

# Global Model Test Bed: Fostering Community Involvement in NOAA's Next- Generation Global Prediction System

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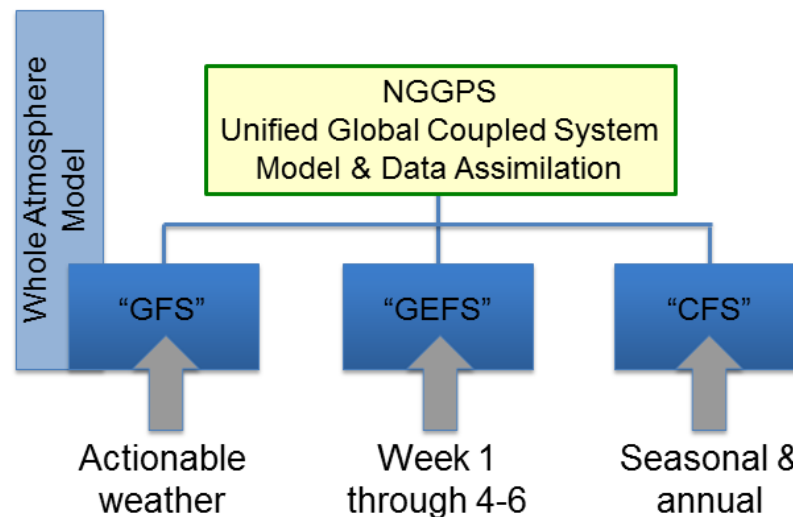
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# NOAA's Next-Generation Global Prediction System (NGGPS)

**Design/develop/deploy new unified prediction system using non-hydrostatic scalable dynamics with improved DA and physics for global applications**



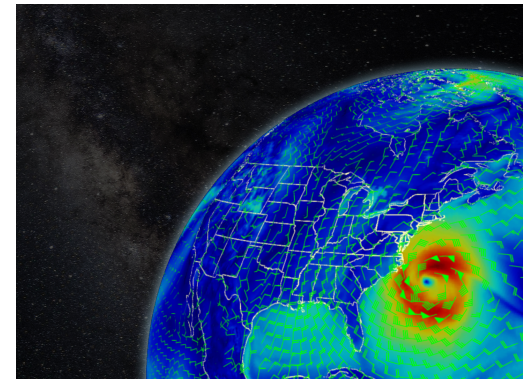
Courtesy Hendrik Tolman

**Community involvement is key to success**

# Global Model Test Bed (GMTB)

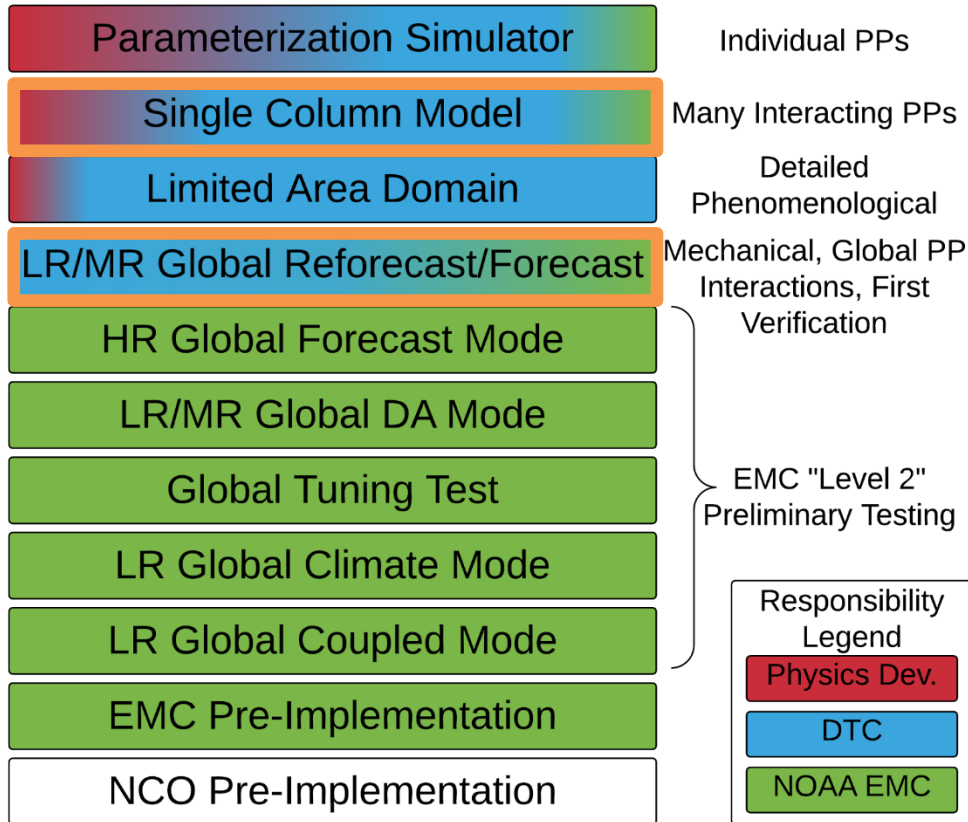
**New area within the Developmental Testbed Center  
aimed at accelerating transition of community  
developments onto NOAA's global prediction system –  
current focus in atmospheric physics**

