# Recent advancements on the community Unified Forecast System

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NMME Workshop 2023

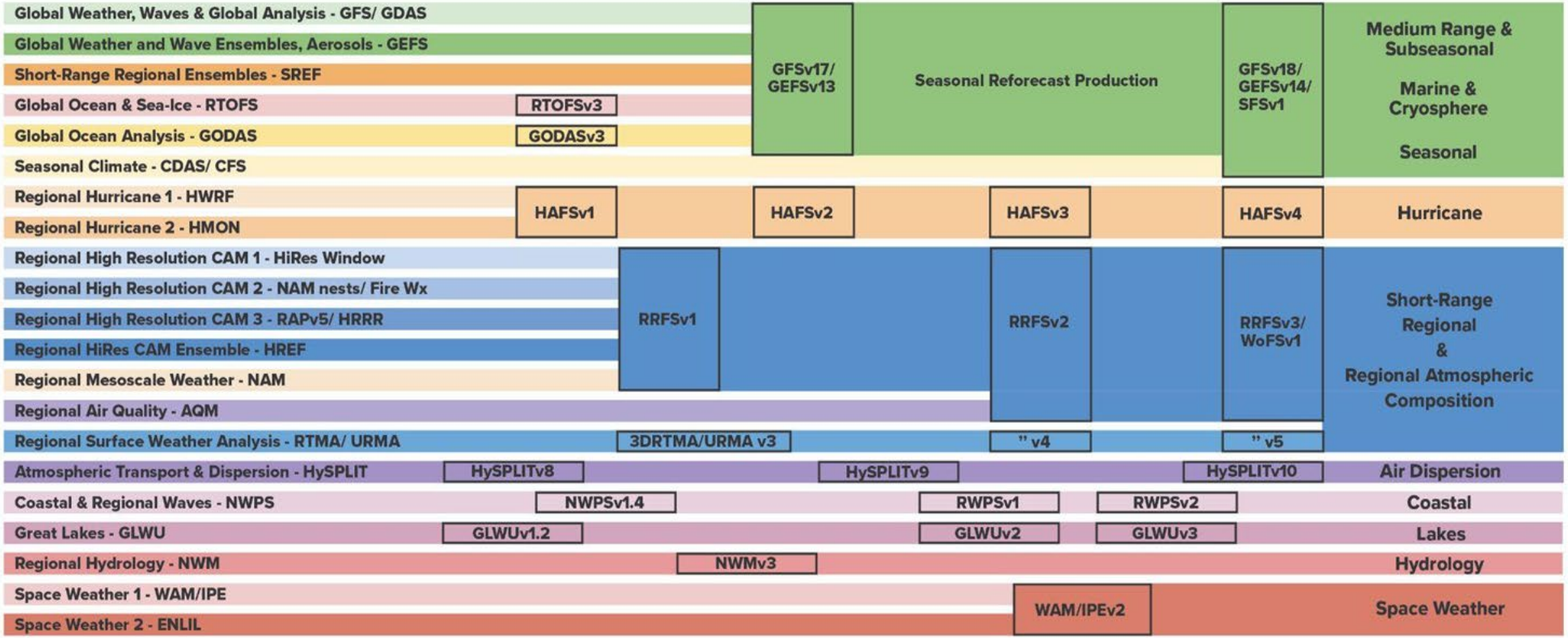
# What is the difference between EPIC and the UFS?

