Observing System Simulation Experiments (OSSE)

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Why an OSSE?

An OSSE is a modeling experiment used to estimate the **potential improvement** to numerical weather forecasts when a **new type of observation** is introduced. OSSEs help to more efficiently develop new observation types to **improve numerical weather forecasts**.

OSSE Impacts

- Determine the best way for NOAA to use new observing systems
- Guide requirements for instrument development

Benefits of OSSEs

- Much less expensive and easier than investing in a new observation system
- OSSE system can test the potential impact of a wide range of new observing systems
- Faster integration of new observations into operational models

Figure 1. Global Hawk high-altitude UAS (left), which will fly with a tail-mounted pod to deploy NOAA dropsondes (right).

OSSEs for NOAA's Unmanned Aircraft Systems (UAS) Program

The NOAA UAS Program is investigating the feasibility of using UAS to improve numerical weather prediction, with a particular emphasis on increasing lead time and **accuracy for hurricane track and intensity forecasts** to reduce loss of life and economic damage from the storms.

The UAS OSSEs will investigate which platforms and instruments will yield the greatest forecast improvements. The OSSE will also be able to provide guidance for optimal flight paths and sampling strategies for UAS missions.

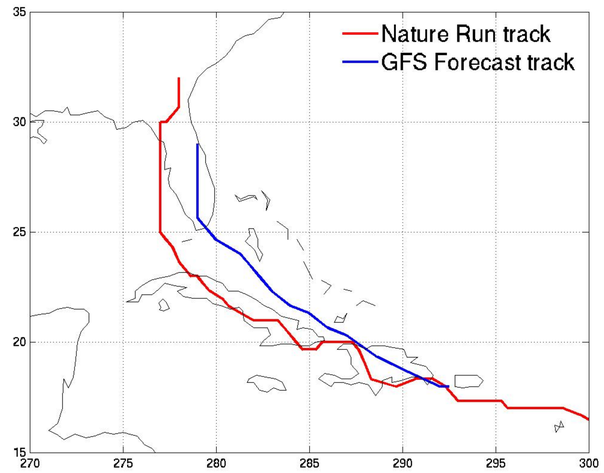

Figure 2. Track of an Atlantic tropical cyclone in the European Centre for Medium-Range Forecasts (ECMWF) Nature Run (red line). The GFS forecast track (blue line) for this storm for August 22 00Z, shows significant track error.

Global OSSE for Hurricane Track

- Initial experiments will focus on the Genesis and Rapid Intensification Process (GRIP) NASA Global Hawk mission
- Joint OSSE collaboration with ECMWF, National Aeronautics and Space Administration (NASA), National Center for Environmental Prediction (NCEP), the United Kingdom Met Office (UKMET), the National Environmental Satellite, Data, and Information Service (NESDIS), and ESRL
- Experiment results expected in summer 2010 for UAS dropsonde and radiometer missions