- Development of infrastructure for testing physics
  - Hierarchical Test Bed
  - Common Community Physics Package
  - Interoperable Physics Driver
- Assessment of innovations in physics



# Physics Testbed: Hierarchical concept

## GMTB/EMC Testing Hierarchy



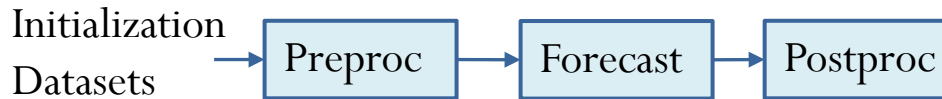
LR/MR/HR=low/medium/high-resolution

GMTB is developing a test harness (initial tiers) the research community can use for conducting tests of physical parameterizations

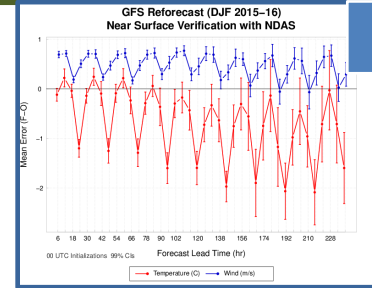
Physical parameterizations that pass initial tests can be transferred to EMC for further testing

# (Re)forecast workflow description

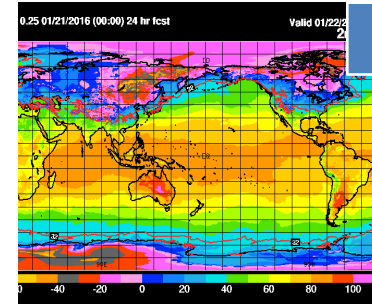
## Workflow supplied by NOAA EMC



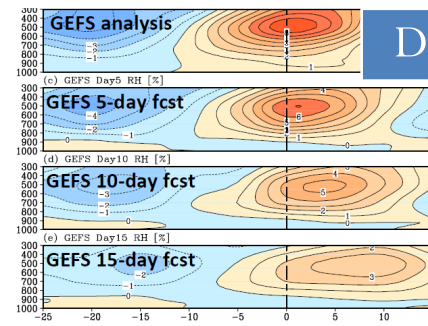
## Workflow developed by GMTB



Verification



Graphics



Diag – soon!