- **Unified Forecast System is open-source software with multiple applications that use a common code base (cars)**

- **Earth Prediction Innovation Center (EPIC) is a program that supports the export of production code and the import of community innovations (highway with on/off ramps)**

# UFS phased transition

**21 Independent Stand-alone Systems** → **8 UFS Applications**

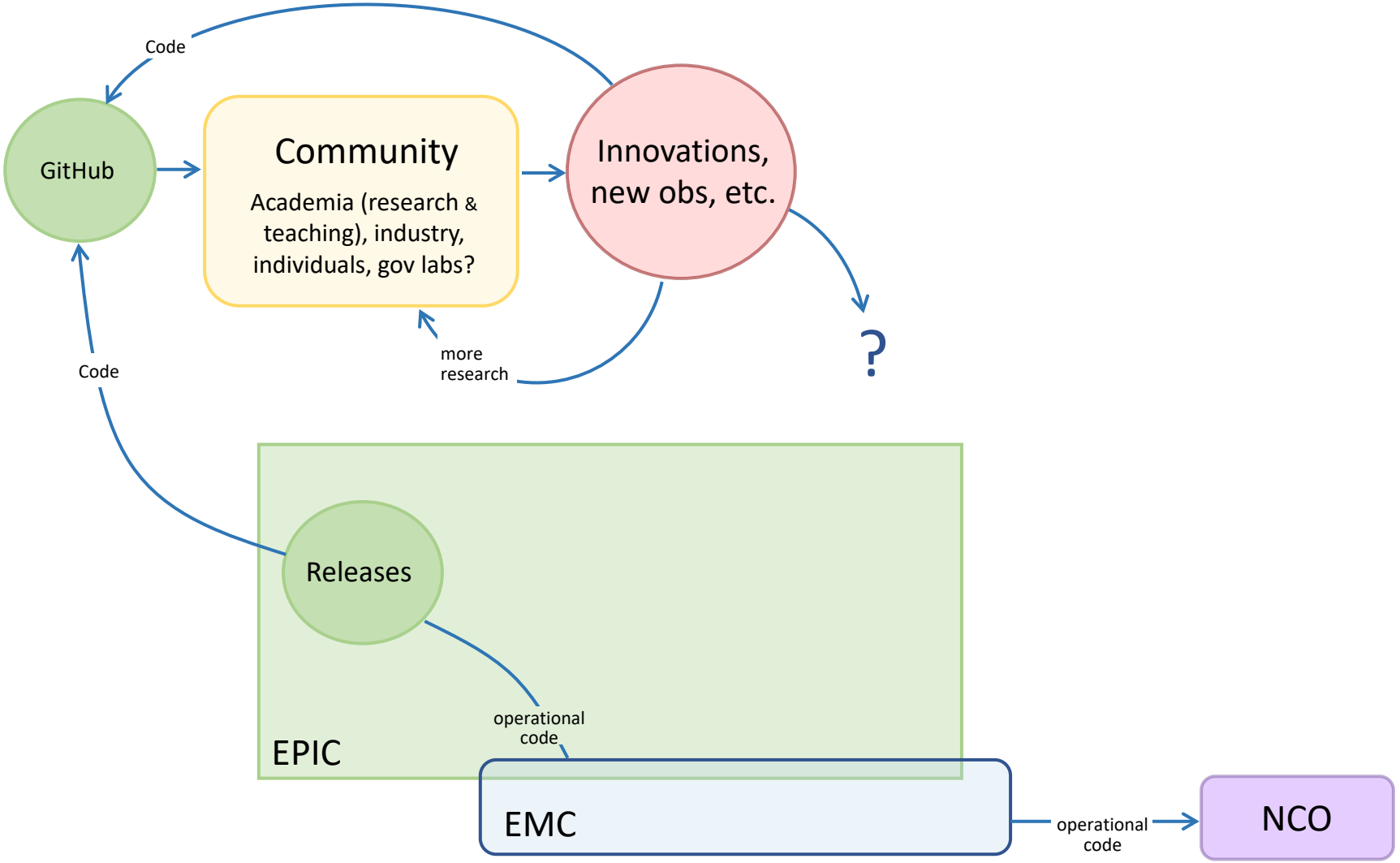


# UFS Matrix, Roles, and Touchpoints

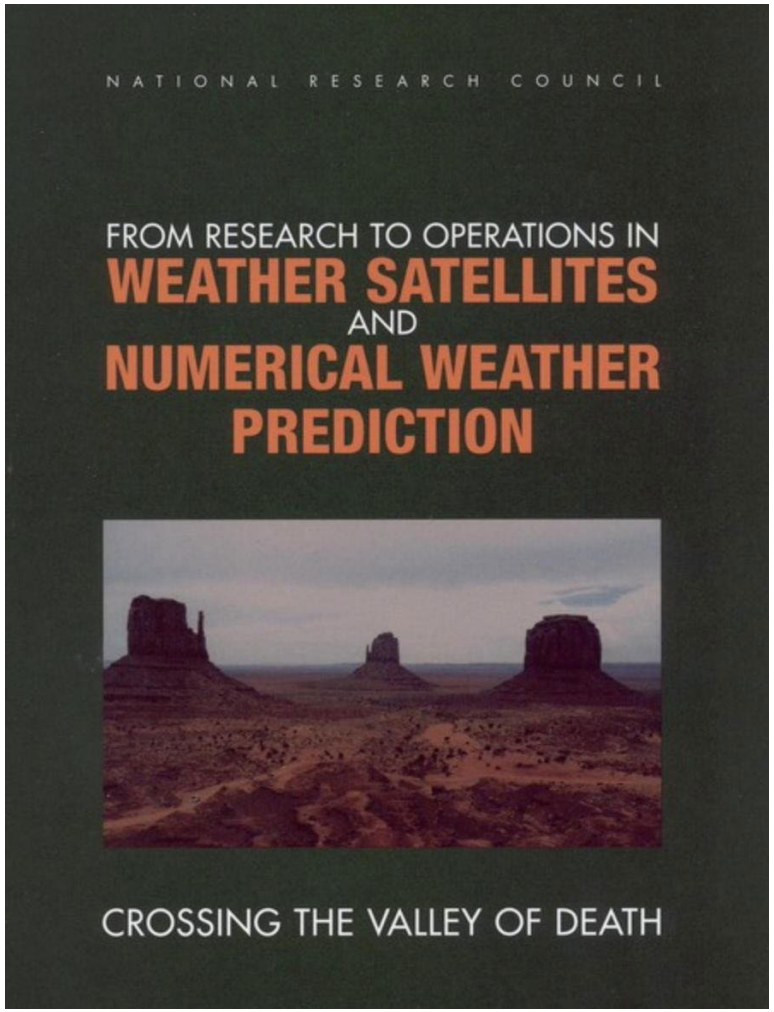
**UFS Application Teams (ATs) are responsible for developing and delivering each UFS product**

| | Medium-Range Weather | Short-Range Weather | Seasonal | Hurricane | Space Weather | Marine and Cryosphere | Coastal | Air Quality | ? |
|---|---|---|---|---|---|---|---|---|---|
| UFS CMB | Representatives of organizations contributing resources to UFS from public, private, and academic sectors | | | | | | | | |
| UFS-SC | Overall leads for each application are responsible for identifying forecast skill priorities, determining science strategies, developing release schedules, and representation from cross-cutting teams and working groups | | | | | | | | |
| Cross-Cutting Teams | Leads and points of contact for cross-cutting teams focused on communication and outreach, release preparation, system architecture and infrastructure, and V&V | | | | | | | | |
| Working Groups | Leads and points of contact for working groups focused on aerosols and atmospheric composition, data assimilation, ensembles, dynamics, land, marine, physics and post-processing. | | | | | | | | |

# Future process vision: enabling community innovation



# R2O, Valley of Death, and The Funnel




National Research Council (2000)

