

UFS 101

Hendrik Tolman

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BLUF

For several years, the Unified Forecast System (UFS) has been an idea focusing on improving operational forecasting at NOAA as a community partnership.

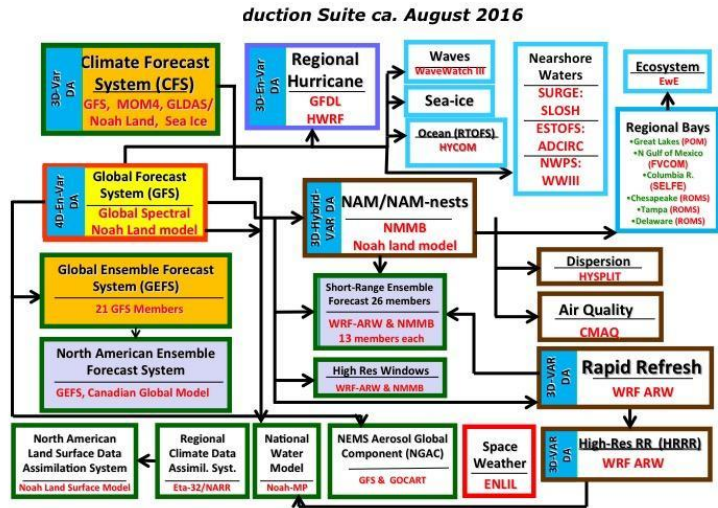
By now the idea has become a reality, particularly with the several UFS implementations in operations and several code releases that allow for researcher to easily install operational model applications on their computers.

This presentation is about the core UFS, not about the UFS support provided by EPIC. For the latter, see <https://epic.noaa.gov/> and other talks this week.



History: Simplifying the NCEP Production Suite

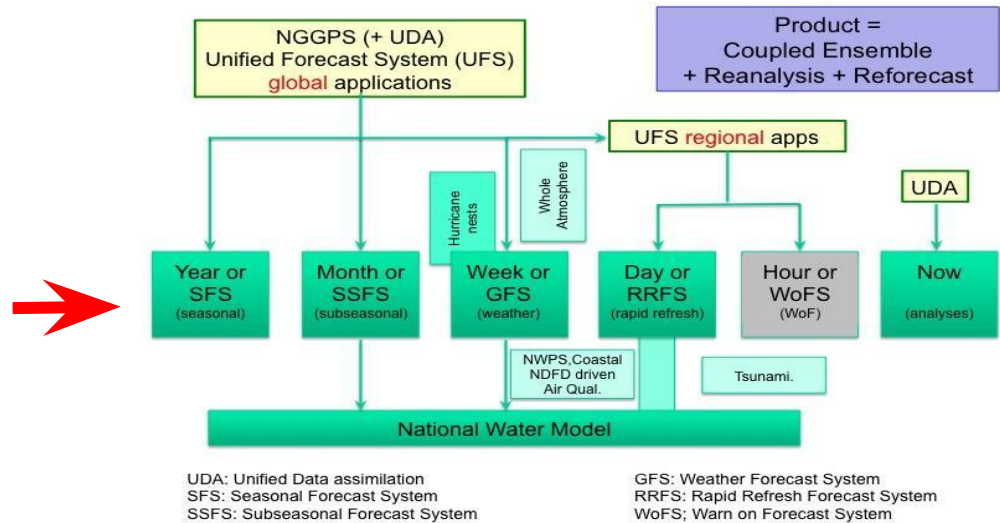
Roadmap Fig. 1



Courtesy Bill Lapenta

In 2016, 26 major systems

Moving to < 10 major systems



Roadmap Fig. 2

“System” in UFS =
code + governance +
community

About the UFS

Purpose

The Unified Forecast System (UFS) is a comprehensive, **community-developed** Earth modeling system, designed as both a **research tool** and as the **basis for NOAA’s operational forecasts**.

Governance

Planning and **evidence-based decision-making** support improving research and operations transitions and community engagement.

Scope

UFS is configurable into multiple **applications** that span local to global domains and predictive time scales from less than an hour to more than a year.