## Complementary workflows EMC workflow

- GMTB keeping pace with EMC procedures
- GMTB/EMC collaborate to resolve issues on both sides

## GMTB workflow

- Highly flexible and configurable
- EMC verification methods in DTC's **Model Evaluation Tools (MET)**

# Test of Grell-Freitas Cu scheme in GFS

Test plan created jointly with EMC, NGGPS Program Office, and developer (G. Grell)

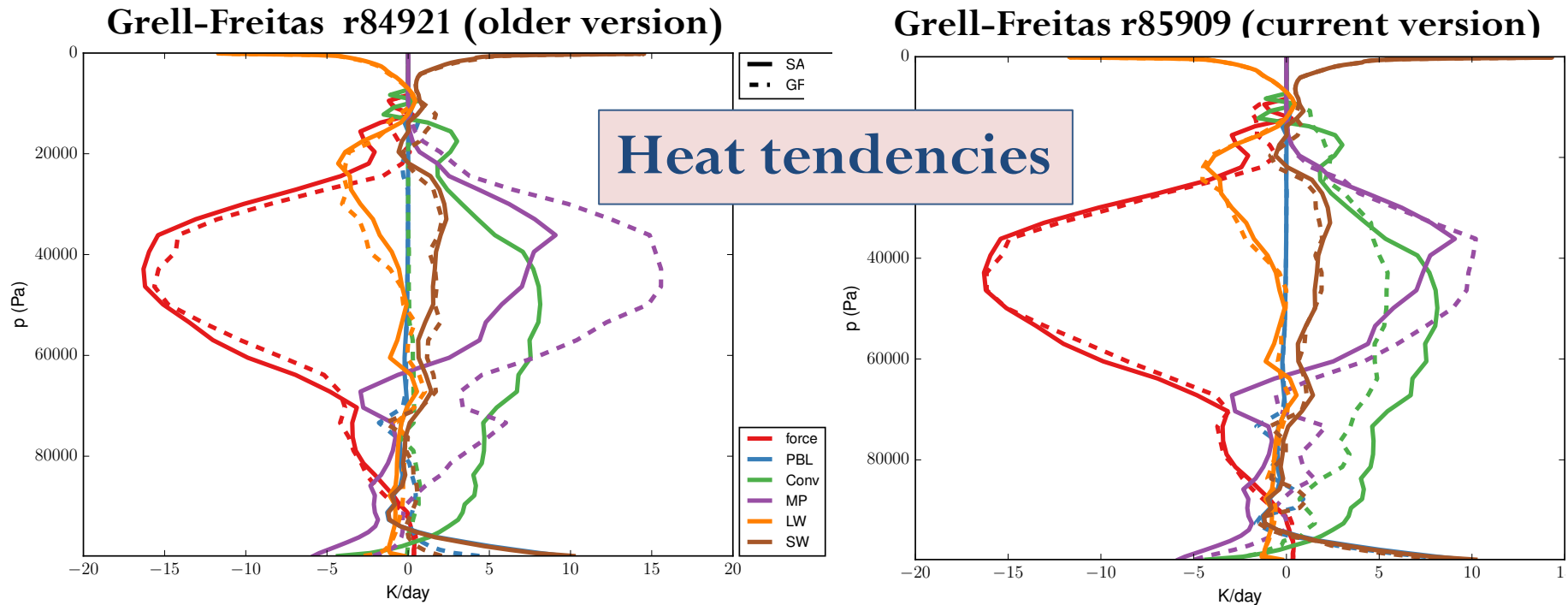
SCM	Cu	Res (km)	Run by	IC	Period
	GF SAS	~34	GMTB	GEWEX Tropical Warm Pool Summer case	1 field campaign

Global	Cu	Res (km)	Run by	IC	Period
	GF SAS	~34	GMTB	Operational GFS analyses	JJA 2016
	SAS	~13	NCEP		

Connecting GF to GFS correctly was a multi-month iterative process with developer – effort should not be underestimated!

