



Strategic Implementation Plan (SIP) for a Community-based Unified Forecast System (UFS)

Model Physics Working Group

Presented by

Jack Kain, NCEP/EMC

Presented at Coordination Meeting

for UFS SIP

August 2, 2018; College Park, MD



Model Physics WG Membership



- *Jim Doyle** (NRL)*
- *Georg Grell** (ESRL/GSD)*
- *Jack Kain** (NCEP/EMC)*
- *Chris Bretherton** (UW)*

****Co-Chairs**

- Jordan Alpert (NCEP/EMC)
- Jian-Wen Bao (ESRL/PSD)
- Ligia Bernardet (DTC/GSD/CU)
- Fei Chen (NCAR)
- Rob Cifelli (ESRL/PSD)
- Jimmy Dudhia (NCAR)
- Stephen Eckermann (NRL)
- Mike Ek (NCAR)
- Timothy Fuller-Rowell (CU/SWPC)
- Jongil Han (NCEP/EMC)
- Yu-Tai Hou (NCEP/EMC)
- Steve Krueger (U. of Utah)
- Shian-Jiann Lin (GFDL)
- Shrinivas Moorthi (NCEP/EMC)
- Louisa Nance (NCAR)
- Joe Olson (DTC/GSD/CU)
- Robert Pincus (CU)
- Bill Putman (NASA)
- Suru Saha (NCEP/EMC)
- Ruiyu Sun (NCEP/EMC)
- Vijay Tallapragada (NCEP/EMC)
- Joao Teixeira (JPL)
- Greg Thompson (NCAR)
- Helin Wei (NCEP/EMC)
- Fanglin Yang (NCEP/EMC)
- Valery Yudin (CU/SWPC)
- Chunxi Zhang (OU/CAPS)
- Ming Zhao (GFDL)
- Linjiong Zhou (GFDL)
- Xiaqiong Zhou (NCEP/EMC)



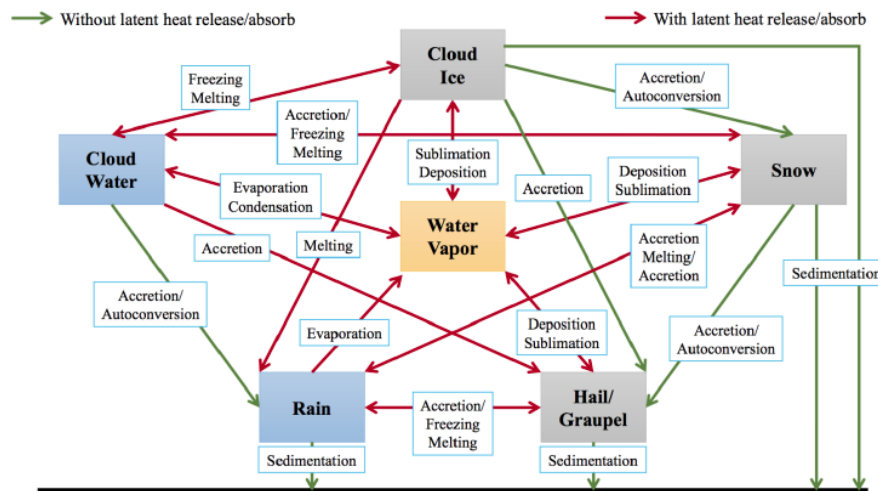
Model Physics WG

Project Milestone Accomplishments



- **SIP project accomplishments to date:**
 - **FV3-GFSv1 implementation Q2FY19**
 - Mostly GFS (GSM) physics
 - GFDL Microphysics
 - NRL O3, H2O Photochemistry Parameterization

