WISDOM: Predictive Maps and Visualization

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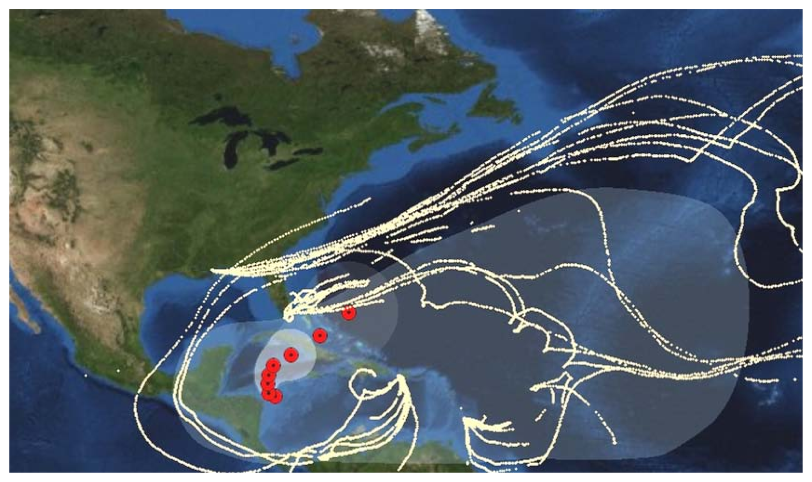
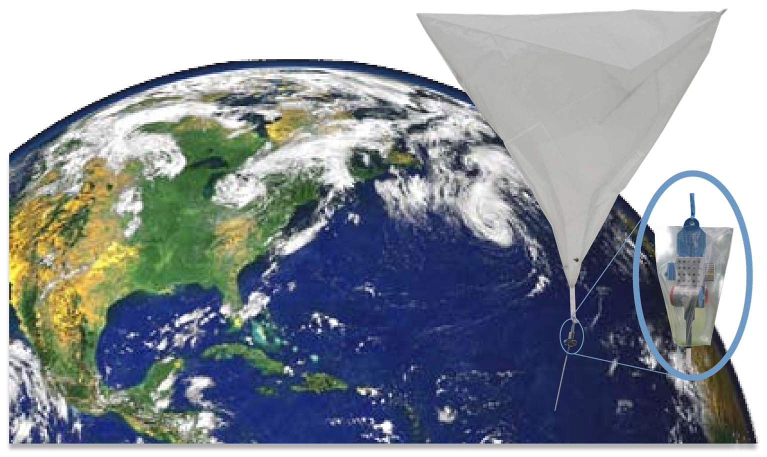
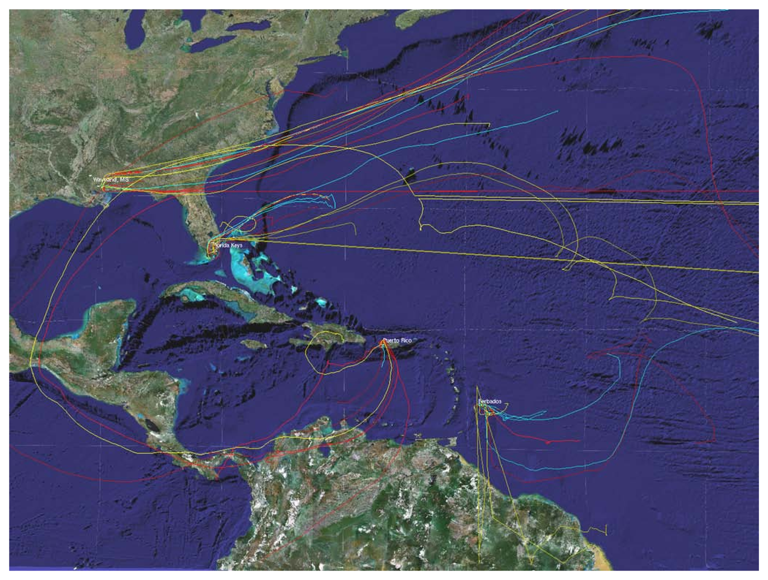
WISDOM

