



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

Data Assimilation *Working Group*

Presented by

Jeff Whitaker, (ESRL/PSD)

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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
- Tanya Peevey NOAA/ESRL
- Alex Kuparov
- Eric Bayler NOAA/NESDIS
- *Co-Chair* **



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Accomplishments & Challenges



- **SIP project milestones completed/progress *this year*:**
 - Project 6.1 (Use of observations)
 - GOES-17 AMVs, MetOp-C, Megha-Tropiques/Saphir and Himawari-8/AHI radiances, KOMPSAT-5 and Megha-Tropiques/ROSA GNSSRO, Ozone mapper (OMPS) (work ongoing, some ready for implementation)
 - Traditional Alphanumeric Codes (TAC) to BUFR transition continuing
 - Correlated observation error implementation in GSI
 - Project 6.2 (DA Algorithms)
 - 4DIAU in FV3GFS & model space localization in EnKF (candidates for GFS v16)
 - [FV3GFS 3D/4DVar/4DVar \(no physics\) in JEDI](#) (initial capability demonstrated)
 - EnKF and Block Lanczos solvers for ensemble update in JEDI (work started)
 - Project 6.3 (Coupled DA)
 - JEDI coupled ocean/sea-ice analysis (initial system demonstrated)
 - Project 6.4 (JEDI Framework)
 - UFO: forward operators for most obs. types, generic QC filters (initial capability)
 - [Marine DA realistic initial system](#)
 - community engagement (JEDI tutorials, IODA workshop)
 - Project 6.5 (Rapidly updating global DA)
 - ESRL/EMC/JCSDA collaboration starting soon with Supplemental funding.
 - SAWG 'tiger team' activity: [JEDI interface with UFS model](#)



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Accomplishments & *Challenges*



- **SIP project issues (main challenges):**
 - DA cuts across many SIP Annexes (aerosols, marine, land etc), keeping track of all the cross-cutting projects and dependencies is challenging.
 - Is observation processing (ingest, "obsproc", etc.) within the scope? We believe the answer is yes and that re-engineering the operational workflow leveraging the JEDI/IODA project is crucial and needs acceleration.
 - Chicken/Egg problem - many projects are waiting for the enabling technology in JEDI.



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Team Coordination and Dependencies

- List major team coordination/dependency successes or issues.
 - Successes: JEDI progress, FV3GFS v15 implementation, JEDI/UFS SAWG tiger team collaboration.
 - Issues: coordination with DA projects in other Annexes. How can they be coordinated?
- What project(s) should be accelerated (due to criticality to overall effort, dependency from another area, etc.)?
 - JEDI IODA. (coordinate with 're-engineering' of NCEP obsproc infrastructure)
 - JEDI EnKF (needed for CAM, land DA projects).
- Based on experience to date, what change(s) do you recommend to your working group.
 - Roles/responsibilities of working groups needs to be better defined.

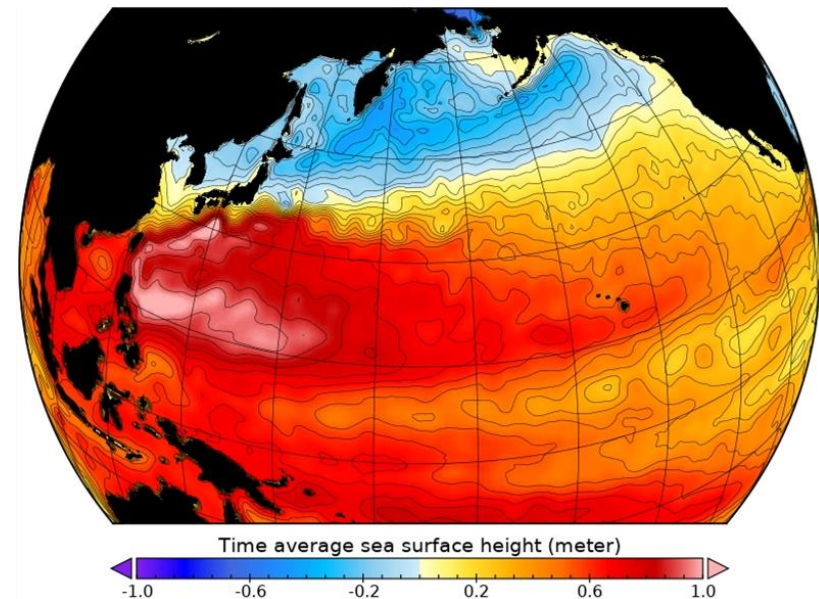


Marine (Sea-Ice/Ocean) DA



- **IODA/UFO:**
 - Fairly complete set of marine forward operators (ocean and sea-ice)
 - Conventional observations from FNMOC (Argo, CTD, XBT, moorings, gliders, ...)
 - NESDIS sea surface height (Jason 2-3, SARAL, Cryosat-2, Sentinel-3a)
 - L2 satellite SST products
- **Model encapsulation**
 - MOM6 model advance (file based)
- **Dual-space 3DVAR + multivariate Static B** (ocean and sea-ice)
- **High-resolution** ($\frac{1}{4}$ degree MOM6)

