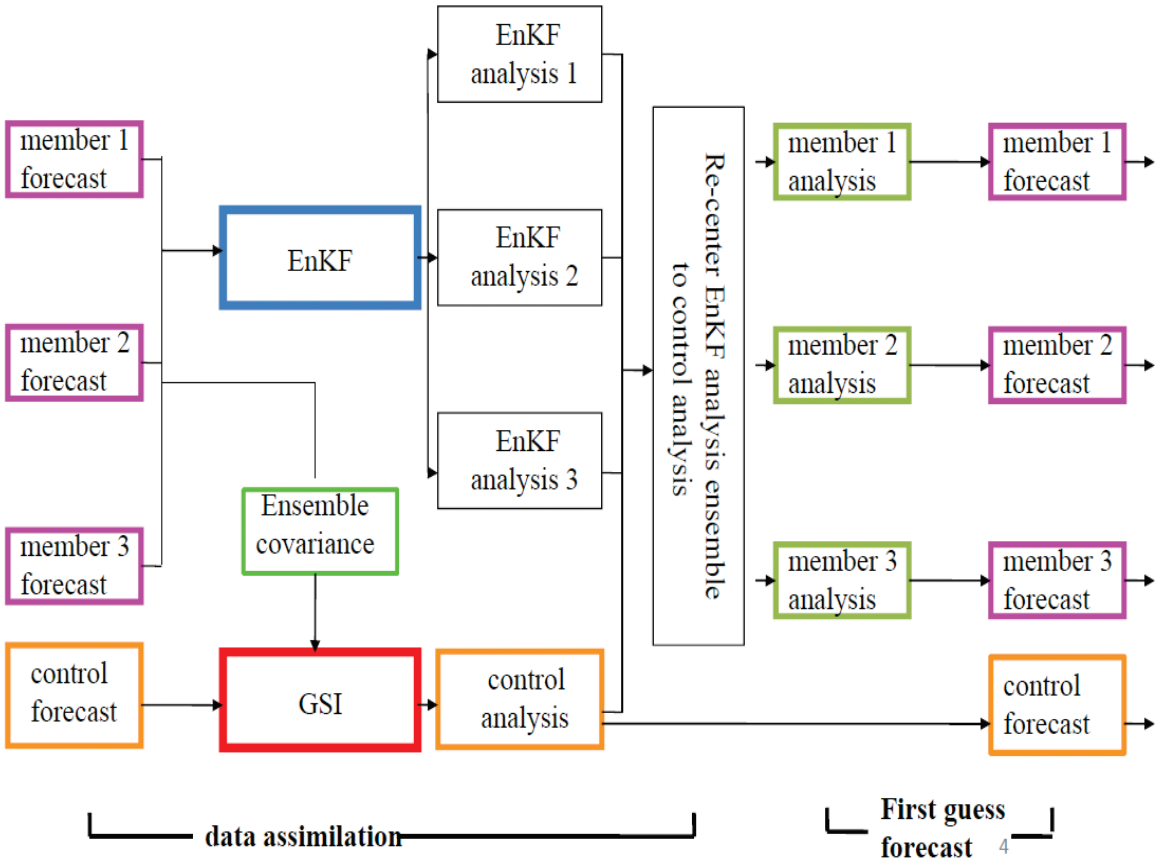
2017-2018 HWRF DA TESTING & PLANS

Outline

- 2017 milestones
- Ongoing developments
- Planned testing
- Long-term route

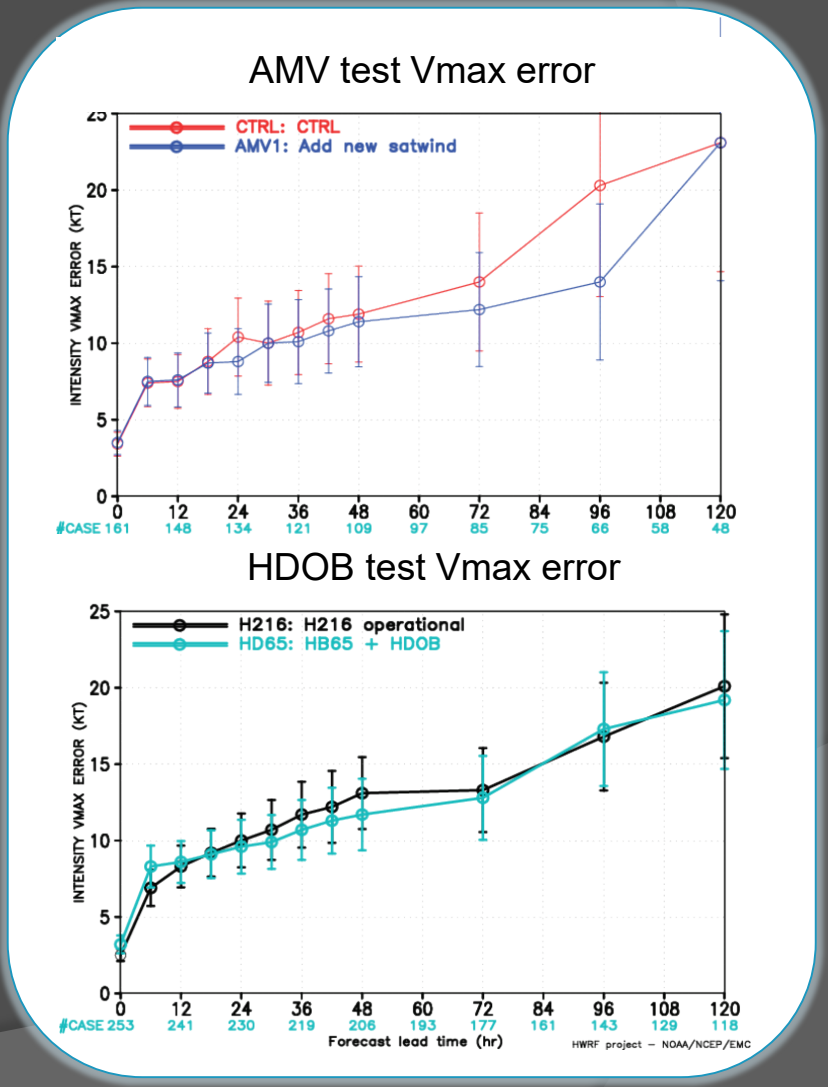
Milestones: New DA System

Hybrid EnKF-GSI DA system: 2 way coupling



Milestones: New Data

- Three new classes of AMVs added
- HDOB data (flight level) assimilated for first time
- Implementation testing showed very positive benefits for both