GFDL MP at a glance

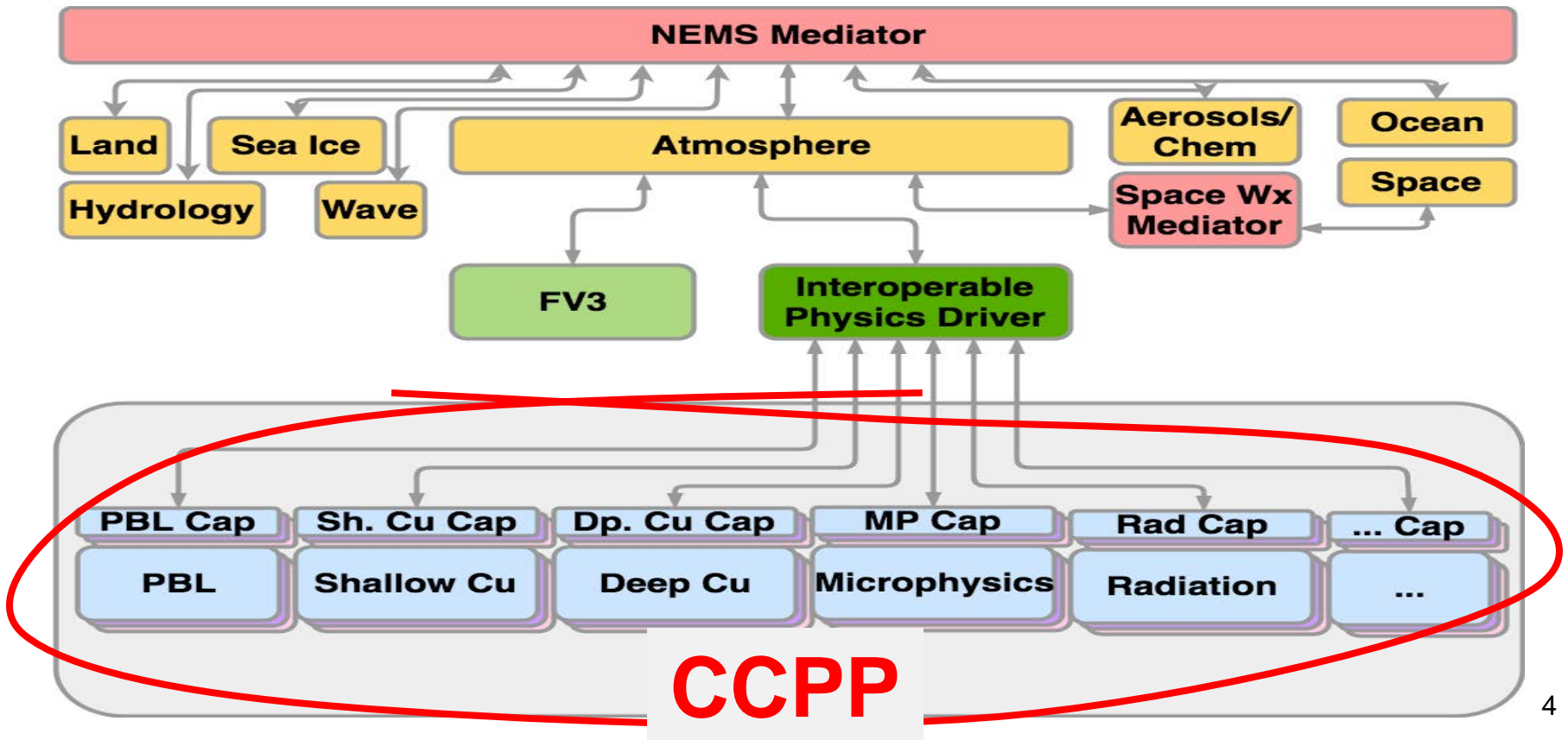




Model Physics WG Project Milestone Accomplishments



- **SIP project accomplishments to date:**
 - Development of Common Community Physics Package (CCPP) and Hierarchical Testing Framework (HTF)





Model Physics WG Project Milestone Accomplishments



- **SIP project accomplishments to date:**
 - **CCPP Developments**
 - CCPP v1 public release (April 2018)
 - GMTB Single Column Model public release (April 2018)
 - CCPP framework now in EMC VLAB Master and integrated with FV3



Model Physics WG

Project Milestone Accomplishments



- **SIP project accomplishments to date:**
 - Prioritize development/testing of two Physics Suites that are candidates to replace current (FV3-GFSv1) suite:

