Cycling prototypes: vehicle for collaboration and development of the MRW/S2S application

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• Skill of UFS MRW/S2S equally depends on forecast model and data assimilation (I.C.) quality.
• So far development focused on the improvement of the forecast model (coupled prototype 1-8).
• This talk is about bringing forecast model development and DA together.
From research to operations

{NOAA OAR, NOAA EMC, Univ., JCSDA}

- Funding starts
- Exper. start
- Prelim. results
- Refine
- Publish

3+ years

Transition candidates in EMC system
Cycling prototypes

1+ years

Final candidate
Parallel testing and acceptance

1+ years

Operational/real-time workflow
Stable system and high up-time

5+ years

U.S. Commercial Sector and Public

Reproduce aspects of commercial system in private sector

Consume operational products
From research to operations

Goal:
- Reproduce science advances in operations
- Shorten the transition lag
  (3-5 years NOAA, 1-3 years ECMWF)
Challenges:
- Research has different starting points and workflows.
- Reproducing science across organizations and platforms.
- High tax of running pre-operational configuration in research (complexity, cost, expertise).

Suggested solution:
- Make cycling prototypes available to research community.
- Reducing the tax of running pre-operational workflow in research.
Definition: cycling prototype

- Scientifically valid configuration for all major components: UFS, DA.
- Tagged version of all major executables: UFS, GSI, SOCA, land DA.
- Reproducible software stack to compile and run major executables.
- Observational data and I.C. to run a valid experiment.
- Reference solution for a known period of time.
Example of cycling prototype: UFS RnR

- NOAA PSL has developed coupled cycling system using:
  - UFS coupled model at 1° p7c physics.
  - GSI 3DVAR + GSI LETKF
  - SOCA 3DVAR + SOCA LETKF.
Cycling prototype: vehicle for structured development and collaboration

Suggested sequence of prototypes for GFSv17/GEFSv13

Now

CP0: coupled UFS P7c (FV3, MOM6, CICE), 1°, 3DVAR

CP1: Reproduce CP0 using global workflow + UFS P8c (+ WWIII)

CP2: Upgrade resolution (1/4°), + all sky assimilation, + land DA

CP3: + ensemble, + hybrid DA at 1°

CP4: Upgrade resolution (high-res control + ~1/4° ensemble)

CP5: Computational optimization.

CP-Final: Parallel testing

2024
Role of EPIC: infrastructure for running of the basic components

- HPC stack;
- Nightly testing of components on NOAA platforms:
  - RDHPC: Hera, Orion, ...
  - Parallel Works: AWS, AZURE, GCP
- Basic components needing testing (includes tagged versions with specific configurations):
  - GSI, JEDI (soca, fv3-jedi), UFS
- Providing archive of:
  - observations and initial conditions (collaboration with PSL).
  - Fixed files (orography, coastlines, look-up tables, ...)
End