Design

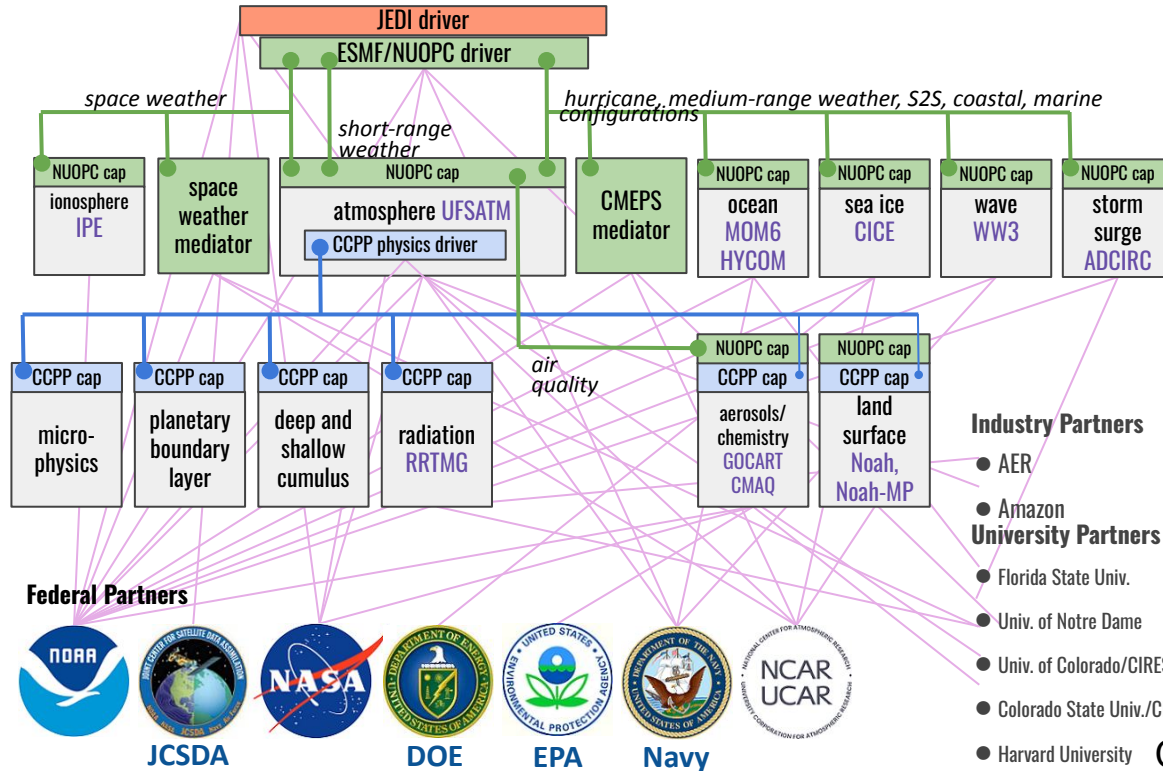
UFS is a **unified** system because the applications within it share science components and software infrastructure.

Impact

UFS is a **paradigm shift** that will enable NOAA to simplify the NCEP Production Suite, to accelerate use of leading research, and to produce more accurate forecasts for the U.S. and its partners.



Components and Contributors Jan 2020



Courtesy C. DeLuca



UFS mandates

- In NOAA
 - NOAA Science Council report on community modeling (2017)
 - UFS Vision and Roadmap documents, signed by NWS, NOS, OAR and NESDIS AAs (developed 2018, published 2020)
 - [NOAA Administrative Order 201-118](#) entitled “Software Governance and Public Release Policy” (2024)
 - [NOAA Modeling Strategy](#) (2024)
- In Law:
 - LEGEND Act (15 U.S.C. § 8512a) (2022)
 - SHARE IT act (Public Law No: 118-187) (2025)

LEGEND Act

NDAA Dec. 2022 Section 10601,
LEGEND Act. “LEARNING EXCELLENCE
AND GOOD EXAMPLES FROM NEW
DEVELOPERS”

- Directed at NOAA
- “Open Source”
- With some exceptions
 - Obsolescent code
 - Restricted code
- Mentioning EPIC
- Models **and** Data
- Foundational for UFS

Purposes.--The purposes of this section are—

(1) to support innovation in modeling by allowing interested stakeholders to have easy and complete access to operational model codes and to other models, as the Administrator determines appropriate; and

(2) to use vetted innovations arising from access described in paragraph (1) to improve modeling by the Administration.

UFS references

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- Alves, J., H. Tolman, A. Roland, A. Abdolali, F. Arduin, G. Mann, A. Chawla, and J. Smith, 2023: NOAA's Great Lakes Wave Prediction System: A Successful Framework for Accelerating the Transition of Innovations to Operations. *BAMS*, **104**, E837–E850.
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UFS-SC needs to develop a more formal definition

