HFIP Milestones/Deliverables

Note: “Better Understanding of”, “Begin to..”, “Improve ..”, not good choices for wording

HFIP Workshop

November 9-10, 2009

Stream-1 Topics/Issues

- Over intensification esp. sheared systems
  - Perform inter-model (HWRF, GFDL, HWRFx, CoAMPS, GFS) comparison of environmental shear evolution, vortex response, for 2009 storms , also stream 2 (2)
- Minimum resolution to resolve convection
  - Increase resolution or fix parameterization?
  - Oper. Goal for 3 to 4 km real time run by 2012
  - <1 km by 201x
- Development of advanced physics for high resolution
  - Microphysics, surface fluxes, PBL, wave/ocean, radiation, convective parameterization, gravity wave drag
  - Determine impact of gravity wave drag with further diagnostic studies of HWRF re-runs (1)

Stream -1 Topics/Issues

- Data assimilation, especially for regional models
  - For global models, determine impact of including eye dropsonde input (1)
  - Comparison of techniques
    - EnKF, 4Dvar, hybrid, digital filtering, nudging
    - When will inner core assim. be available in real time?
  - More emphasis on satellite data
  - What data is needed for very high resolution model?
  - Special challenges for coupled systems
- Vortex initialization
  - Develop generalized vortex initialization that also works for weaker/sheared storms (fy10 work for possible fy11 oper implementation, Emphasis on 9 km model (1)
    - Use GFS EnKF as baseline (1)
  - Determine what additional information from the existing NHC model input (CARQ) data can be used for vortex initialization (1)
  - Develop confidence indicators for CARQ data (1)
- Role for OSSEs?
  - Optimal mix, targeting strategies

Stream 1 Topics/Issues

- Detailed analysis/diagnostics of model runs
  - Kinematics and thermodynamics
  - Vortex 3-D structure
  - Large scale
    - Systematic biases
    - Circulation features; sub-tropical high, TUTT, trades, etc
  - Evaluation against observations
    - In situ and remote sensing
  - Hold workshop to create multi-scale diagnostic framework for addressing model biases and errors (1)
  - Create tools for generating synthetic passive/active microwave and IR imagery from model output (2)
  - Compare available observations (e.g., aircraft flight level winds) to model forecasts for 2009 forecast cases (1)
- Ensemble forecasts
  - Methods for generating perturbations
    - Initial condition, physics
  - Global versus regional
  - Configuration
    - Resolution versus ensemble size, ocean coupling
  - Information content and NHC forecast applications

Stream 1 Topics/Issues

- Ocean model
  - What complexity is needed?
    - Resolution, assimilation, physics
  - Perform comparisons of coupled model forecasts with varied ocean models, including no coupling (also stream 2) (1 to 2)
  - "Ground truth" ocean model/assimilation performance using in situ and remote sensing data (2 or 3)
  - Evaluate impact of ocean model input on statistical intensity models (1 or 2)
  - Trade-offs with atmospheric component
- Land surface model
- Ocean, wave, storm surge
- Coordination of HWRF and CoAMPS efforts
- Administrative issues
  - Provide community support for HWRF

Stream 1 Topics/Issues

- NCEP EMC and NCO constraints
  - Current computing at NCO through FY13
  - Competition for resources
    - Space Wx, Nexgen, tsunami, etc
  - GFS changes have downstream influences
  - ~1.5 year cycle for implementations
  - Increase bandwidth through HFIP interaction
  - How can stream 2 influence stream 1?

Stream 1 Topics/Issues

- What observations are needed?
- Determine what observations are needed, what form and tools, priorities (current and future)
- Establish service to provide access to and distribute data and model output (1)
- Separate coordination for storm surge
- (See also obs team input)
  - Assimilation
  - Verification
    - Use mobile platform/instrument data to evaluate model forecasts at or near the coast (e.g., DHC)
    - Develop techniques for verification using non-traditional, non-uniform data
  - Model evaluation (including parameterizations)

Stream-2 Topics/Issues

- Data assimilation, Initialization
  - Global and regional
  - Inner core issues
  - Develop methods for assimilation of inner core observations (5)
    - Nonlinear/non-Gaussian errors
    - Representativeness
  - Create error covariance matrices suitable for inner core ?? (3)
  - Inclusion of model uncertainty
  - Assimilation resolution versus model resolution
  - Full utilization of satellite data
    - Develop plan for utilization of GOES-R and NPOESS
    - Develop more accurate height assignment for satellite feature track winds
  - Revise aircraft (e.g. G-IV) data collection strategies to account for new sensors and results from OSSEs, data denial experiments (3)

Stream-2 Topics/Issues

- Physics
  - Advanced parameterizations, better diagnostics
  - Obtain sfc fluxes, wave properties, sea spray and near surface and boundary layer wind speed, T, q for testing and evaluation (4)
    - Leverage field programs
  - Obtain new data for microphysical/aerosol parameterizations
- Ensembles
  - Hold workshop on TC ensemble applications
  - Run and evaluate 15 km global ensemble to address trade-off issues
  - Design including initial condition and model errors
    - Determine best methods for perturbations for ensembles and diagnose perturbations from existing methods (storm and environment)
  - products, downscaling, decision support
  - Verification
    - Define set of metrics for verification besides ensemble mean
  - Bias corrections
  - Inter-model comparisons
  - Regional models running off different global models
  - Embed statistical intensity models in global model ensembles
- Model numerics
  - Reduce numerical noise from model (1)
  - Develop and test numerical methods that are compatible with physical parameterizations at high resolutions needed for TCs
  - Optimize scalability

Stream-2 Topics/Issues

- Resolution requirements (horiz, vertical) trade-offs
  - Perform comparison of HWRFx at three horizon. resolutions (1)
  - Test impact of vertical resolution (also stream 1) (2)
- Predictability limits for track, intensity, structure
  - Evaluate predictability of statistical TC intensity prediction
  - Develop methods for using model ensembles, adjoints for estimating predictability
  - Determine if “chaos” or other physically based methods can be used to estimate TC intensity predictability
- Ocean model complexity
  - Develop and test coupled ocean/atmos global model forecasts (3)
  - Develop and test coupled ocean/atmos/wave/surge regional models (4)
- Genesis and ET (extra-tropical) issues
  - Perform validation and diagnostics of TC genesis/ET in global and regional models (1)
- Diagnostics
  - Assess model response to shear through idealized model studies, comparison with data, especially inner core (3)
- What observations are needed?
  - Use of special field programs (GRIP, PREDICT, etc) for validation, diagnostics
  - Assimilation
- FY10 demo configuration
  - Database including ensembles