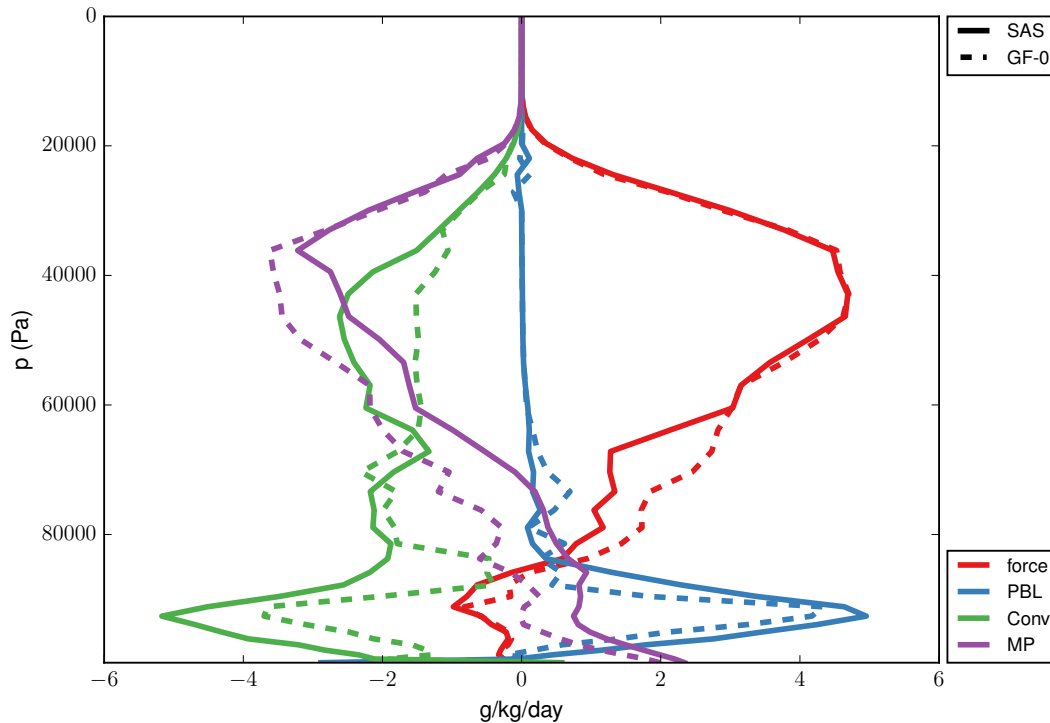
# SCM: tool to quickly identify code issues



**Problem in GF code identified using SCM, led to fix by developer:**  
Erroneous near zero deep convection (dashed green line) in implemented GF code

# SCM: tool to understand physics suite

Grell-Freitas r85909 (current version)

