Physics Working Group

Presented by

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Physics WG
Membership

- Ligia Bernardet (ESRL/CIRES/DTC)
- *Chris Bretherton** (U. Washington)*
- Arun Chawla (NOAA/EMC)
- *James Doyle** (NRL)*
- Jimy Dudhia (NCAR)
- *Georg Grell** (NOAA/ESRL)*

- *Shrinivas Moorthi** (NOAA/EMC)*
- Daryl Kleist (EMC)
- Bill Kuo (NCAR)
- Robert Pincus (U. Colorado/CIRES)
- Vijay Tallapragada (EMC)

- *Co-Chair ***

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Initial Findings

- **Guiding Principles**
  - Next-generation physics suite for NCEP/EMC needs to perform well for weather to seasonal time scales for deterministic, ensemble, & coupled applications
  - The physics suite should be scale and aerosol aware, contain the required complexity, and fully represent the key interactions between physical processes
  - Leverage expertise and advancements in the community to accelerate physics development and transition to operations

- **Strategy**
  - Coordinated development efforts centered on EMC and GMTB, in close collaboration with developers across the community (including NGGPS)
  - Common Community Physics Package (CCPP) suites using a standard interface [Interoperable Physics Driver (IPD)] with carefully vetted physics suites for global modeling applied at various resolutions and time scales
  - Comprehensive physics diagnostics, and unified (uncoupled, coupled, ensemble) standardized metrics
  - Hierarchical testing in 1D and 3D versions of the unified model as well as testing in a DA cycling mode

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Science Challenges

- Identify and include the necessary complexity in physics parameterizations
- Explore strategies for validation of physics schemes using observations and data assimilation systems and utilize these to better diagnose systematic errors that arise due to the physics
- Address grey zone challenges
- Advance the development of scale-aware physics
- Advance the development of parameterizations (unified as appropriate) for:
  - coupled earth system physics (land/hydro, ocean, ice, aerosol, atmos…)
  - deep atmosphere physics for space weather applications
- Develop improved stochastic physics using a single dynamical core and single suite of physics
- Increase the realism and complexity of the interactions between physical processes (including fluxes, radiation, cloud fractions, convection, microphysics and aerosols).

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Challenges

- **Establish unified metrics** (coupled, uncoupled ensemble) and **scorecards** that address short-range convective, sub-seasonal and seasonal scales

- **Interface with relevant testbeds** (e.g., Global Model Test Bed) to establish testing procedures to conduct evidence-based, transparent assessment of parameterizations & suites.

- **Entrain the broader research community** for effective physics development, and facilitate/enhance R2O transitions.
  - Establish a Common Community Physics Package (**CCPP**) to share physics between the research community & operational centers, and accelerate transitions to operations
  - Facilitate training for current and future physical parameterization developers

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Challenges and Barriers

- **Sufficient computational resources** (storage, ease of community access, documentation) to meet the demands of full testing and evaluation of physics in uncoupled, coupled, & ensemble applications at ops. centers and community testbeds.

- **Adequate funding resources** are needed to foster collaborations between operations and research, and to leverage new physics research in the community

- **Closely coordinated** with other key efforts: land, ocean, aerosols, data assimilation, ensemble, verification and diagnostics efforts

- **Actionable and effective decision making** to guide physics parameterization planning and development