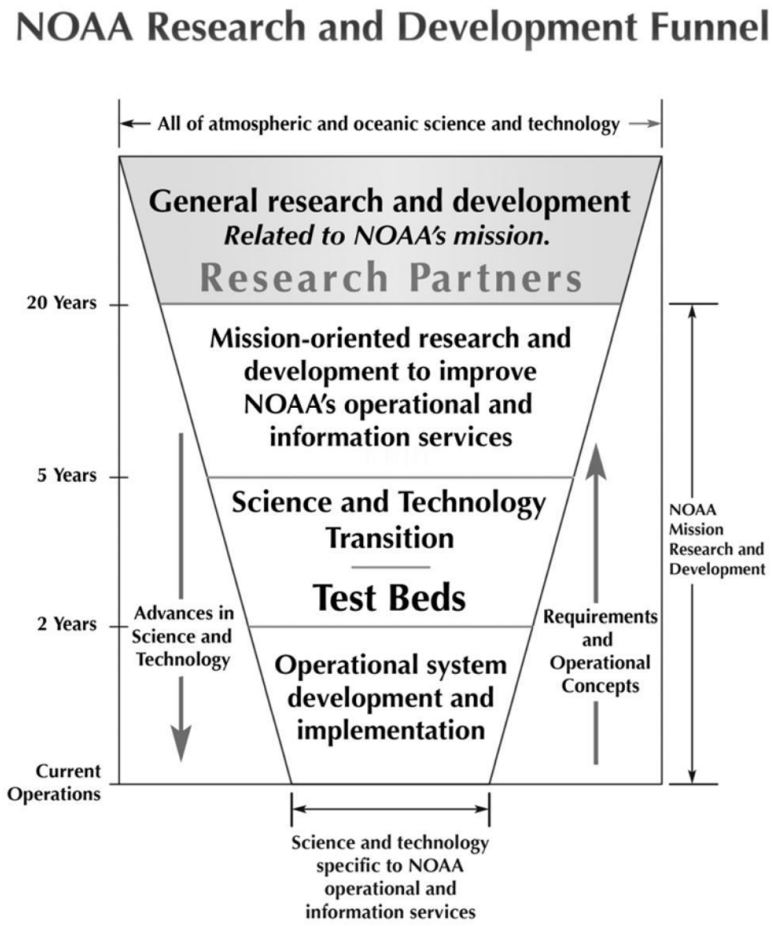
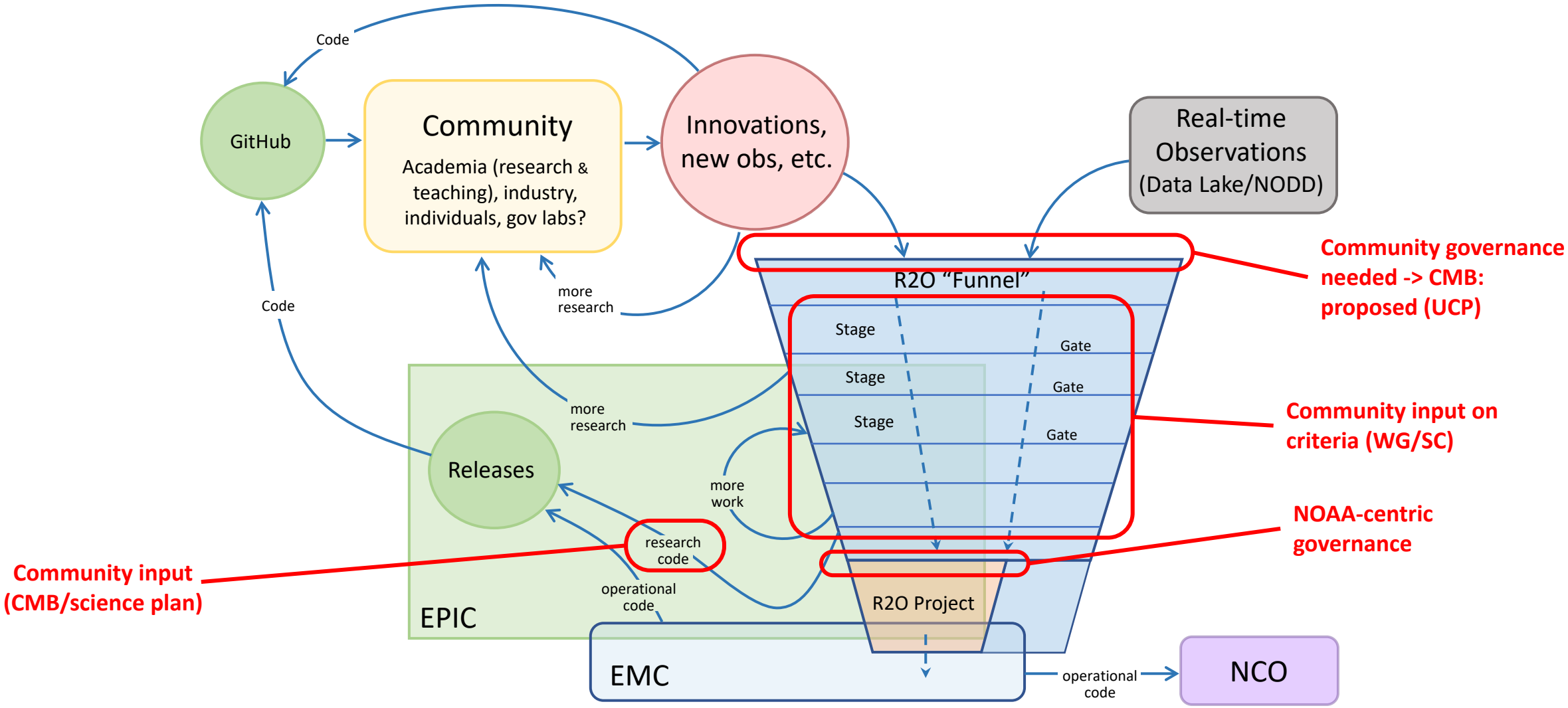