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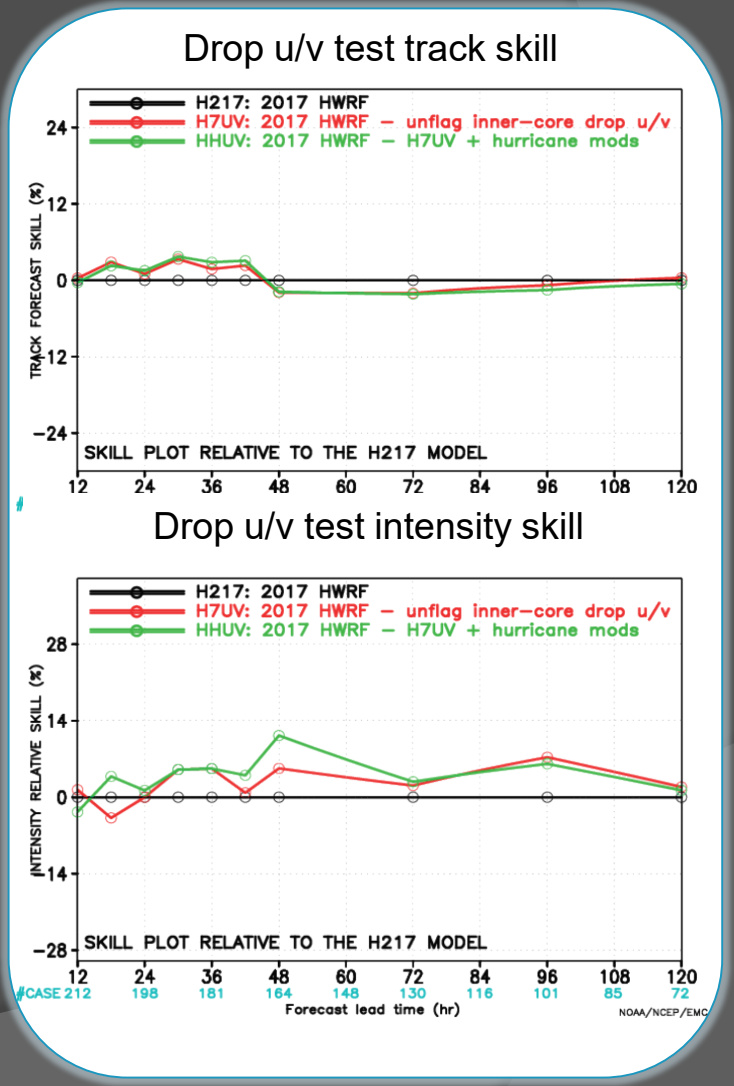
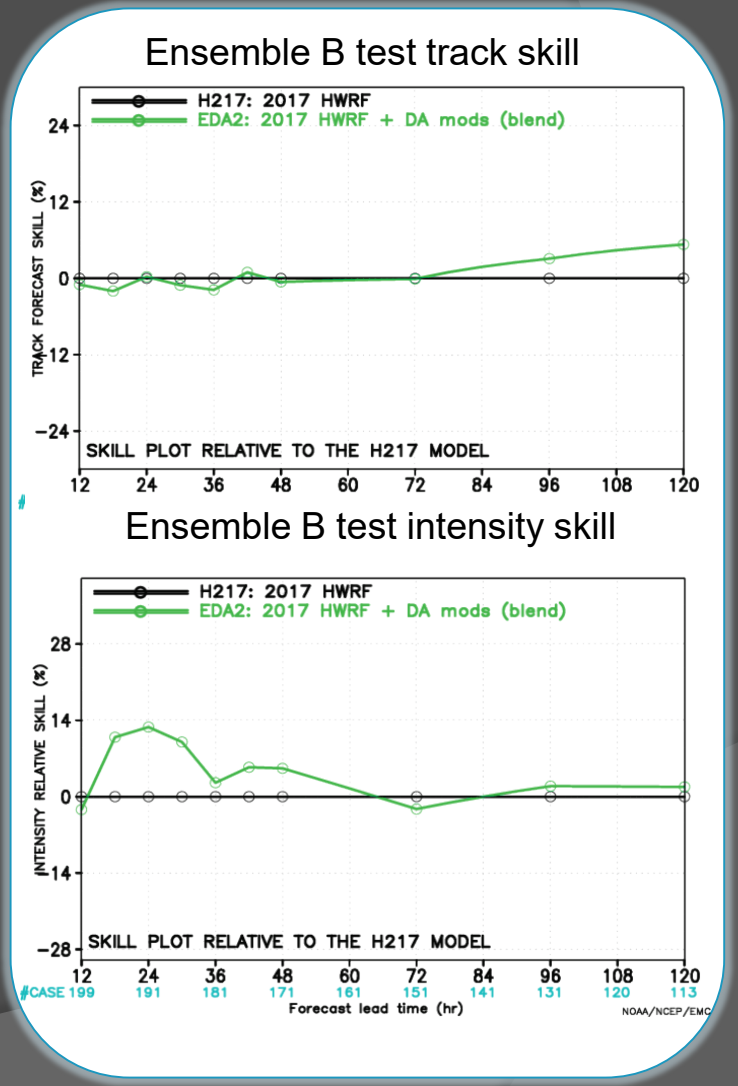
Developments: Dropsondes