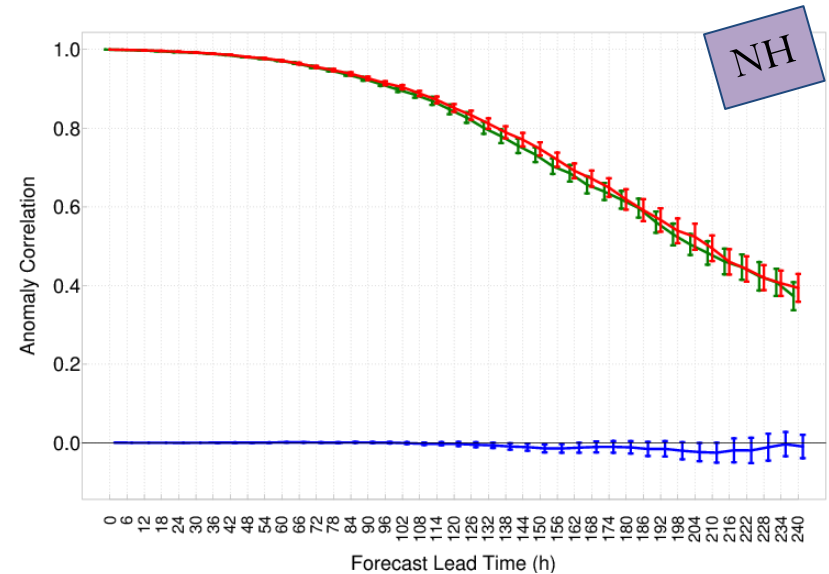
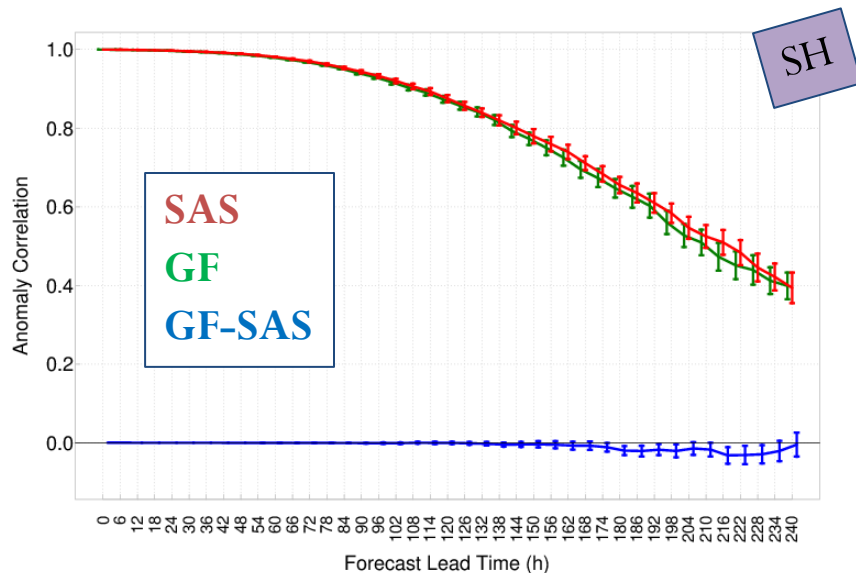


Partition between  
**convective** and  
**microphysics**: runs with GF  
let microphysics play a larger  
role

Low level equilibrium  
between **convective**  
**drying** and **boundary**  
**layer moistening**: larger  
extremes in runs with SAS



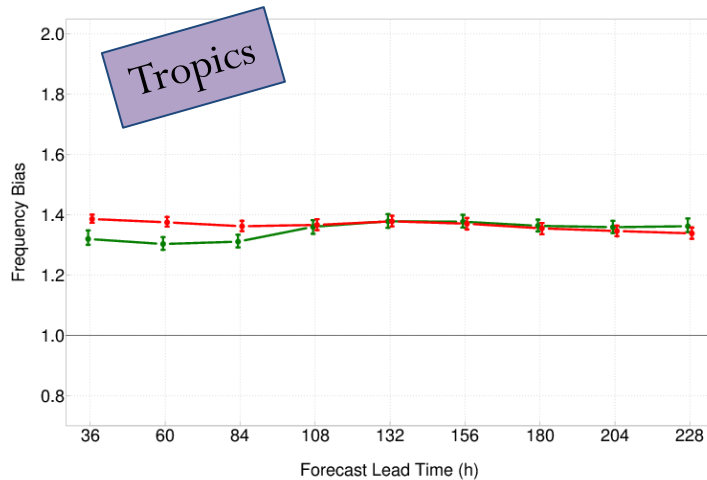
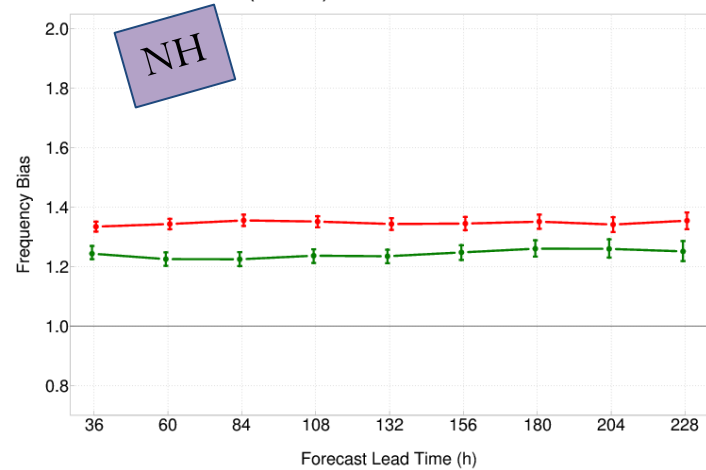
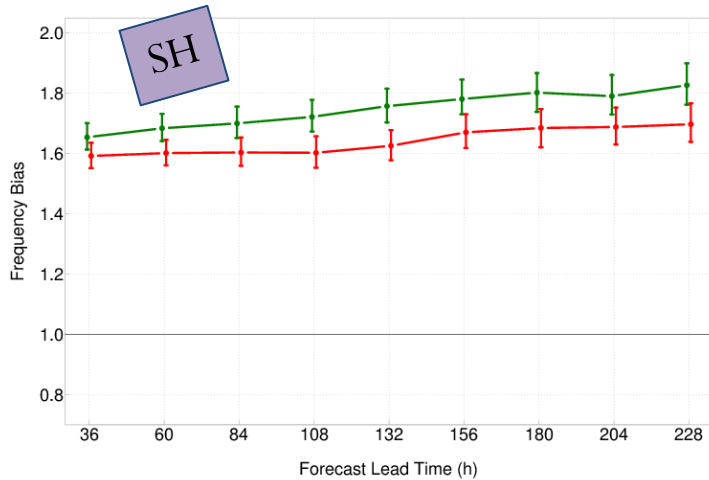
# 500 hPa height anomaly correlation



