HFIP Model/Physics Strategy

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HFIP Telecon

April 16, 2014

Outline

- **FY14-19 Regional Modeling strategies**
  - Advancements to model infrastructure: High-resolution nests with focus on multi-scale interactions
  - Regional high-resolution multi-model ensembles (S1.5DTT)
  - Ocean Model impact on hurricane forecasts (OMITT)
  - Evaluation of aircraft recon data impact (RDITT)
  - Assessment of benefits of 2-way nesting vs. 1-way nesting
  - Advanced air-sea-wave-surge-land-hydrology coupled models

- **FY14-19 Physics strategies**
  - Advanced scale-aware physics for multi-scale applications including vortex-shear interactions
  - Aerosol aware physics for radiation and microphysics
  - Development/adaptation of 3D physics schemes
  - Advanced physics for air-sea interface including impacts of waves, sea spray and ocean currents
  - Physics development closely tied with observations model diagnostics
  - Focus on RI/RW processes to accomplish HFIP goals for increased POD and reduced FAR
  - Stochastic physics to assist DA and ensemble development
  - Abandon HFIP High-Resolution Physics Tiger Team (merge with Model Strategy Team)

- **FY14-19 Global Modeling strategies**
  - Leverage Sandy Supplemental supported Global Model Development activities
  - HIWPP selection of a preferred non-hydrostatic global model for future OAR development for data assimilation and physics would be a likely focus for HFIP global modeling for the 2017-2019 period
  - Evaluate reasons for increased growth of track forecast errors beyond day-4
  - Address 7-day track forecast goals and improved TC genesis prediction goals

- **Future Operational Model Infrastructure Towards Global-to-Local Scale Modeling***
  - **Develop a self-consistent 3D->4D EnsVar DA system using cycled HWRF backgrounds with moving nests, and can be used by ARW/NMME/NMMB**
  - Adopt NMMB/NEMS framework for HWRF **---- FY15/16**
  - Accelerate transition of HWRF components to NMMB/NEMS, further increase of model resolution to ~1-2 km near the storm region **--- FY16/17**
  - Configure and test multiple moveable nests within the NMMB/NEMS framework (basin-scale HWRF) using advanced computationally efficient procedures **--- FY16/17**
  - Efficient coupling between various components within NEMS including post-processing and product generation **--- FY17/18**
  - Adopt the high-resolution nesting strategies to develop global-to-local scale modeling for hurricane forecast applications **--- FY18/19**
  - Design efficient high-resolution ensemble strategies to provide probabilistic guidance on track, intensity (including RI), size and structure forecasts **--- FY18/19**

**Partially supported by SS HIWPP project*

HFIP Modeling Strategies

- Comprehensive assessment of requirements for 2-way nesting (FY14)
  - EMC-ESRL-HRD
- Continuation of RDITT to further evaluate the impact of aircraft recon data on hurricane forecasts (FY14-15)
  - HWRF/EMC; HEDAS/HRD; ARW/PSU; HWRF/OU
- Evaluate the impact of Ocean/Wave coupling on hurricane intensity forecasts (FY14-15)
  - EMC, NRL, URI, USNA, HRD, UM
- High-Resolution Ensemble of Multi-model Regional Ensembles for 2014 Hurricane Season (FY14 & beyond)
  - EMC, NRL and GFDL
- Continue evaluating multiple hurricane models through Stream 1.5 exercise (FY14-19)
  - EMC, NRL, URI, USNA, HRD, UM

Physics Strategy

- Generate clear road map for physics development
- Make full use of observational data to evaluate the performance physics schemes, which would lead to improve the physics schemes
- Focus on developing the physics suites which can predict RI/RW more accurately.
- Focus on scale aware and feature aware physics
- Adopt Stochastic physics components to represent uncertainties in the empirical formulations of physical parameterizations and especially for high-resolution regional model ensembles

Physics Strategy

- Optimum combination of LSM/PBL/Radiation/Microphysics/Convection schemes
- Implement scale/feature/aerosol aware physics components including radiation and microphysics
- Stochastic physics and ensembles for improved RI/RW predictions
- 3-way air-sea-wave coupling for better representation of physical processes at the air-sea interface
- Coupling to advanced NOAH LSM and hydrology models for improved downstream applications
- Development of unified physics for various applications (global-to-local scale)
- **Combine Physics Strategy team with Modeling Strategy Team for better coordination**
- **Redirect High-Resolution Physics Tiger Team to focus on evaluating the deficiencies in current physics schemes to identify areas for improvement --- use all available observations and conduct systematic evaluation**
- **Focus on answering a few critical questions:**
  - **Surface physics: Stochastic nature of Cd/Ck; Sea-state dependence (waves and spray)**
  - **Microphysics: role of individual hydrometeors**
  - **PBL: Role of rolls, vertical/horizontal diffusion**
  - **Convection: Magnitude and impact of downdrafts and connection to Microphysics**
  - **LSM: Connection to surface physics**
  - **Radiation: CRF; impact on air-sea fluxes**

Model/Physics Evaluation Strategy

- Optimizing observations and observing strategies to better evaluate and improve model physical processes focused on HWRF
  - Improve forecast performance through a systematic evaluation process, whereby model biases are documented, understood, and ultimately eliminated by implementing accurate, observation-based physical parameterizations.
  - Compare operational model output with similar, observationally-based corollaries over appropriate spatial & time scales (e.g. air-sea interaction, boundary layer, etc.)
  - Identify processes/areas that are poorly evaluated due to inadequate sampling
  - conduct process-oriented simulations to improve physical understanding and better quantify model sensitivity and variability
- **Action: Develop a plan, milestones and timelines for model/physics evaluation.**