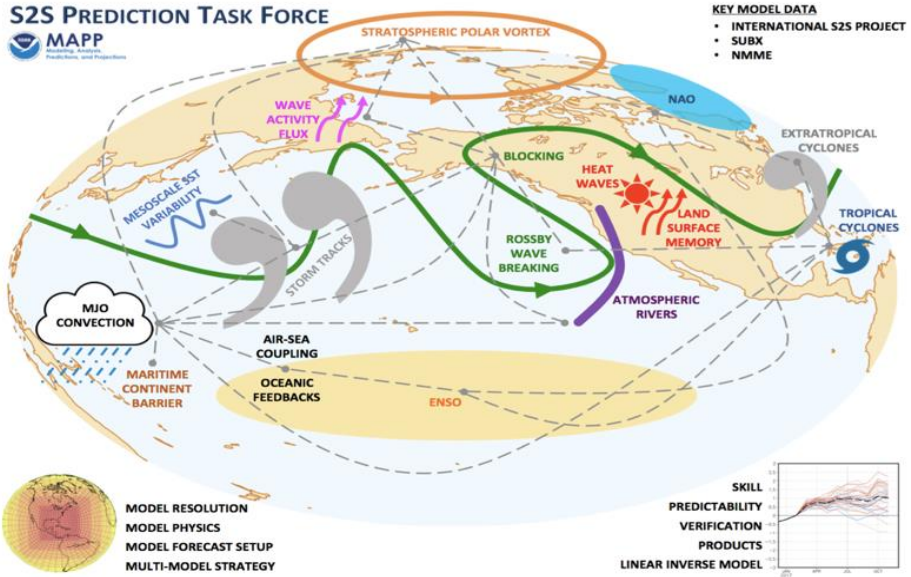
NOAA S2S Planning

Dave DeWitt (NOAA/NWS/CPC)



WSWC/CDWR: May 2019

Outline

- Relevant Definitions
- Background on PL115-25, Section 201
- Report to Congress* (Note that everything discussed here has been publicly disclosed as part of the public vetting process)
  - -Science challenges
  - -End to end initiatives to address science grand challenges
- NOAA's approach to building the most skillful S2S prediction system
- Earth Prediction Innovation Center
  - -Background
  - -How might EPIC help to accelerate S2S improvements

Definitions

"Authorization": Amount of funds that can be expended toward a government program. Authorizations don't provide any funds.

"Appropriation": Amount of funds that the Congress is providing to execute a government program.

Subseasonal is defined as the period from 2 weeks to 3 months; *Seasonal* ranges from 3 months to 2 years.

The Weather Bill, PL115-25, Section 201 (S2S Prediction) and the subsequent renewal under NIDIS are authorizations. To date, there has been no associated appropriation for this bill.

Report to Congress

§ h. “Reports”, calls for…

- Not later than 18 months after date of enactment (18 Oct 2018), the Undersecretary shall submit to Congress (relevant House and Senate Committees) a report including:
  1. An analysis of how NOAA’s S2S forecasts are used for public planning and preparedness,
  2. NOAA plans for the continued improvement of an S2S forecasting capability, including products to meet the need described in 1, and
  3. An identification of the needed research, monitoring, observing and forecasting requirements for number 2
- The Undersecretary shall consult with relevant Federal, regional, State, tribal, local government agencies, research institutions, and the private sector in the development of this report.
- The report is currently with NOAA senior leadership for final review before going to Department of Commerce for review.

NOAA's Report

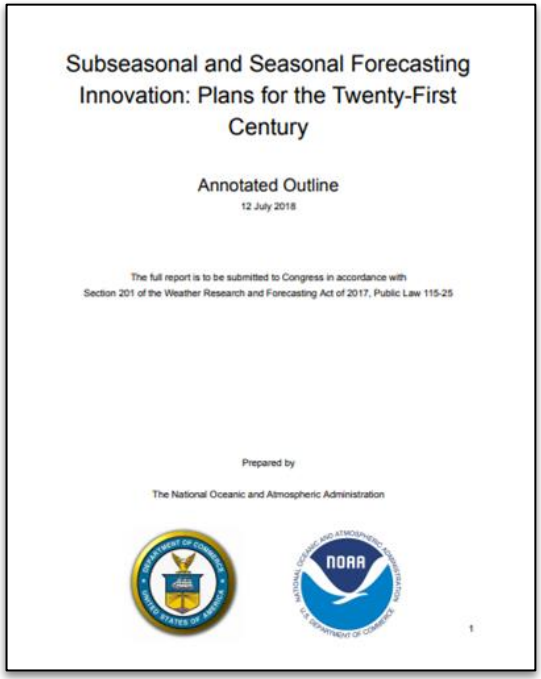
"Subseasonal and Seasonal Forecasting Innovation: Plans for the Twenty-First Century"