Weather **I**n-Situ **D**eployment **O**ptimization **M**ethod: Improve (WISDOM) tropical storm track forecasting by launching enough horizontal balloon sondes in the data poor region of a hurricane's synoptic environment (Weather In-Situ) to monitor the atmospheric steering currents at 12,000 and 25,000 feet. In addition to GPS, updated sensor package for 2009 included pressure sensors to monitor atmospheric pressure at float altitudes. Other sensors (temp, wind data, humidity) can be added in the future. There were ten launch sites for 2009 (vs four for 2008).

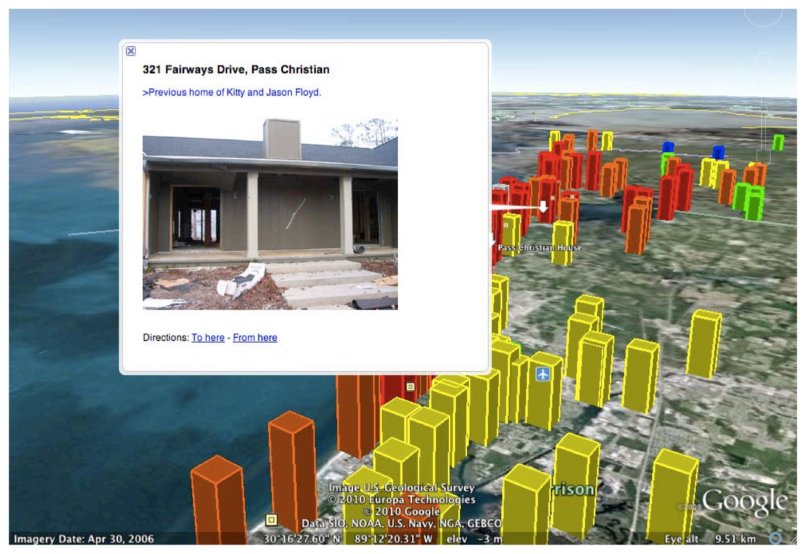
Success Story: Two predictive storm models used balloon data to increase their accuracy and decrease their cone of uncertainty.