Fig. 1. The "research and development" funnel. This schematic gives an overview of how NOAA's mission-based research and development can be organized to keep its operational and information services at the state of the art in science and technology.

Alexander MacDonald , Richard Fulton, Maureen Kenny, Steven Murawski, Peter Ortner, Alfred Powell, Avery Sen, and Louis Uccellini, 2006: *Research Location in NOAA: Physical and Social Sciences*

# Process vision for the future: governance and decision points



# UFS Community Support, Training, and Tutorials

Getting Started - Earth Predict

epic.noaa.gov/getting-started/

Earth Prediction Innovation Center

## Getting Started

### Welcome to Getting Started!

**The only pre-requisite to start this workflow is getting an AWS account** which can be done here.

Log in as ***root user*** if you have never used AWS before.

Once you are logged in you can start the video and tutorial below. The video walkthrough goes over running the Short Range Weather Application on the cloud as an example. As the EPIC team makes more UFS applications available on the cloud, we will make video tutorials that cover each; signing onto the cloud and getting things running will remain the same.

### Running the Short-Range Weather Application on the AWS Cloud

Getting Started - Earth Predict | SRW_Infrastructure_setup_2.p

epic.noaa.gov/getting-started/

Earth Prediction Innovation Center

If you run into any issues we encourage you to ask questions on our newly created Github Discussions board where someone from the EPIC team or someone from the community can answer it.

Initial Steps to Configure AWS Instance

**Please be aware that you will need to cover the costs of running the SRW on the cloud**. Below is a break-down of what kinds of charges you may incur:

## EPIC AWS Costs

Table View | Chart View

Show 10 rows

| UFS Process | AWS Services | Cost |
|---|---|---|
| Continuing Monthly Costs | x5.xlarge EC2 Image Builder, S3 | $10 - $12 |
| Image builder | x5.xlarge EC2 Image Builder, S3 | $4 - $6 |
| SRW Run | x5.xlarge EC2 Image Builder, S3 | $8 - $10 |
| Total Monthly Single Run | x5.xlarge EC2 Image Builder, S3 | $22 - 28 |

# JEDI Academies

The JEDI Academy is a week-long training for new users of the JEDI Data Assimilation system. JCSDA organized 7 JEDI Academies since 2018 (in-person and online).

