Earth Prediction Innovation Center (EPIC)

Perspectives from the JCSDA

Tom Auligné, Director, Joint Center for Satellite Data Assimilation
**EPIC Legislation**: Advancing weather modeling skill, reclaiming and maintaining international leadership in the area of numerical weather prediction

![Graph showing RMSE for z500 over lead time](image)

Magnusson et al. (2019)
Vision: An interagency partnership working to become a world leader in applying satellite data and research to operational goals in environmental analysis and prediction.
Joint Effort for Data assimilation Integration (JEDI)

- “The strength of a common goal” = one system with multiple configurations

- JEDI is for scientific exploration and operational forecasting (incl. R2O2R)

- We want flexible, reliable, efficient, generic, readable and modular code. This is not specific to Earth system modeling: the software industry has moved to generic and object-oriented programming 20 years ago.

- Keys to success = separation of concerns, interfaces, and reusable components
Next-Generation Software: From Generic to Specific

JEDI Software Framework

Templates (controlled by traits)

Factories (controlled by config)

NEPTUNE
FV3GFS
GEOS
MPAS
LFRic
WRF
MOM6
CICE5

...
JEDI: One System with Multiple Configurations

Analysis of lowest model layer for: seas4 valid: 2018041506

Analyzed ice fraction aggregate

Analyzed Sea Surface Height (m)

Analysis of lowest model layer for: seas4 valid: 2018041506

Analyzed aerosols

200 hPa T increment propagated 24h by GFSv15 on AWS (1,728 cores) in 7min20s

Adjoint Sensitivity to initial conditions @500 hPa
JCSDA Ecosystem: from Waterfall to Agile

- Easy access to up-to-date open-source software for the community
- Agile development
- Automatic testing, CI/CD
- Hierarchical testing (cheap versions of operations)
- Collaborative peer reviews (developers = testers)
- Dynamic documentation
- Code portability (HPC, Cloud, laptop)
Community Engagement and Support

Outreach
- Workshops, seminars, newsletter, website

Planning
- Thematic planning meetings

Training
- Summer schools and tutorials

Development
- Visiting Scientist Program
- HPC support
- Code Sprints
Example from latest JEDI Academy

1. fire up a machine on AWS Cloud, access latest code from multiple JCSDA Github repositories, build application, run test case (20 minutes)

1. submit issue ticket, submit new code, automatic testing (30 minutes)

1. peer-review (same day)

1. merge code to JCSDA Github (5 seconds)
The Quiet Revolution of Data Assimilation

Past

Virtual center (amalgamation)

Working groups → “Talking groups”

Present

Distributed center (integration)

Common operating plan, world-class staff (core and in-kind), lean management → results driven

Financially-independent labs (e.g. Met Office) requesting JCSDA developments for their research
Final Remarks and lessons learned for EPIC

Data Assimilation is a major foundation for EPIC to reclaim international leadership in NWP within 5-10 years.

Quiet revolution based on modern software practices, agile collaborative development, and community inclusion. All concepts scale to more models, applications, partnerships.

Center of excellence requires focus, world-class staff committed to success, and nimble decision making.
US Earth Prediction Enterprise