Synthesis

NCAR director Jim Hurrell has charged us with with developing a roadmap and implementation plan for developing a single atmospheric modeling system that will be supported to the community for most of NCAR's weather and climate applications.

Implementation Caveat: Because it will take time to develop a single modeling system and workflow to match existing usability, start with moving towards interoperable components (dynamical cores, physical parameterizations, software infrastructure components, analysis tools, etc.) and data formats (e.g., for model initial conditions).

Goals

Reproduce a majority of the existing weather and climate prediction capability in a unified system, and provide global nonhydrostatic coupled earth-system modeling capabilities for weather and climate applications.

Climate

- Understand the mechanisms that lead to interdecadal, interannual, and seasonal variability in Earth's climate.
- Apply this modeling system to estimate the past and likely future of Earth's environment

Weather

- Provide a flexible weather simulation tool for the community that enables construction of forecasts, as well as a research and development capability
- Data assimilation capabilities to initialize the model
- Key phenomena: Hurricane Prediction, Convective Weather Prediction, Antarctic Prediction

Geospace

- Improve forecasting of space weather hazards and their impacts on the Earth, people, and technology.
- Characterize and evaluate the impact of solar variability on the coupled terrestrial and space climates.

Enable frontier weather to climate science at NCAR and in the community

- Mesoscale (Weather) processes in the coupled system:
    - Subseasonal to Seasonal (S2S) prediction: including global scale phenomenon such as ENSO, QBO, MJO, Monsoons
    - Land-Atmosphere Interactions
    - Tropical Cyclones and Other extreme events (Convection)
    - Chemistry-Atmosphere interactions (volcanoes, fires, urban emissions)

    - Atmosphere-Ionosphere interactions (ionospheric disturbances and instabilities
- High resolution climate impacts
    - Regional climate extremes
    - Extreme weather phenomena under climate change
- Provide an atmospheric model capability for a unified earth system
    - geospace
    - chemistry
    - coupled earth system modeling

Push the frontiers of atmospheric simulation science

- Develop and coordinate ‘unified’ (and convergent) physics that works across scales, and encourage its development with community partners
- Multi-scale (weather to climate) validation and evaluation tools
- Robust common frameworks for more efficient computation, development and testing
- Education and training to grow user base and educate next generation of forecasters and scientists