UFS component models

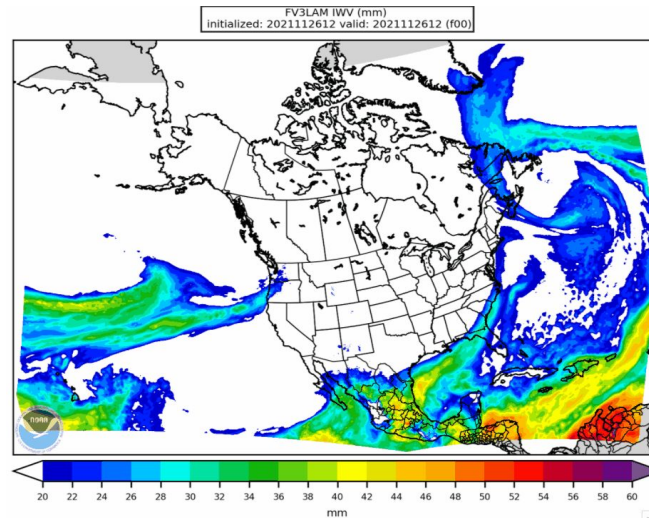
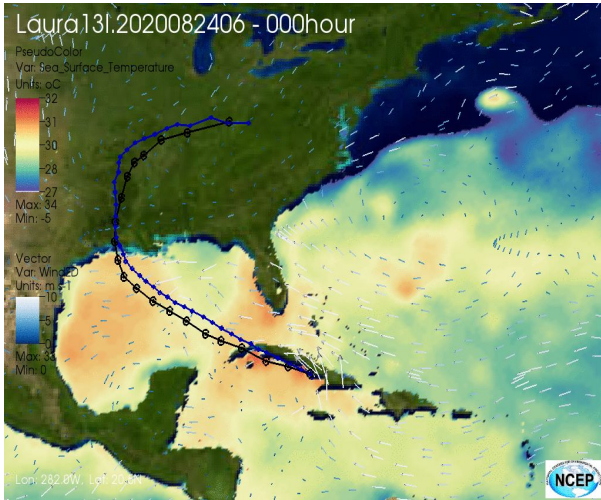
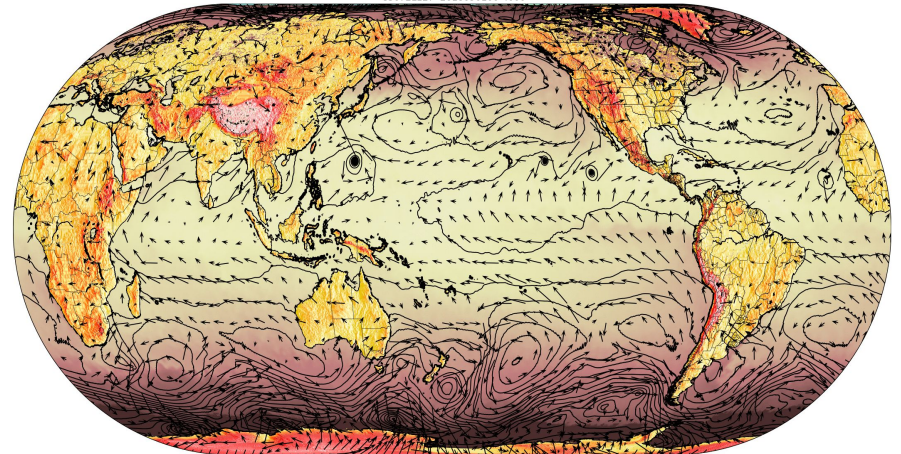
What defines a UFS component model?

- UFS working groups and teams decides this is a focal model
- UFS Steering Committee only needs to be included if there are conflicts
- Component model is UFS-ready once
 - Code management principles are acceptable
 - “Wrapping” with ESMF / NUOPC is developed / owned
 - Applications (coupled) are defined
- Ownership: ***UFS is not a funding opportunity!***

UFS progress

- **Simplifying the production suite:**
 - Reduce the complexity of the Production Suite, measured as the reduction in the number of major applications (baseline is 26 in 2016)
 - 70% planned, 23% achieved (HAFS and RRFs are next big steps)
- **Building the community:**
 - reducing the cost of setting up GFS modeling system outside of the NOAA
 - Was \$15M+ for GFS, now 1 person 1 day on your computer
 - NSF starting to support UFS (6 projects funded in 2023)
- **Improving Operations:** Evidence driven, community teams
 - Much larger teams supporting development
- **NOAA planning:**
 - 10 Year NOAA Modeling Strategy (UFS, JEDI)
 - [NOS modeling strategy](#)
 - NOAA Administrative Order 201-118

UFS is real!



Next Steps

- Governance
- Next UFS strategy document to be developed before the next UIFCW
- Software modernization focus
 - Other talk at UIFCW
 - Position paper “*Software modernization for the UFS*” DOI: [10.25923/gfbx-pk53](https://doi.org/10.25923/gfbx-pk53)
 - Starting to discuss next generation coupling approaches within the UFS
- MPAS inclusion (WoFS and more ?)
- Applications, Applications, Applications
- EPIC, EPIC, EPIC <https://epic.noaa.gov/>

Questions ?