- Will serve as a guidepost for NOAA planning and execution, as well as to inform the public and NOAA's stakeholders on its efforts on subseasonal and seasonal forecasting
- This document traces the continuum of effort from S2S products and services to the innovations needed to enable and improve them
- Two main goals: (i) improving the skill of the S2S forecasts, and (ii) enhancing the value of S2S products for stakeholders

Process, cont.

Engagement Mechanisms

- Outreach at AMS and AGU Conferences
- Structured Interviews (Surveys)
- Leveraging existing plans and documents
- Canvassing stakeholders
- Direct engagement with subject matter experts
- Review by ICMSSR
- Sharing an Annotated Outline Publicly



Subseasonal and Seasonal Forecasting Innovation: Plans for the Twenty-First Century

Annotated Outline

12 July 2018

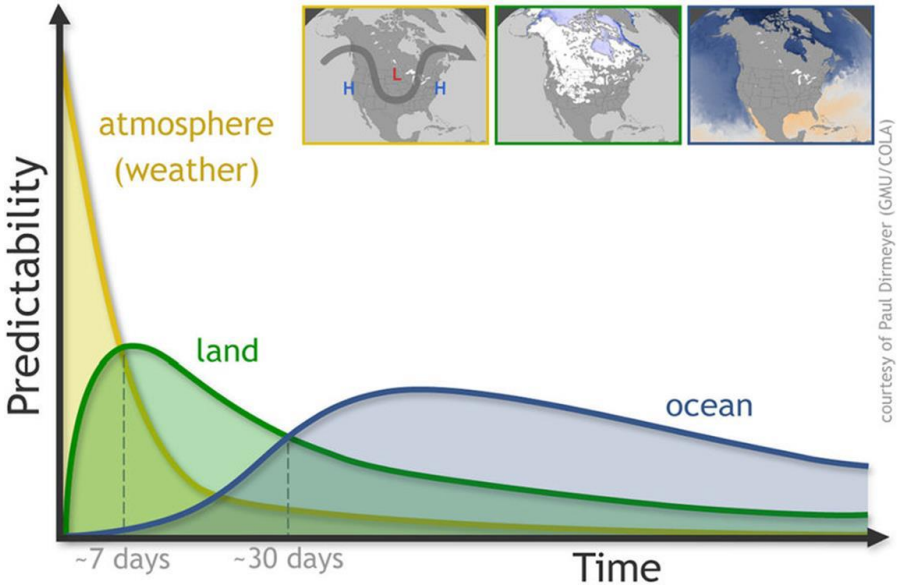
The full report is to be submitted to Congress in accordance with Section 201 of the Weather Research and Forecasting Act of 2017, Public Law 115-25

