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

Data Assimilation Working Group

Presented by
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Presented at SIP Coordination Meeting
May 14-16, 2019; College Park, MD
Data Assimilation WG
Membership

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- Tom Auligne JCSDA **
- Ron Gelaro NASA/GMAO **
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- Curtis Alexander NOAA/ESRL
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- 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/4DEnVar/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** (¼ degree MOM6)

30-day cycling assimilation of satellite SST (NESDIS/ACSPo 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/4D-EnVar/4DVar running with FV3GFS/GEOS
3DVar/4D-EnVar running with MPAS, LFRic
Growing, but not yet complete set of observation operators
work just started on EnKF solver

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

Observations: Satellite radiances, AMVs, GNSS-RO, Marine observations, Aerosol Optical Depth, radiosonde, surface ps, aircraft
JEDI interfacing with UFS systems through File I/O:
Flexible components: un-, weakly, or strongly coupled DA

JEDI DA

JEDI Abstract Model

Pseudo-model

FV3GFS File I/O

MOM6 File I/O

CICE5 File I/O

FV3GFS

MOM6

CICE5
JEDI driving UFS systems thru the NUOPC_Driver (in-core):

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