- Inner-core dropsonde u/v are currently flagged due to concerns about drift
- Drift probably not an issue in all cases
- Unflagging u/v outside of R64 increases intensity skill by 5-10%



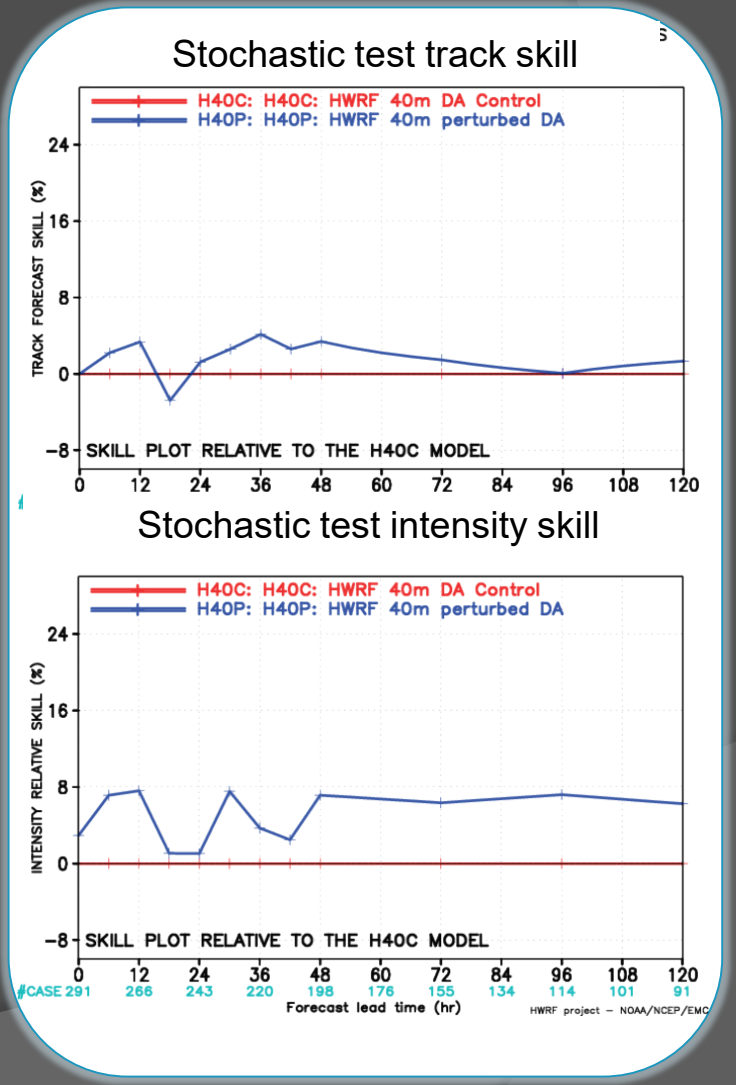
Developments: DA tuning

- Current DA system uses 20% static covariance, which comes from GFS
- This is particularly harmful for new DA system
- Using full ensemble covariance with new DA system yields major improvements



Developments: DA tuning

- Tests conducted to include stochastic physics (PBL, SAS, Cd) in DA ensemble
- Only applicable to new DA system
- Further significantly positive results for track and intensity



