

# Experimental Prediction

# Observations to Understand Limits to Intensity Predictions

- Atmosphere
  - Development of a comprehensive database for validation of numerical models
    - In situ measurements
      - Microphysics, wind, thermodynamics, rain
    - Remote sensing
      - Coastal radar, airborne,
      - Satellite
- Interface
  - Air-sea fluxes
  - Wave field
  - Surface wind stress
  - Land surface fluxes
  - Observational mesoscale network (enhanced radar, met stations) – rugged, autonomous
  - Rain – storm surge
- Ocean
  - Network of tide gauges
  - Currents, temps, salinity, altimetry

# Modeling to Understand Predictability

- Development of appropriate metrics for intensity over the ocean and landfall
- Determine the practical and intrinsic predictability limits using appropriate coupled atmosphere/ocean model
  - Ensemble and data assimilation approaches
  - Phenomenon - dependent predictability limits
    - Rapid intensification and decay
    - Inner-core dynamics and thermodynamics
    - Storm - environmental interactions

# Appropriate Model Configurations

- Develop and validate skillful deterministic intensity/structure prediction models
  - Fully coupled (atmosphere-wave-ocean-land)
  - Appropriate physics parameterizations
  - Required horizontal and vertical resolution
- Develop appropriate 4-D data assimilation technique for coupled model
  - Improved initialization for hurricane models
  - Sensitivity for parameter estimations
  - Database of “ground – truth” analysis [state estimation]
- Development of probabilistic prediction techniques
  - Ensemble prediction system
  - Feature-based statistical methodologies – accounting for propagation and structure changes separately

# Priorities for Improved Hurricane Intensity/Structure Prediction Models

## Highest Priorities

- More 3-D, real-time, accessible, quality-controlled observations in the core of the hurricane
- Skillful 4-D data assimilation for atmosphere and ocean initialization (e.g., ensemble Kalman filter and 4-D variational techniques)
- Very high resolution (1km) for atmosphere, (1/24<sup>th</sup> degree) time-dependent ocean

## High Priorities

- Implementation of spatially-compatible physics appropriate for coupled ocean, interface, hurricane model
- Distributed high performance computer resources for multiple centers producing skillful intensity/structure prediction models
- Develop functional, interoperable databases for sharing model fields
- Developing appropriate forcing for less than 1 km wave & surge in the coastal areas