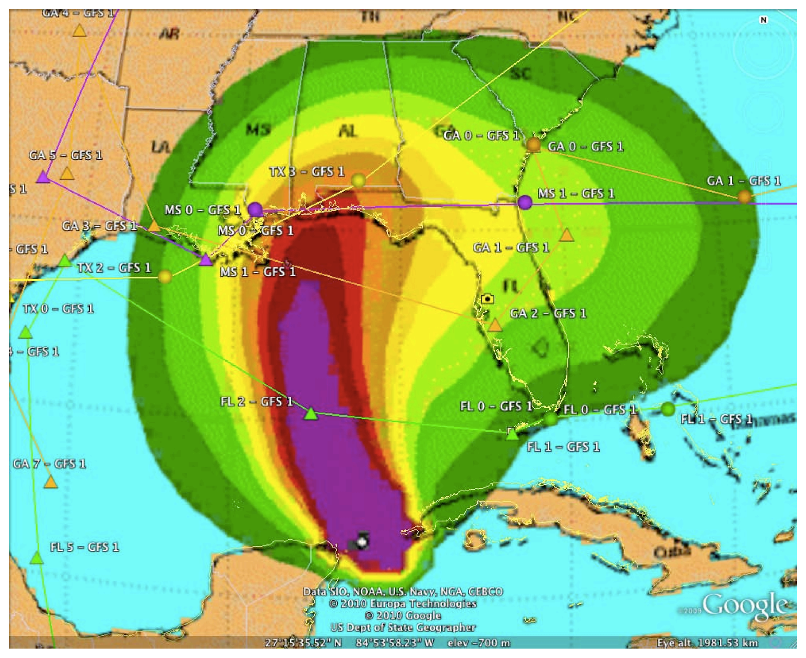




Predictive Maps



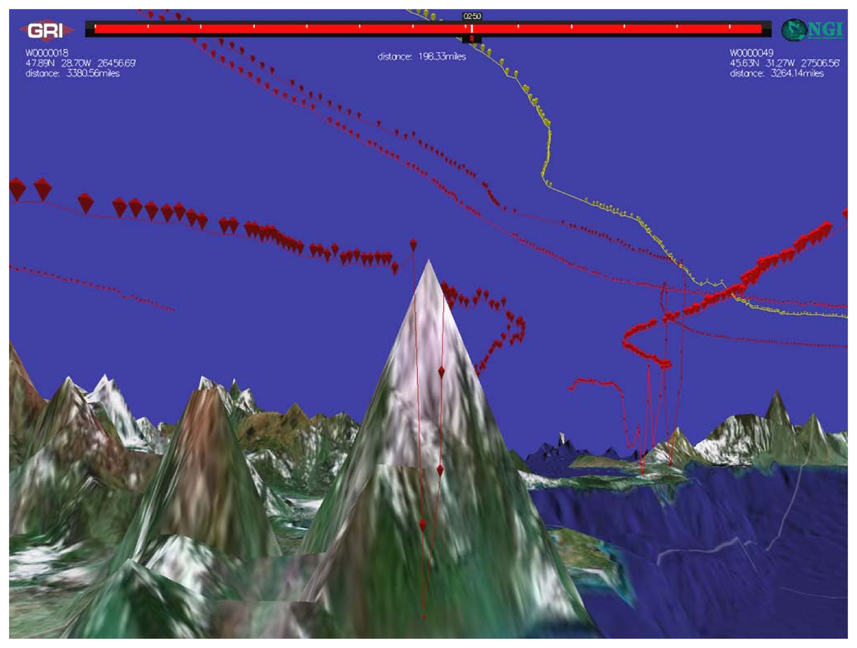
Success Story: The predictive maps allowed the balloons to be strategically launched at the correct time and location to intersect Hurricane Ida (2009). Hurricane Ida was the most intensely measured storm to date.



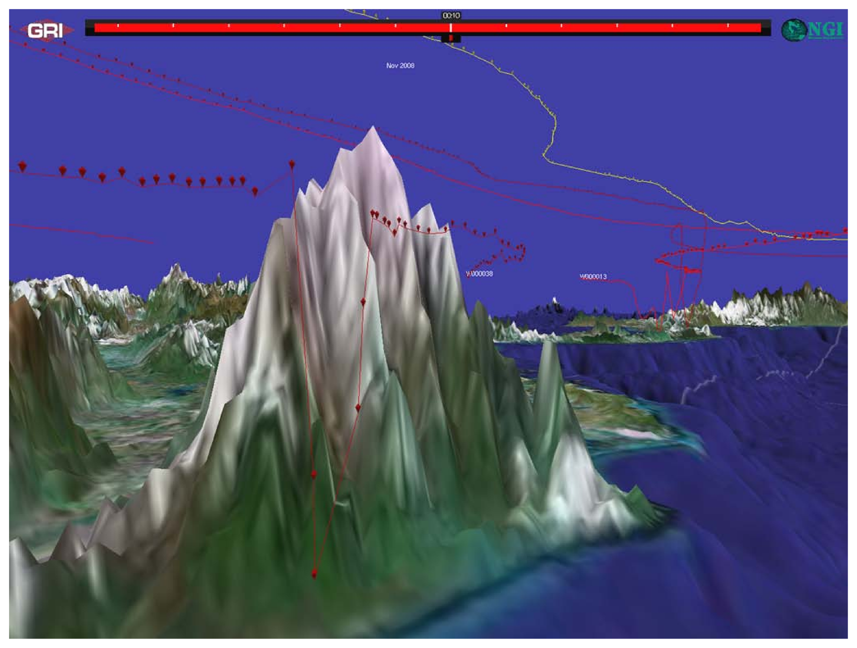
We developed **A** **G**oogle Earth **A**utomated **V**isualization **E**nvironment (AGAVE) in our first-year NGI project in 2007 to automatically generate KML files to view various catastrophic weather events. Using a PHP-based web interface, users could select desired data (e.g., storm surge, hurricane track) and desired visualization elements (e.g., push pins, image overlays) and create a KML on-the-fly with no programming required.