**S Hemisphere:** GF has statistically significant lower AC for a few lead times later in forecast period (but by then AC below usable 0.6)

**N Hemisphere:** SAS and GF similar

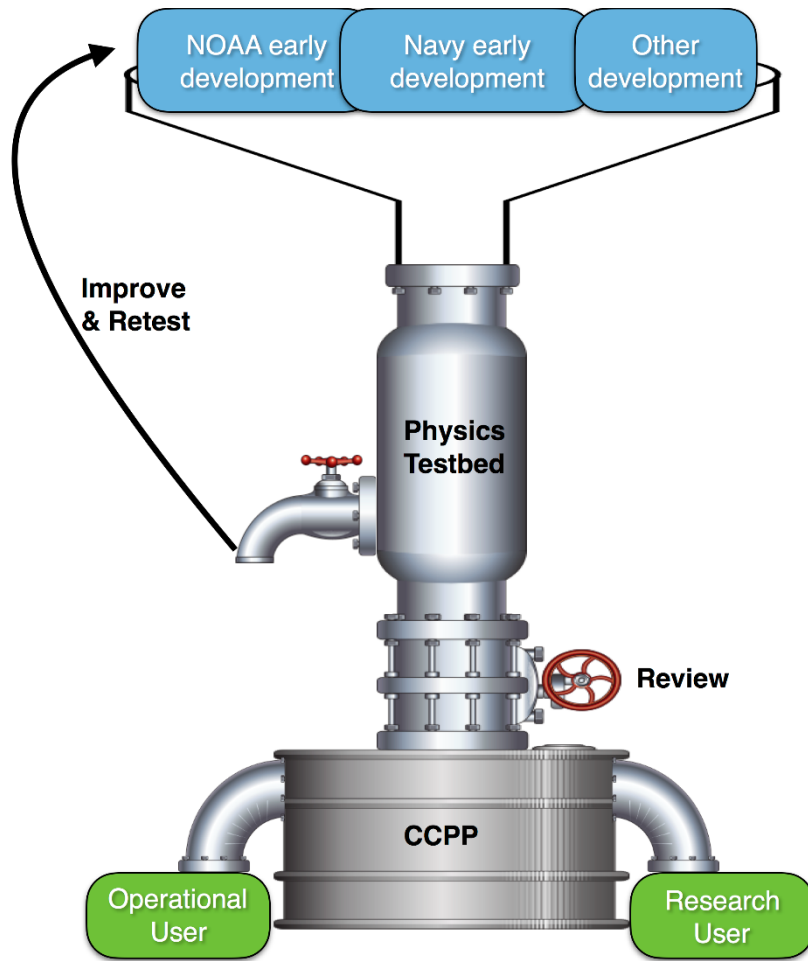
# Precipitation frequency bias (>0.25"/day)