Prepared by

The National Oceanic and Atmospheric Administration

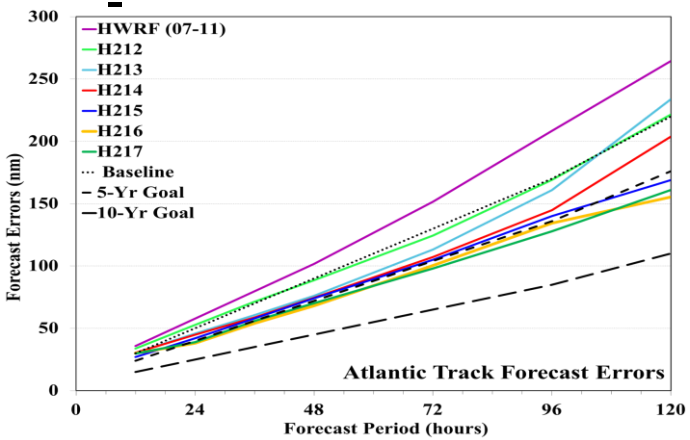
Draft Report

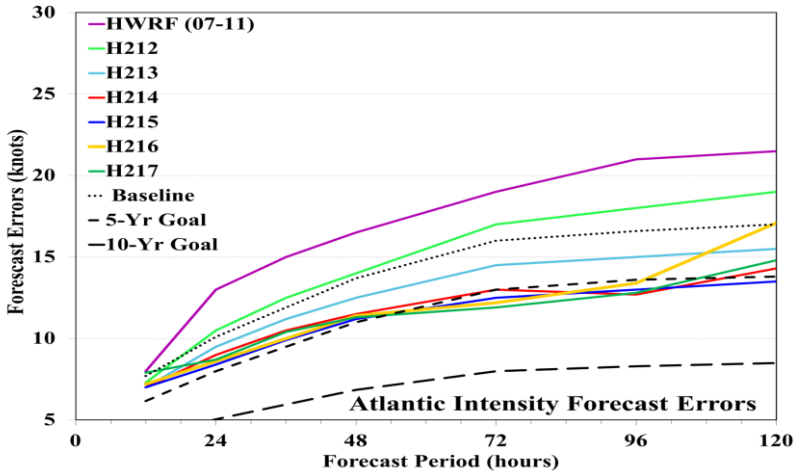
- Section 4.0 Requirements for Improving S2S Products and Services
  - 4.1 Background
  - 4.2 Forecast Requirements
  - 4.3 Research Requirements
  - 4.4 Observational Requirements
  - 4.5 Monitoring Requirements
  - 4.6 Towards Improving S2S Capabilities, Usage, and Value
  - 4.7 Pilot Projects



Pilot Project/Grand Challenge Science

- NOAA has shown that focused, end to end problem-oriented projects can be used to accelerate improvements in forecast skill for “weather phenomena”. Best example of this is the Hurricane Forecast Improvement Program (HFIP).





Elements that Made HFIP Successful

- Recognition of the difficulty of the problem and the fact that there is no single activity that will solve the problem. Rather, compounding incremental improvement will lead to long-term measurable gains in forecast skill. HFIP sought to accelerate this improvement.

- Well-defined metrics and timelines for evaluating success that are co-developed with the relevant stakeholder communities.

- Recognition of the need to focus on operational outcomes, i.e. not research for research's sake.

- **Sufficient sustained investment in all required aspects of the problem, including human resources, high-performance computing, observing systems, and transition of research innovations to operations.**

Elements that Made HFIP Successful (Continued)

- Leveraging the talents of all parts of the weather enterprise, including NOAA labs, other federal agencies, the research community, and relevant NWS operational centers.

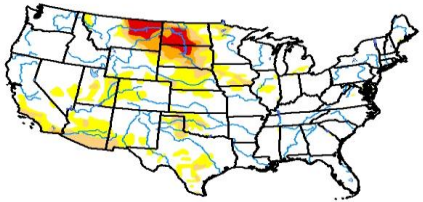
- **Recognition that making progress on this problem will require allowing some higher-risk, higher-reward research, i.e. allowing scientists to be more creative but still focused on operational outcomes.**

"Managing the tension between research push and operational pull."

- Tying science priorities to key decision points for the relevant stakeholder communities.

Examples of Relevant Water Resource Sectoral Challenges

U.S. Drought Monitor
Continental U.S. (CONUS)



July 11, 2017
(Released Thursday, Jul. 13, 2017)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	76.90	23.10	9.60	4.31	2.19	0.00
Last Week 07-04-2017	77.65	22.35	8.45	3.83	1.43	0.00
3 Months Ago 04-11-2017	73.01	26.99	8.17	1.44	0.09	0.00
Start of Calendar Year 01-03-2017	53.89	46.11	22.53	8.63	3.15	0.96
Start of Water Year 09-27-2016	53.60	46.40	18.96	8.10	3.20	1.16
One Year Ago 07-12-2016	55.60	44.40	17.68	6.19	2.57	1.11