We updated AGAVE to provide an automatically generated KML file for visualizing predicted balloon locations. The resulting predictive maps were used to determine when and where to launch balloons to improve the odds of the balloons intersecting the storm system. As opposed to 2008, when balloons were released from all launch sites, the balloons in 2009 were deliberately launched from strategic sites. The pre-launch models allowed the balloons that were launched to better fill the data void over the Atlantic Ocean.

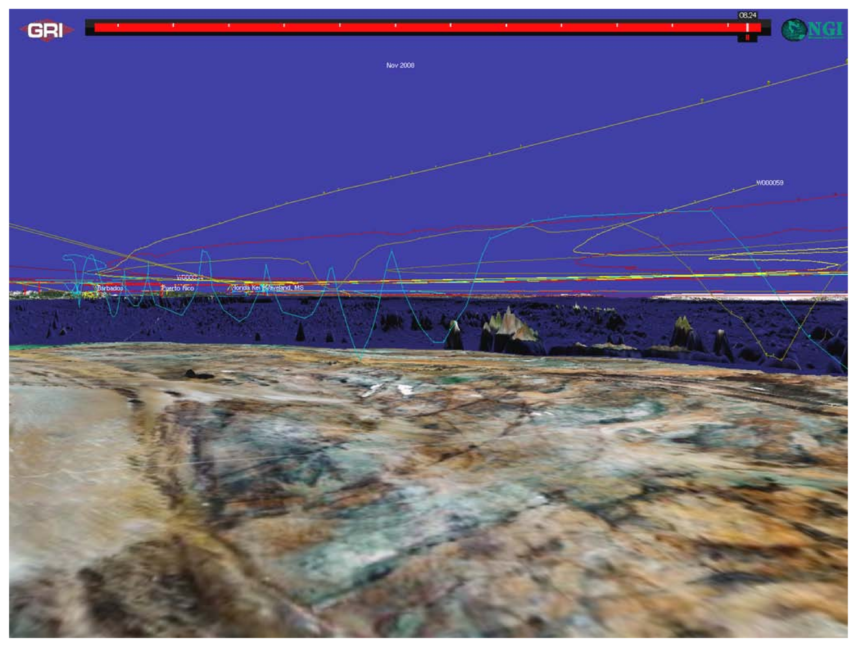
3D Visualization



Balloon drops beside low-resolution terrain.



Balloon drops beside high-resolution terrain.



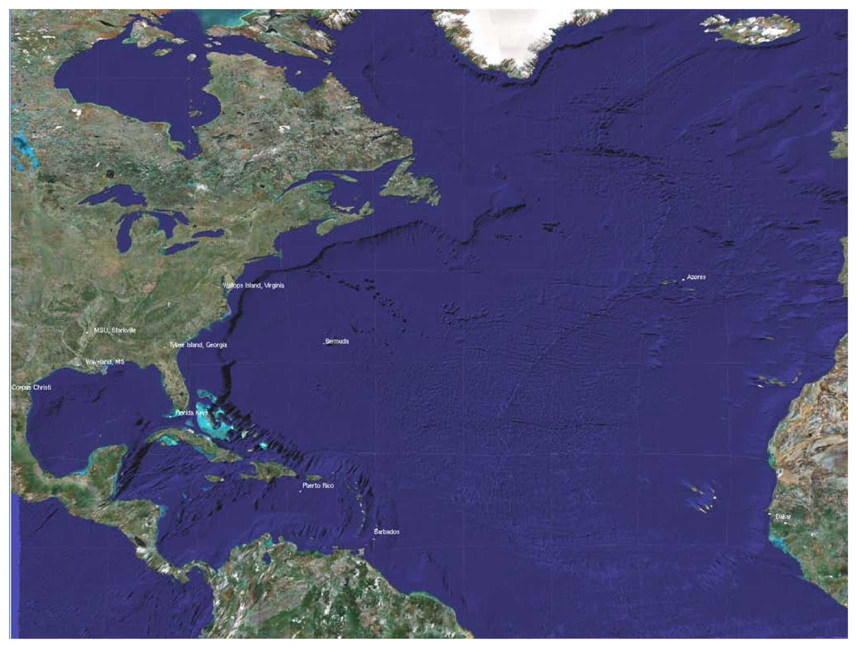
Balloon oscillates over Africa.