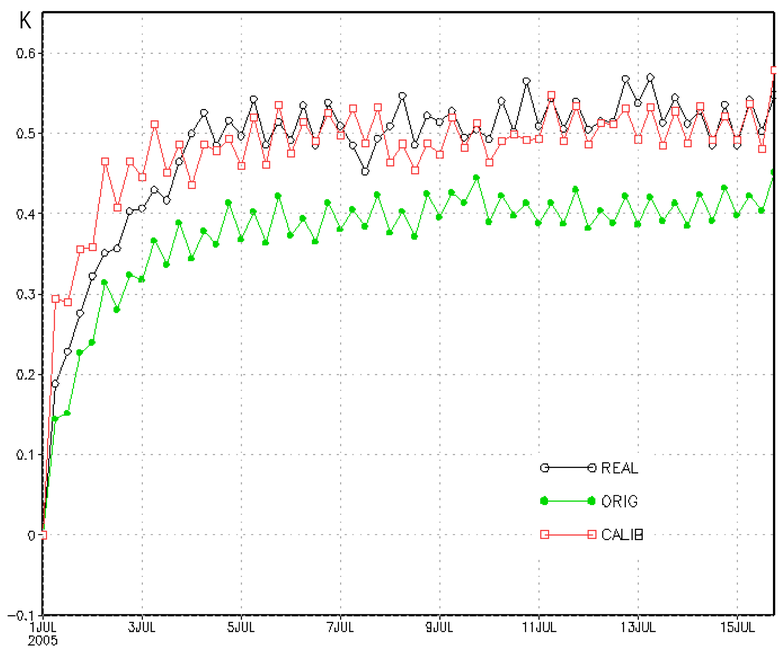

Figure 3. Data denial tests show that the calibrated model temperature observations (red) behave similarly to real data (black) in comparison to the uncalibrated model data (green).

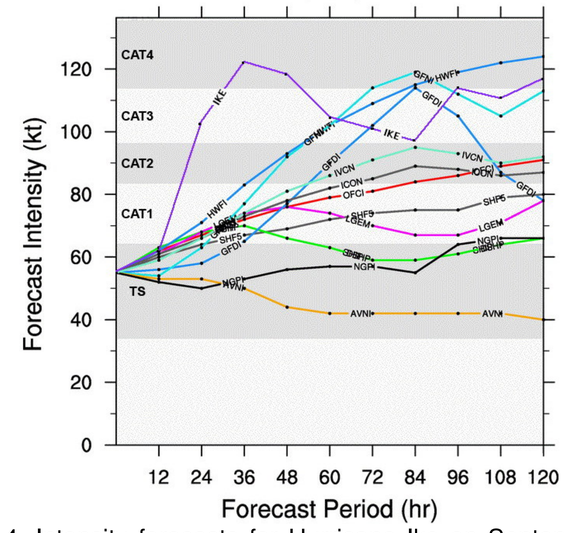

Figure 4. Intensity forecasts for Hurricane Ike on September 3 2008. The operational models fail to predict the rapid intensification of Ike on September 4 to a category-4 storm (purple).

Regional OSSE for Hurricane Intensity

- High resolution modeling at ESRL with the Weather Research and Forecasting model (WRF-ARW) and Hurricane WRF
- Collaboration between NASA's Global Hydrology and Climate Center, Atlantic Oceanographic and Meteorological Laboratory (AOML), and ESRL
- Results will inform NOAA planning for UAS acquision and manned aircraft deployments

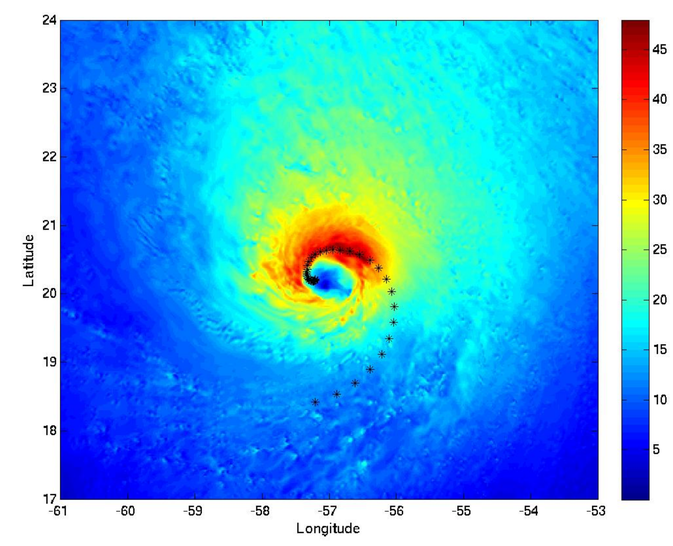

Figure 5. Synthetic flight path (black dots) of a low-altitude UAS in Hurricane Ike. The flight level wind speed is shown in color.

Summary

OSSEs are a valuable tool for NOAA to effectively and efficiently evaluate and design new observing systems to improve numerical weather forecasts.