<u>Physical Process(es)</u>	<u>SUITE</u>		
	<u>FV3-GFSv1</u> <u>(Q2FY19)</u>	<u>RAP/HRRR</u>	<u>Climate Process Team</u> <u>EMC/CSU/Utah</u>
MICROPHYSICS	GFDL	Thompson	Morrison-Gottelman
PBL/TURB	GFS/EDMF	MYNN/EDMF	Simplified H-O Closure (SHOC)
DEEP MOIST Cu	SA-SAS	Grell-Freitas (GF)	Chikira-Sugiyama-AW (CSAW)
SHALLOW MOIST Cu	SA-SAS	MYNN/EDMF	SHOC
RADIATION	RRTMG	RRTMG	RRTMG
LAND	Noah	RUC	Noah-MP

Plus: UGWD, Noah-MP, Flake, RRTMGP



Model Physics WG Project Upcoming Developments



- **SIP WG Ongoing Efforts:**
 - **CCPP framework being regression tested in FV3-GFSv1**
 - **CCPP will provide the Physics interface for FV3-GFSv2**
 - **All high priority Physics packages will be ready for testing through CCPP in FV3GFS by Oct 1**
 - **Hierarchical Testing Framework (HTF) development will be rapidly accelerated through Hurr-Supp funding**



Model Physics WG

Team Coordination and Dependencies



- Computer resources are inadequate for full testing of physics suites
- Benefits of CCPP interface has yet to be demonstrated during the development cycle
- Hierarchical Testing Framework (HTF) still not mature enough to impact development
- Implementation timelines for new physics are very aggressive given the thorough testing required
- *Metrics WG*: Verification metrics not codified or appropriately weighted among CAM/Weather/S2S requirements
- *Land and System Architecture WGs*: Coordinate on a flexible implementation strategy for land surface (inline or component)
- *Ensemble WG*: Stochastic physics and accounting for model error
- *Aerosols and Atmos Composition*: Aerosol aware physics



Model Physics WG Project Milestone Accomplishments



EXTRA SLIDES

The Global Model Test Bed (GMTB) is funded by the NOAA Next-Generation Global Prediction System to foster community involvement in the development of NCEP's global prediction systems
Shown at NOAA/NCEP, WCRP/GEWEX, and other science meetings.

Courtesy:
Mike Ek

NCAR & NOAA Lab (Boulder) GMTB activities

1. Development and maintenance of testing infrastructure

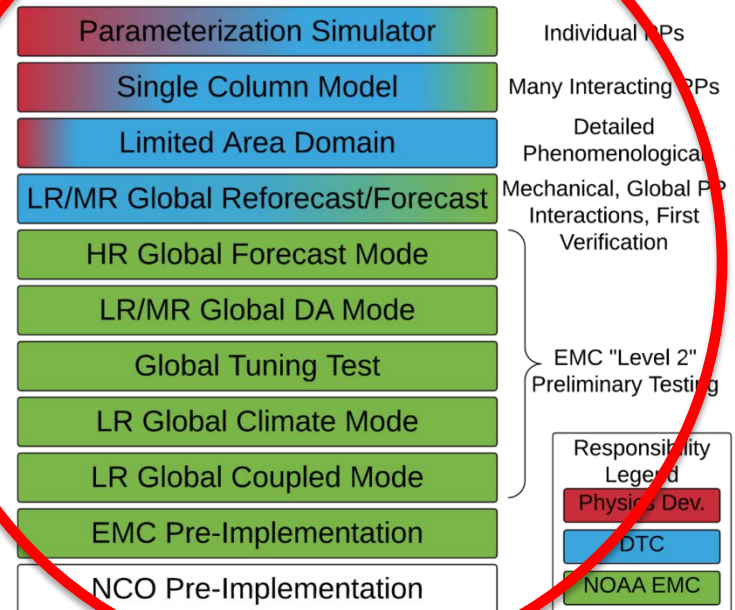
- Single column model, global workflow, verification, diagnostics

2. Testing and evaluation

2. Common Community Physics Package

- A collection of physical parameterizations, grouped in suites, that can be used with multiple dynamic cores
- A framework that enables collaborative development and R2O