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30-day cycling assimilation of satellite SST ([NESDIS/ACSP0 AVHRR L2P](#)) and altimetry ([Jason-2](#), [Jason-3](#), [Sentinel-3a](#), [Cryosat-2](#), [SARAL](#)) with MOM6 1 degree model, 24-hour window. Kuroshio large meander correctly placed



Atmospheric DA (multiple solvers, many models)

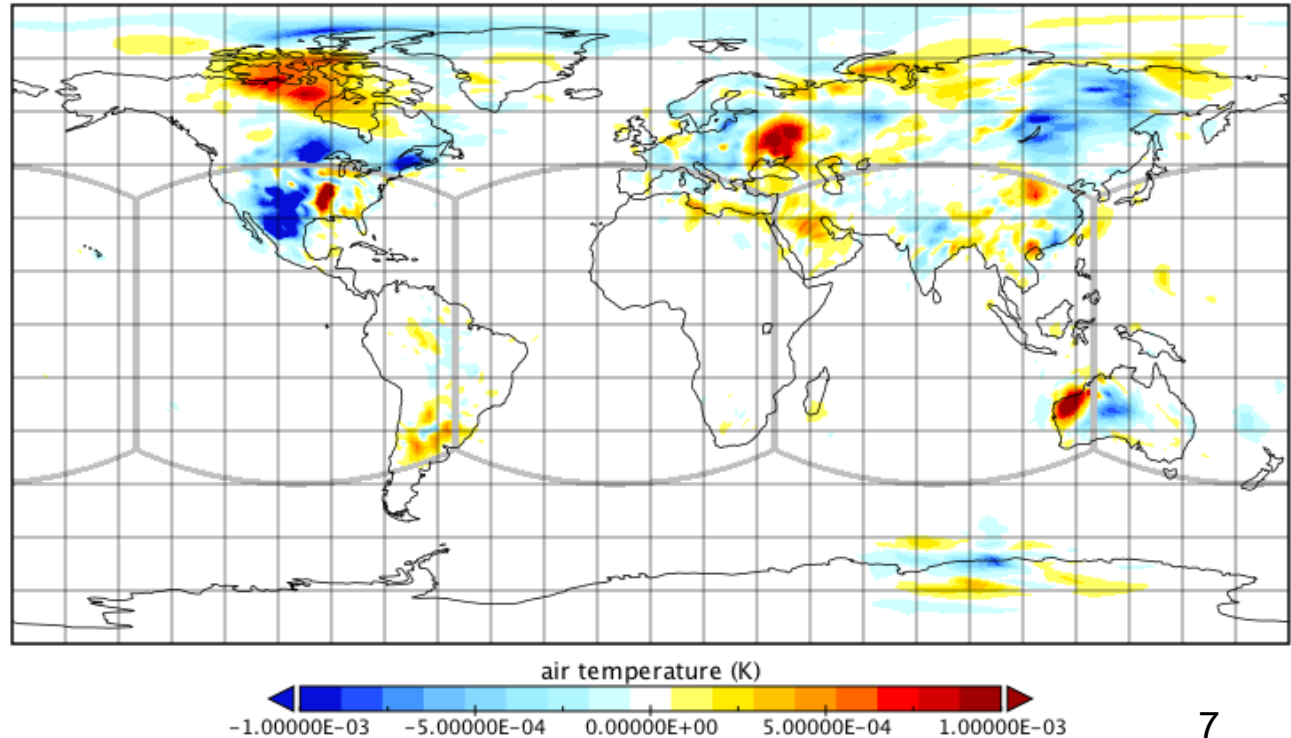


3DVar/4DEnVar/4DVar running with FV3GFS/GEOS
 3DVar/4DEnVar running with MPAS, LFRic
*Growing, but not yet complete set of observation operators
 work just started on EnKF solver*

Observations: Satellite radiances, AMVs, GNSS-RO, Marine observations, Aerosol Optical Depth, radiosonde, surface ps, aircraft