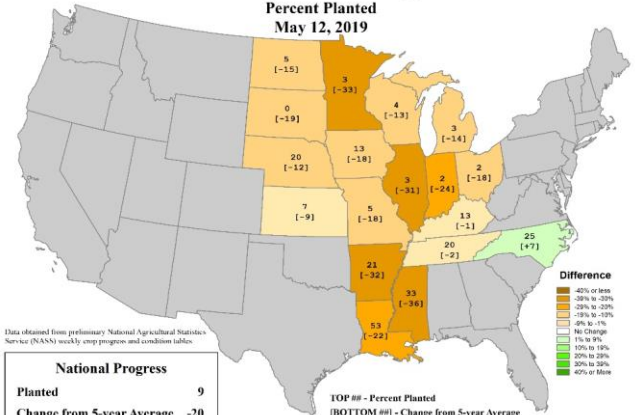
Intensity:
D0 Abnormally Dry
D1 Moderate Drought
D2 Severe Drought
D3 Extreme Drought
D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
David Simeral
Western Regional Climate Center

http://droughtmonitor.unl.edu/

U.S. Soybeans Progress
Percent Planted
May 12, 2019

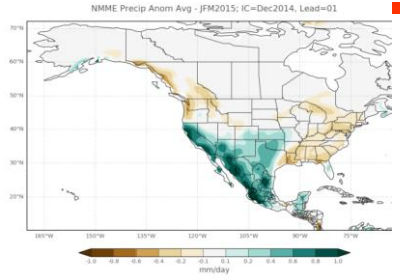


Data obtained from preliminary National Agricultural Statistics Service (NASS) weekly crop progress and condition tables.

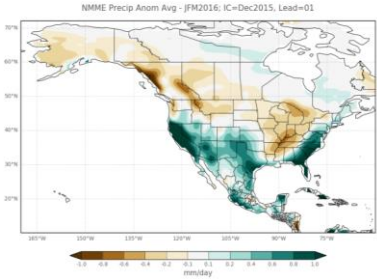
National Progress	
Planted	9
Change from 5-year Average	-20

TOP ## - Percent Planted
[BOTTOM ##] - Change from 5-year Average

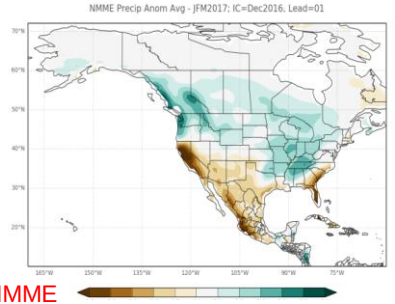
Key Science Challenges to Improving S2S Precipitation Prediction Skill



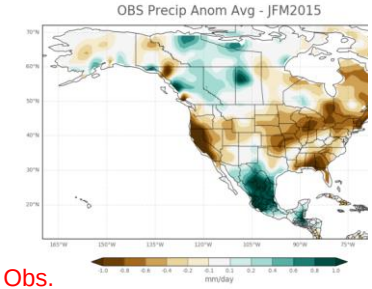
NMME 2015



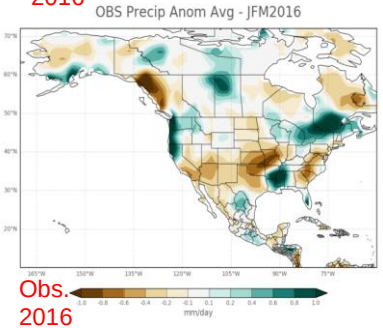
NMME 2016



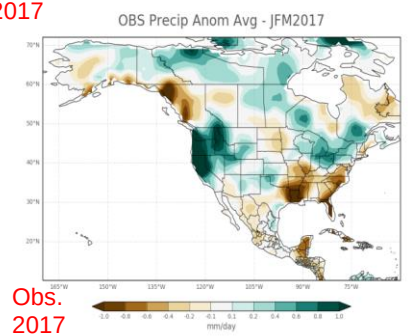
NMME 2017



Obs. 2015



Obs. 2016



Obs. 2017

State of the art NMME first season precipitation forecasts for winters of 2015-2017 were consistently of wrong sign over California and most of the west. Is this due to a limit in predictability, or missing or misrepresented physical processes?

