



Integration of the NASA CAMVis and Multiscale Analysis Package (CAMVis-MAP) For Tropical Cyclone Climate Study

PI: Bo-Wen Shen, University of Maryland College Park

Objective

Develop a scalable, multiscale analysis tool, based on the Coupled Advanced multiscale Modeling and Visualization system (CAMVis), to improve extended-range tropical cyclone (TC) prediction and consequently TC climate projection by enabling:

- Understanding of the TC genesis processes, accompanying multiscale processes (both downscaling by large-scale events and upscaling by small-scale events), and their subsequent non-linear interactions.
- Discovery of hidden predictive relationships between meteorological and climatological events.

This project would enable use of data from the ACE, PATH, SMAP, Next-generation scatterometer, and 3D-Winds missions.

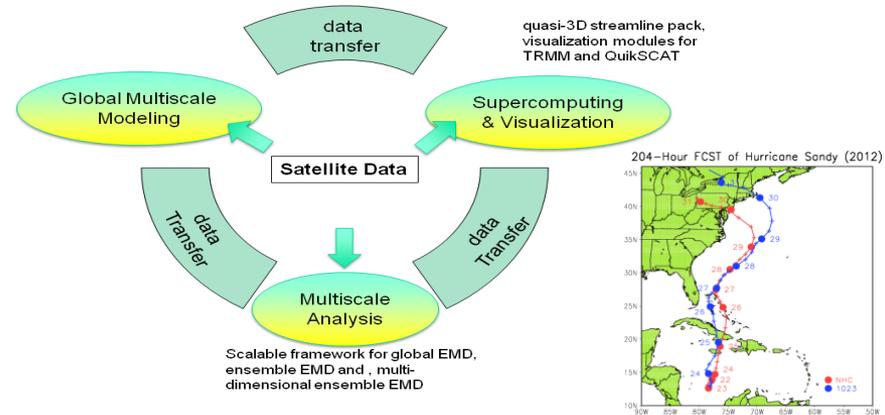


Diagram of integrated CAMVis (top two components) and Multiscale Analysis Package (MAP, bottom) (Center)
204-hour prediction of Hurricane Sandy (Bottom Right)

Approach

Integrate the CAMVis, satellite data modules, and data analysis algorithm on NASA supercomputing facilities. Major tasks include:

- Develop a scalable Multiscale Analysis Package (MAP) that includes the NASA state-of-the-art Hilbert-Huang Transform (HHT), improved multi-dimensional Ensemble Empirical Mode Decomposition (EEMD), stability analysis tools, and conventional methods (e.g., principal component analysis, PCA).
- Integrate the MAP with models and satellite data modules (e.g., TRMM, QuikSCAT, and GPM) of the CAMVis (CAMVis-MAP).
- Apply the coupled system to conduct multiscale time-frequency and/or space-wave number analysis on long-term satellite and/or model data with the aim of studying TC climate.

Co-Is/Partners

Samson Cheung, CSC; Piyush Mehrotra, ARC; Yu-Ling Wu, UAH; Jui-Lin Li, JPL; Wei-Kuo Tao, GSFC

Key Milestones

- | | |
|---|-------|
| • Port and test EEMD codes on NASA supercomputers | 11/12 |
| • Conduct initial multiscale analysis with TC events | 05/13 |
| • Develop a scalable MAP with two-level parallelism for EEMD | 05/13 |
| • Improve the MAP to operate on specified regions | 05/13 |
| • Implement third-level parallelism in "global" MAP (2K-3K cores) | 11/13 |
| • Design layout of output representation and visualizations for multi-dimensional time-frequency and space-wave number diagrams | 05/14 |
| • Integrate MAP, satellite modules, hurricane tracking codes, etc. | 05/14 |
| • Streamline data flow for production runs; test system | 11/14 |
| • Conduct multiscale analysis with multi-year data from global reanalysis, model simulations and satellite data | 05/15 |

TRL_{in} = 3 TRL_{current} = 3