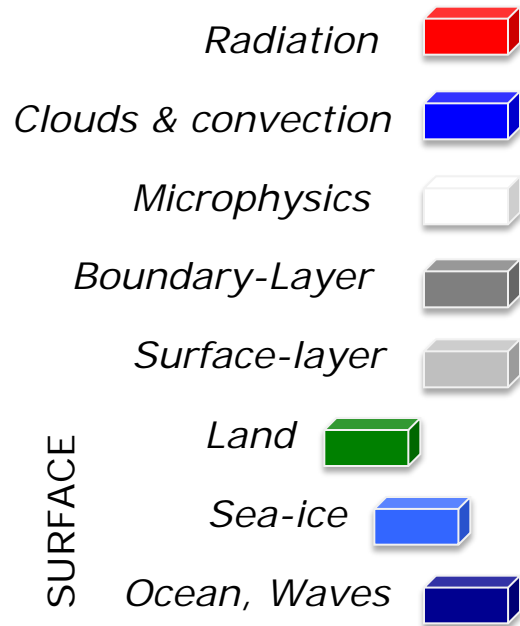
GMTB/EMC Testing Hierarchy



Hierarchical Model Development (HMD): A Simple-to-More-Complex Approach

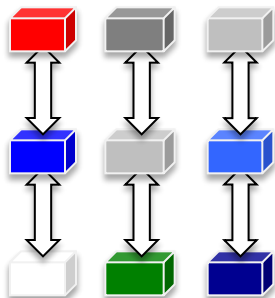
Courtesy:
Mike Ek

Simulators:

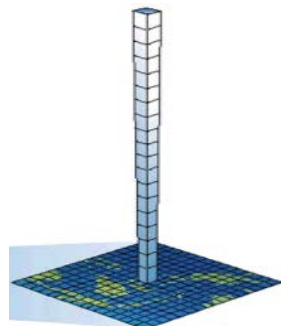


- Simulators: test subcomponents & components at process level, e.g. land-only, PBL-only, etc.
- Testbed data sets to develop, drive & validate components: observations, models, idealized, with process-level "**benchmarks**" to pass.
- Component interactions, with *add'l benchmarks*.
- Full columns, with yet additional **benchmarks**.
- Limited-Area (e.g. convection) w/**benchmarks**.
- Regional & global NWP & seasonal climate, again, with more **benchmarks**, e.g. typical NWP scores.
- **More efficient** model development, community engagement, R2O/O2R and computer usage.

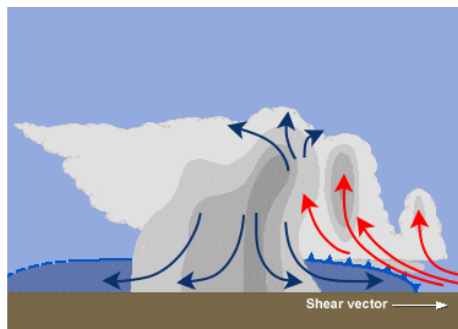
Interaction Tests:



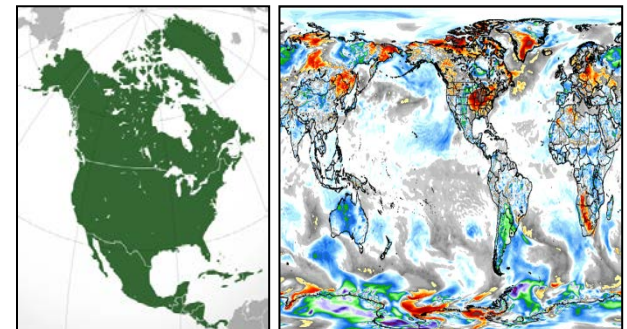
Column Tests



Limited-Area



Regional & Global





Model Physics WG

Project Milestone Accomplishments



- **SIP project accomplishments to date:**
 - summarize in single line bullets (leave the details to the verbal presentation)

Please highlight one accomplishment on a separate slide with an illustrative graphic

- **SIP project issues:**
 - summarize in single line bullets



(Title, ex “Governance”) WG Project Milestone Accomplishments



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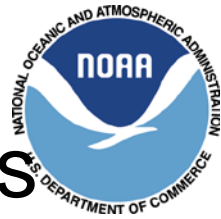
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- **SIP project issues:**
 - summarize in single line bullets



(Title, ex “Governance”) WG Team Coordination and Dependencies



- **List major team coordination/dependency successes/issues**

Limit your presentation; we want to move through the presentations so we can maximize time for discussion