State of the Art S2S Coupled Models Have Major Systematic Errors Forecasting Magnitude and Distribution of Average Precipitation in the Tropics (Even at First Month Lead)

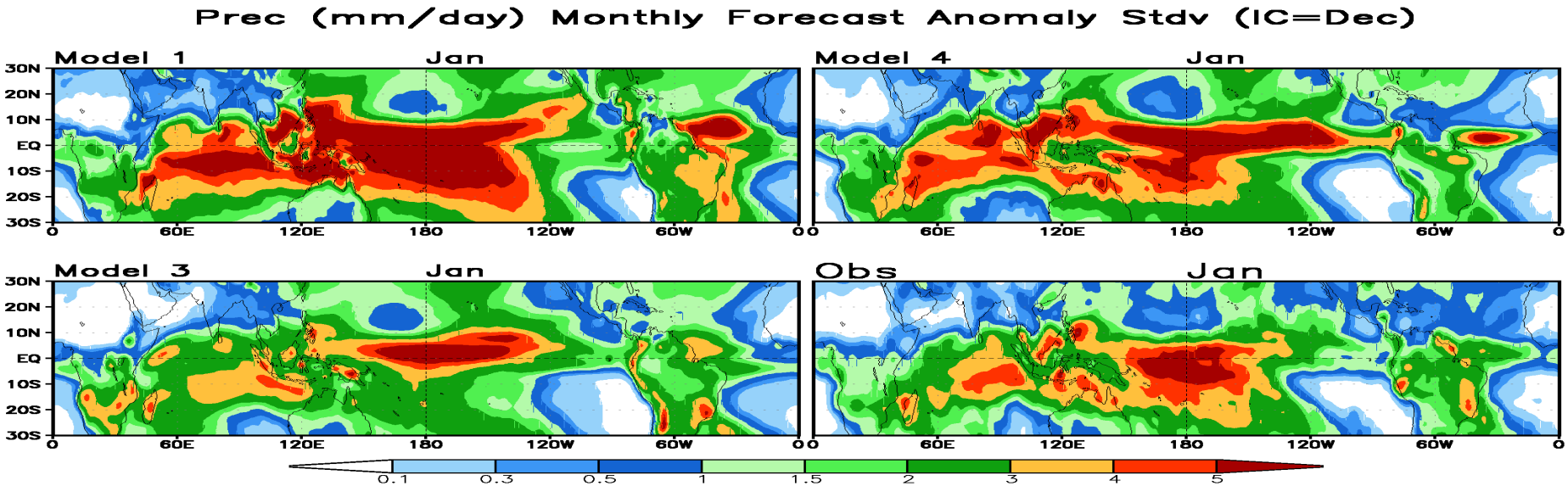


Figure compares standard deviation of precipitation from one month lead precipitation forecasts from 3 state of the art S2S models and observations. It demonstrates that models have errors of 100% or more in predicting mean statistics of tropical precipitation. Result is even worse if you remove large ENSO events .

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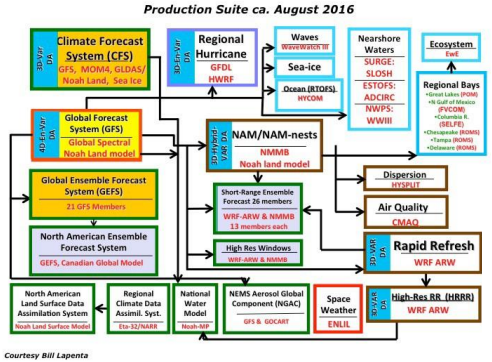
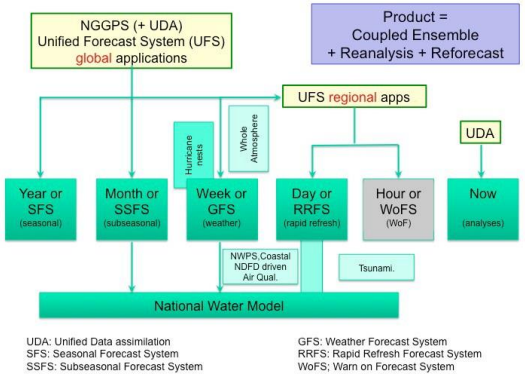
Strategic Vision:
Simplify Modeling Suite



Starting from the quilt of models and products created by implementing solutions rather than addressing requirements ….