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Analysis increment | hybrid 3DVar FGAT
 GFS, C48 (200km), 10 member ensemble

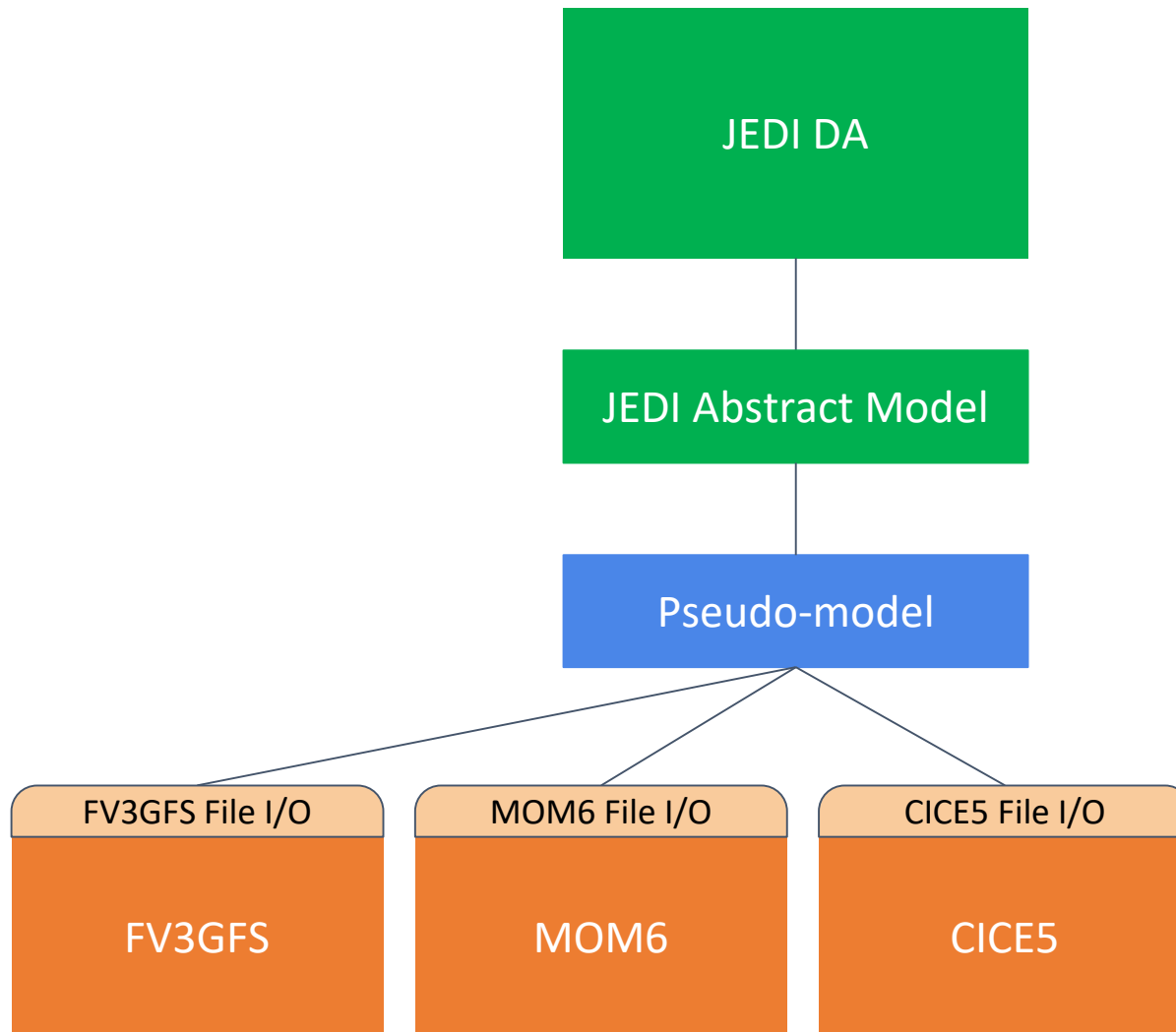


- 2018-05-15 00z analysis
- One outer loop
- Pseudo model
- 10 iterations
- 200km resolution
- 10 member ensemble
- Radiosonde observations
- 800hPa temperature

Data Min = -2.04442E-03, Max = 2.07974E-03, Mean = -1.01476E-05

JEDI interfacing with UFS systems through File I/O:

Flexible components: un-, weakly, or strongly coupled DA



JEDI driving UFS systems thru the NUOPC_Driver (in-core):

Flexible components: un-, weakly, or strongly coupled DA

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