Superior configuration depends on variable, threshold, level, lead time etc. — Results being evaluated by GMTB and EMC

Tuning of GF within GFS has not been performed — many parameters can be adjusted

# Facilitating physics testing: the Common Community Physics Package (CCPP)



**Vision:** a model agnostic, vetted, collection of codes containing atmospheric physics for use in NWP

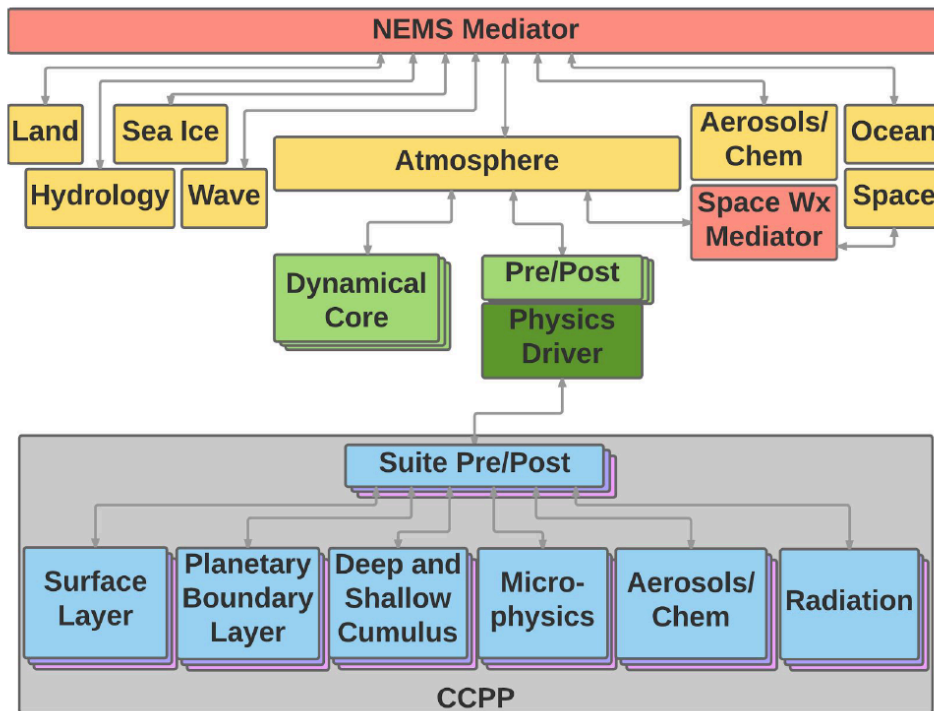
Strategy for engaging the breadth of U.S. talent needed to meet the challenge of NGGPS physics

Testing in collaboration with GMTB

Contributions evaluated with transparent, well established criteria

CCPP is entry point for R & D and operational consideration

# CCPP and Atmosphere connected via Physics Driver



GMTB and collaborators are developing an **Interoperable Physics Driver**, which allows connection of multiple models (including Single Column Model) to multiple suites within the CCPP, facilitating testing

# Wrap up

## **Main focus of GMTB is assessment of community contributions in atmospheric physics**

- Foster an environment that favors community involvement
- Support/organize community workshops
- Design and implement tools to facilitate community experimentation (such as SCM, CCPP, IPD)
- Implement and maintain testbed (for GMTB staff and collaborators)
- Conduct physics testing and evaluation