… we will move to a product based system that covers all present elements of the production suite in a more systematic and efficient way

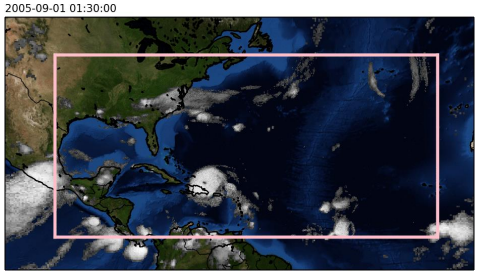


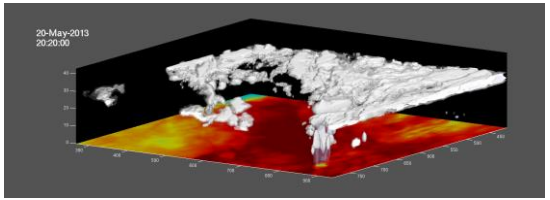
UDA: Unified Data assimilation
SFS: Seasonal Forecast System
SSFS: Subseasonal Forecast System

GFS: Weather Forecast System
RRFS: Rapid Refresh Forecast System
WoFS; Warn on Forecast System

Next Generation
Global Prediction System (NGGPS)

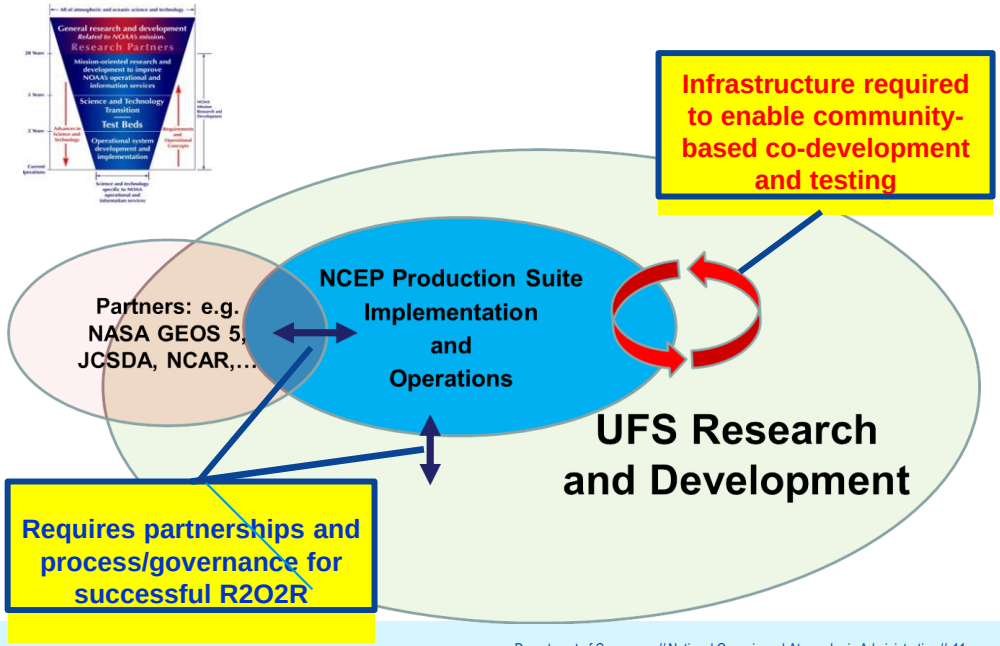
- Identify and adopt an advanced non-hydrostatic dynamic core and evolve it to meet operational needs for the foreseeable future
- Evidence based decision making process to ensure scientific integrity and excellence
- Enhanced O2R2O process and a unified and efficient infrastructure for community engagement and rapid transition of advanced research into operations
- Seamless solutions for tropical weather and climate in a unified global-to-local-scale modeling framework