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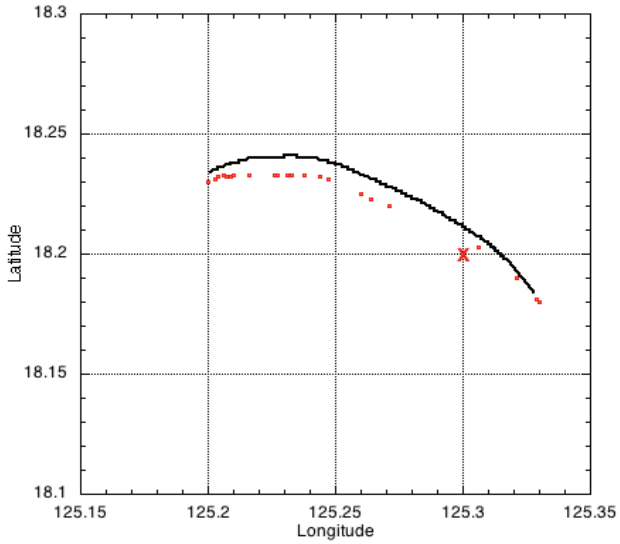
Planned testing: Data

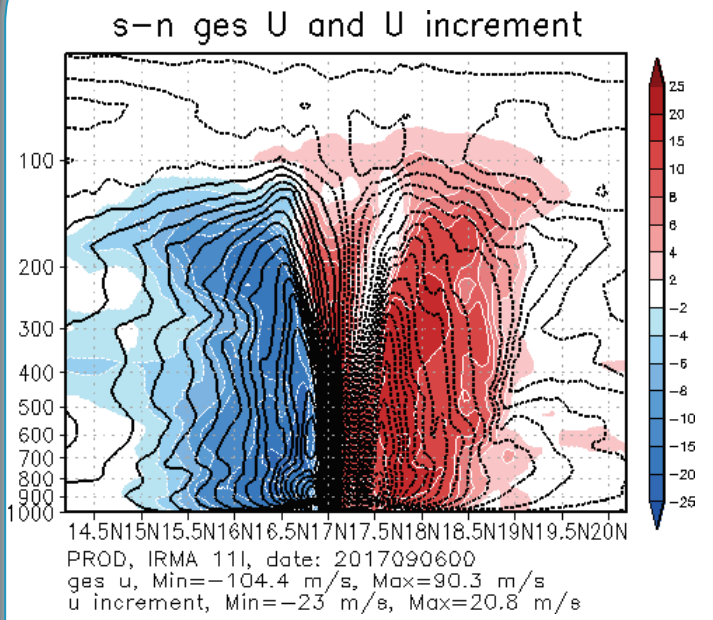
- Dropsonde telemetry – Inner-core u/v can be assimilated if position is accurate
- SFMR
- G-IV TDR (INS issues will be fixed)
- Himawari (WPAC DA) & GOES-R AMVs



Observation locations from a TEMPDROP message (red X), from the corresponding full-resolution data (black dots), and from the HRD technique to calculate position (red dots).

Planned testing: DA system

- DA in WPAC
- Increase GSI outer loops (better fit)
- Vortex initialization (VI)
  - Changes to VI
  - Vortex mods (VM) conditional on TDR?
  - Assimilate synthetic obs instead of VM?
  - Tune blending



Vertical cross-section of U analysis increments (filled) and U wind (contoured) in a cycle of Irma. Note strong anticyclonic increments.

Planned testing: Vortex-scale DA

- Improve and optimize the relocation of the HWRF TC vortex
- Determining an appropriate ensemble size, when assimilating vortex-scale observations, in order to account for HWRF model error/uncertainty and increasing the ensemble spread
- Investigate the impacts for cycling the inner (e.g., 2-km moving) HWRF nest

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Long-term route (2-3y)

- Current operational HWRF scripting structure is significantly hampering R2O, especially for DA
- Moving to 4DEnVAR or frequently cycled 3DEnVAR necessary to prevent spindown and fully use inner-core data
- Migration to basin-scale setup needed to correctly treat satellite data (aside from storm-interaction benefits)

Conclusion

- 2017 HWRF has had significant DA and data usage improvements
- Ongoing testing for H218 suggests 10-20% Vmax improvement is attainable
- Planned testing and upgrades will further improve data usage over next few years
- Accelerated R2O possible with changes to scripting system