- Lectures on JEDI components by JCSDA staff
- Interactive tutorials on using and contributing to JEDI
- Tutorials run on AWS using containers and Jupyter notebooks

# UFS Community Innovation and Educational Support

## WPO offers "Innovations for Community Modeling Competition" with FY2023 Grants

**NOAA's *Weather Program Office* (WPO) is soliciting proposals for four (4) grant competitions, valued at approximately $13.5 million per year. For the first time, WPO is offering the *Innovations for Community Modeling Competition***, integrating four of its Programs: *Joint Technology Transfer Initiative* (**JTTI**), *Earth Prediction Innovation Center* (**EPIC**), *Subseasonal to seasonal* (**S2S**) and *Atmospheric Composition* (**AC**).

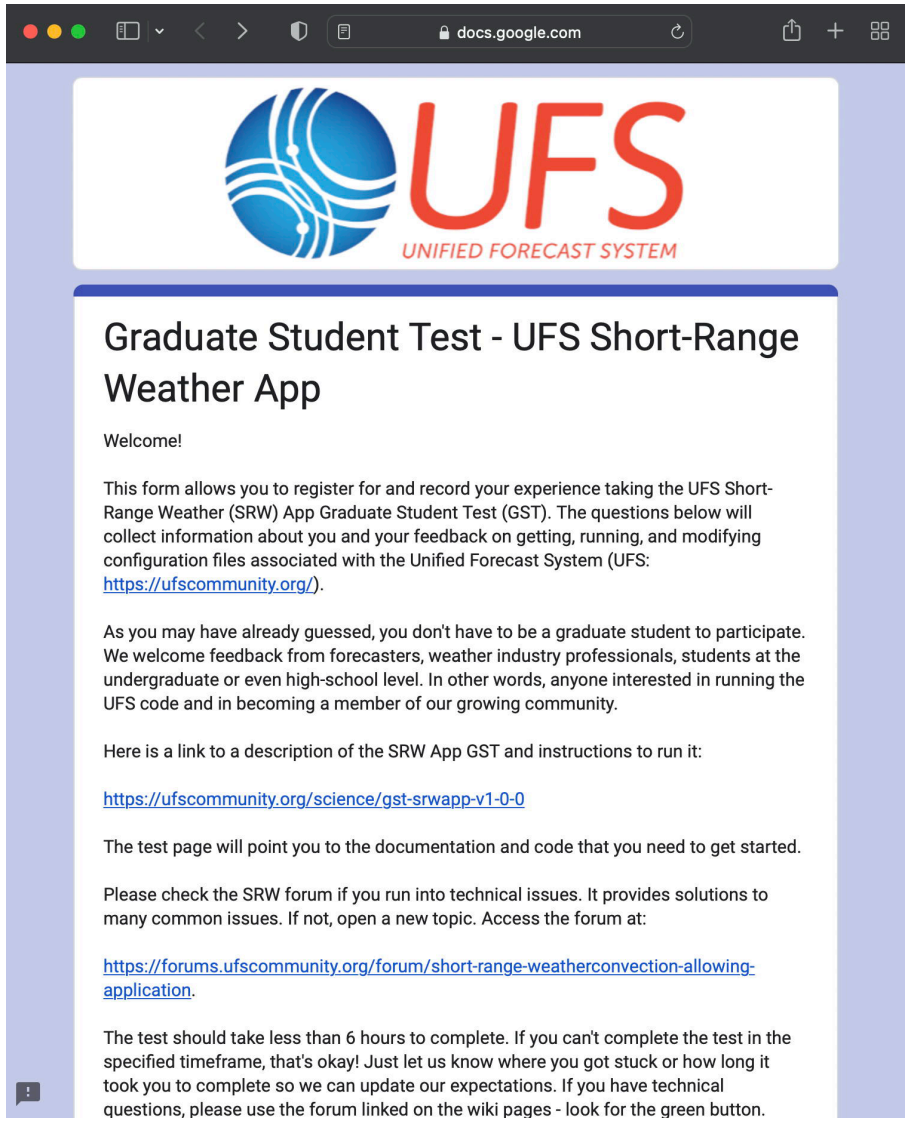
***Innovation for Community Modeling Competition***

The competition will award approximately $5.0 M in total award funding per year. It is expected to fund 10-15 projects with a maximum funding limit of $500K per year.