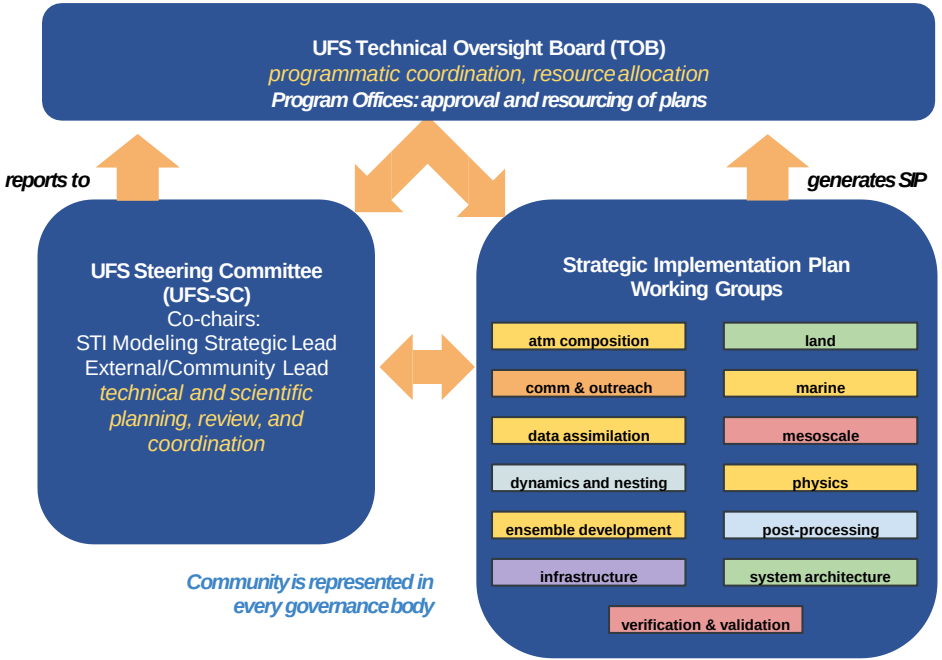


High-resolution nested grid simulations using HiRAM and Finite Volume 3 (FV3)

Unified Forecast System and Community Modeling

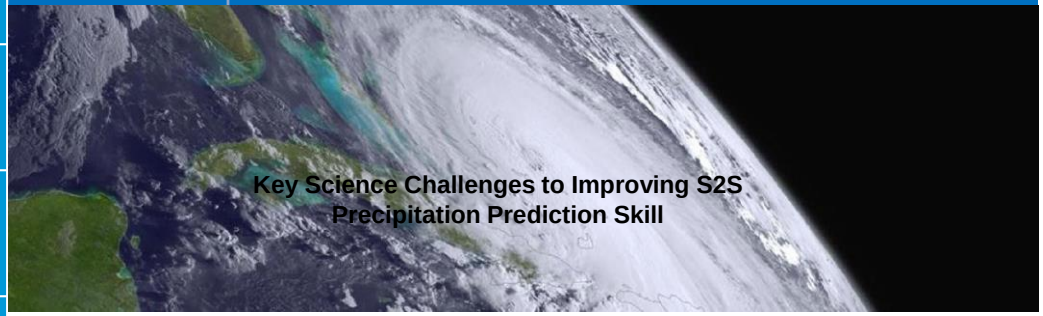


UFS Governance and Working Groups



The Earth Prediction Innovation Center (EPIC)

Overview Presentation
NOAA Weather, Water and Climate Board
Updated 7 May 2019



Weather Research and Forecast Innovation Act:

EARTH PREDICTION INNOVATION CENTER (EPIC)

Goal: To advance numerical guidance skill, reclaim and maintain international leadership in NWP, and improve the research to operations transition process

- Leverage the weather enterprise
- Enable scientists and engineers to effectively collaborate
- Strengthen NOAA's ability to undertake research projects
- Leverage existing resources in NOAA
- Create a community global weather research modeling system
  - Accessible by the public
  - Computationally flexible
  - Utilizes cost-effective, innovative strategies and methods, including cloud-based computing capabilities, for hosting and management of part or all of the system

Potential Synergies Between EPIC and Improved S2S Prediction
DGD (Personal View)

EPIC seeks to accelerate improvements in the NOAA global model (UFS) using a community-based approach.

Improvements in S2S prediction skill are strongly dependent on improving our global model.

Therefore, EPIC represent an opportunity to accelerate improvements in S2S forecast skill.