Strategic Implementation Plan (SIP) for a Community-based Unified Forecast System (UFS)

Data Assimilation Working Group

Presented by

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Presented at Coordination Meeting

for UFS SIP

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Data Assimilation WG
Membership

- Daryl Kleist NCEP/EMC **
- Tom Auligne JCSDA **
- Ron Gelaro NASA/GMAO **
- Jeff Whitaker NOAA/ESRL **
- Andrew Collard NCEP/EMC
- Ricardo Todling NASA/GMAO
- Nancy Baker NRL
- Curtis Alexander NOAA/ESRL
- Yannick Tremolet JCSDA
- Youngsun Jung OU
- Xuguang Wang OU
- Chris Snyder NCAR
- Steve Penny Univ. Maryland

***Co-Chair*

Major Science Priorities

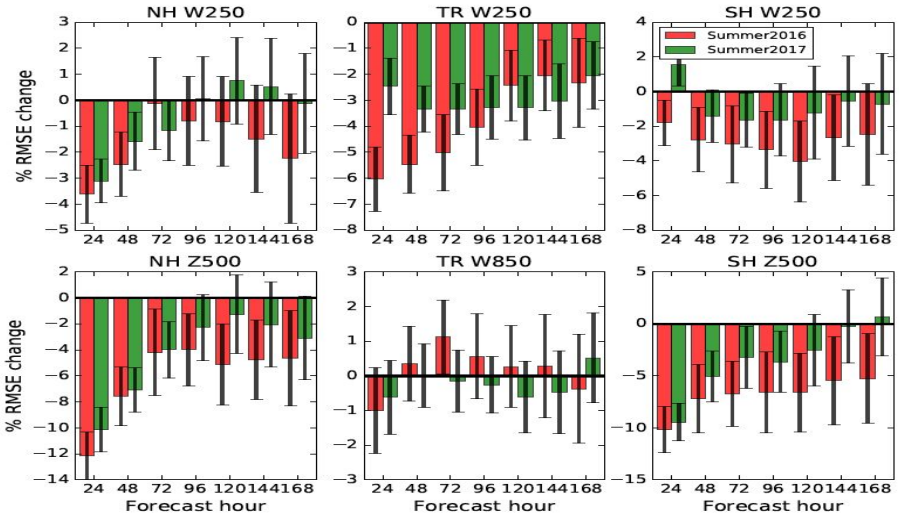
- Coupled data assimilation across the Earth System.
- Multi-scale data assimilation across temporal and spatial scales, from global to convective.
- Making better use of existing and new obs
  - Ever increasing obs volume (hyperspectral, radar)
  - All-sky radiances (currently not used much)
- Representation of model uncertainty in ensembles.
- Dealing with non-linearity and non-Gaussianity in background and observation errors.

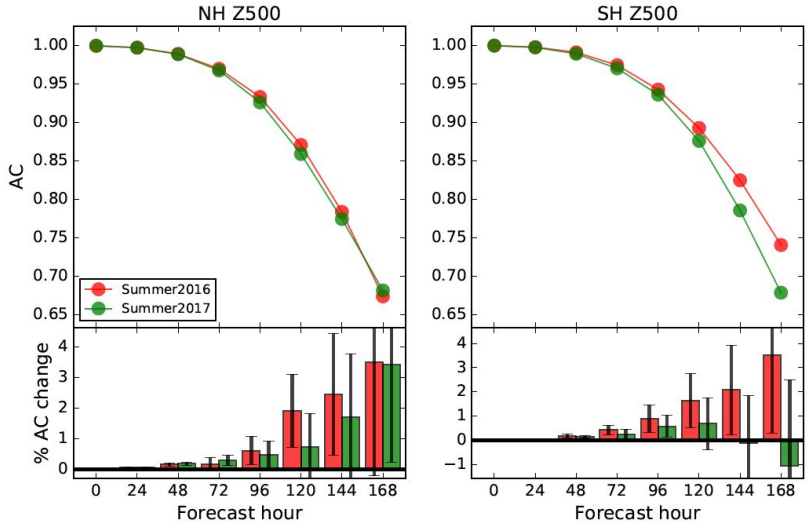
Data Assimilation WG
Project Milestone Accomplishments

- **SIP project accomplishments FY2018**
  - FV3GDAS:
    - ***adapt 4D-Hybrid En-Var data assimilation framework for FV3-GFS; configure and optimize the cycled data assimilation experiments including EnKF and stochastic physics. IAU implemented.***
  - Assimilation of new obs
    - ***GOES-16 AMVs, NOAA-20 ATMS and CRiS included in FV3-GFS***
    - ***ATMS all-sky assimilation***
  - JEDI development
    - ***FV3GFS interface (read model states, ensembles, compute EnVar increments).***
    - ***FV3GFS TLM/Adj integration***
    - ***UFO/IODA development (AMSU-A, GPSRO, radiosondes so far)***
- **SIP project issues:**
  - managing and coordinating transition to JEDI

Data Assimilation WG
Project Milestone Accomplishments

- IO routines in GSI, EnKF
- Regridding between cubed-sphere and Gaussian lat-lon grids in model
- Increase in ensemble and analysis increment resolution
- Workflow for cycled assimilation with FV3-based GFS
- Adoption of new MP scheme (new species in all-sky forward operator)
- Turn off digital filter, vortex relocation
- Tested changes to ozone and water vapor photochemistry
- Ported, tested, tuned stochastic physics in FV3. Implemented and tested 4DIAU.





JEDI Major Achievements

1. Unified Forward Operator: subset of observations *model native grid*
2. Model interfaces: atmosphere, ocean, wave, sea-ice *model native grid*
3. Generic covariance modeling: ensemble *model native grid*
4. Variational solvers: 3DVar, 3DEnVar, 4DEnvar *model native grid*
5. Version 0.1: end-to-end DA system
   code stack + documentation + JEDI Academy

New projects

- 6.1: Observations
  - New data types, better exploitation of existing obs
- 6.2: Algorithms
  - Intercomparison of techniques within JEDI (hybrid 4DEnvar, hybrid 4DVar, EnKF)
  - (multiscale) localization techniques
- 6.3: Coupled DA (FV3/MOM6/CICE5, FV3/NOAH)
  - Weakly coupled, quasi-strongly coupled, strongly coupled
  - Deal with varying space and time scales
- 6.4: Software Infrastructure (JEDI)
- 6.5: Global (Hourly) Rapid Update (Hurricane Supplemental)
  - Use of high-frequency geostationary, surface and radar data
  - Replace SREF/NAM/RAP
  - Overlapping windows (data latency, multi-scale)