To qualify as *innovative*, proposals submitted to the ***Innovations for Community Modeling Competition*** must focus on substantially new approaches.

Model developments should focus on the *Unified Forecast System* (**UFS**) of the future.

WPO is seeking projects that are high-risk proof-of-concept ideas, as well as larger collaborative proposals, that will help NOAA's vision and mission, towards advancing the UFS, to become the most accurate and reliable operational modeling system in the world.



# NSF signals support for exploring multiple configurations

National Science Foundation

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**NSF 23-095**

## Dear Colleague Letter: Physical and Dynamic Meteorology Update on Modeling Tools and Support

April 27, 2023

Dear Colleague:

The purpose of this Dear Colleague Letter (DCL) is to convey to the scientific community that, for numerical modeling-based activities, NSF's Physical and Dynamic Meteorology (PDM) program welcomes proposals that make use of any modeling system that will advance the relevant science.

The dominant model in the mesoscale meteorology community has been the Weather Research and Forecasting (WRF) model, which remains a viable and valuable tool. As a signal of the ongoing commitment to WRF, NSF has recently funded an effort to develop a new containerized version of WRF that will further lower the barrier of entry for the use of the model and evaluation tools. However, newer modeling systems such as the Model for Prediction Across Scales (MPAS) and the Unified Forecast System (UFS) with the FV3 dynamical core are being developed that may significantly expand future capabilities. Thus, NSF encourages PIs to explore these new systems while also introducing them to and training students.

With this DCL, PDM is extending an invitation for supplemental support ideas *to active PDM awards* that will introduce MPAS and/or UFS into the project. The purpose of these supplements should be to: 1) increase the robustness of research findings by demonstrating them on a different modeling system, 2) provide opportunities for training on new modeling tools, and 3) provide assessment and feedback of the capabilities of the new systems. Supplemental funding requests will only be allowed with approval from PDM following the concept paper path described in the next paragraph. PDM also encourages Research Opportunity Award (ROA) supplemental support ideas for faculty from

# Community Modeling Board (CMB)

- **CMB Structure and Initialization - 15 members with representation from the various stakeholder categories; one liaison from the NOAA Modeling Team, and one liaison from the EPIC Program Team.**
- **Enhance communication, collaboration, coordination, and partnerships to increase public, private and academic participation**
- **Serve as a point of contact for leveraging community expertise to advance the UFS and advocate for community needs that will facilitate their contributions to the UFS**
- **Provide strategic advice to the UFS Steering Committee (UFS-SC) on the UFS (e.g., identify modeling priorities, best practices, innovative ideas, etc.)**
- **Help prioritize advancement of the UFS by defining goals and objectives, and identifying barriers**
- **Provide a means to continuously share feedback about research and modeling innovations through various channels (e.g., EISWG, ICAMS, AMS, AGU, etc.)**

# What's next for UFS?

## Short term

- ✓ Map the process
- ✓ Design community governance where needed
- → Road Show/AGU/AMS, including UFS short courses
- → Revise and update Charters/CMB/I2O Report
- → Develop outreach and engagement plan
- → Develop teaching material
- → Surveys/Questions sent out

## Medium term

- ✓ Upcoming opportunities: hackathons, code sprints, fellowships, innovation NOFOs
- → Solicit community input to help solve key challenges
- → Develop a more coordinated approach for releases
- → Develop additional toy models, idealized cases, etc.
- • Expand coupling and applications
- • Explore industry JV and NGO fund-matching opportunities

# Thank You!!

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