Multiple programming advances were made in the WISDOM viewer for the desktop, laptop, stereo desktop, and 3D immersive environment. The program maintained the ability to view all data in real-time from an increased number of launch locations, but was improved to show four times the amount of topographic and bathymetric data. The viewer maintains interactive frame rates and startup time for the program is a third of the previous version.

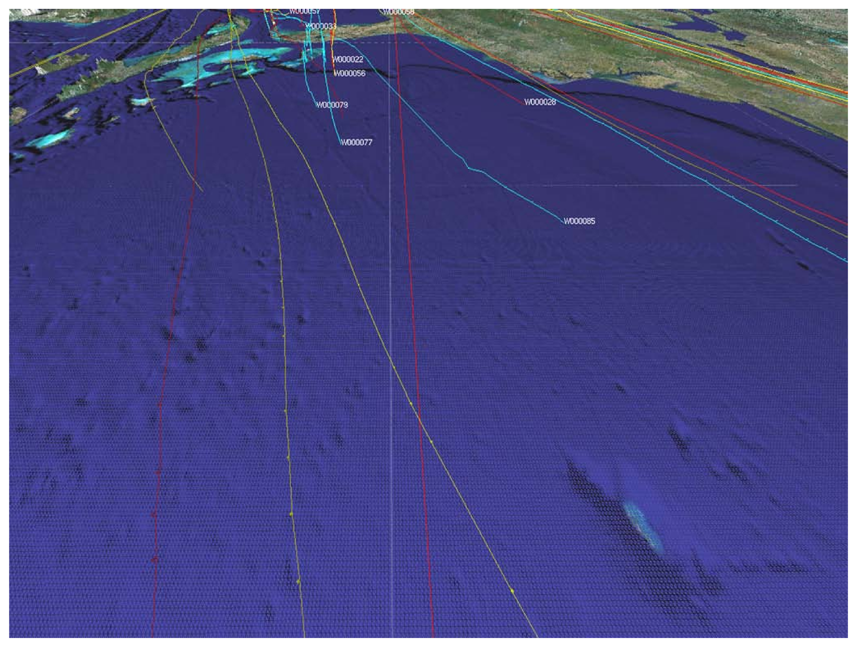
Navigation has been updated to allow the user to change the speed of rotation and velocity. This allows the ability to quickly traverse the Atlantic Ocean or make fine adjustments in position to study a particular balloon. A strafe motion has been added which allows the user to easily follow a balloon's side to side motion along a path or to keep a particular point in focus while panning the camera around that point. Labels to identify the exact balloon and payload have been added to the balloons current location.

Success Story #1: The 3D viewer allows one to observe the balloons interacting with vertical currents more easily than 2D data viewers. While limited access to immersive 3D systems might seem a drawback, the WISDOM demo was shown to over 1000 visitors in MSU's room-sized virtual environment at the High Performance Collaboratory in 2009. An additional 200+ visitors have seen the demo in 2010, with hundreds more already scheduled during summer camps in June and July.

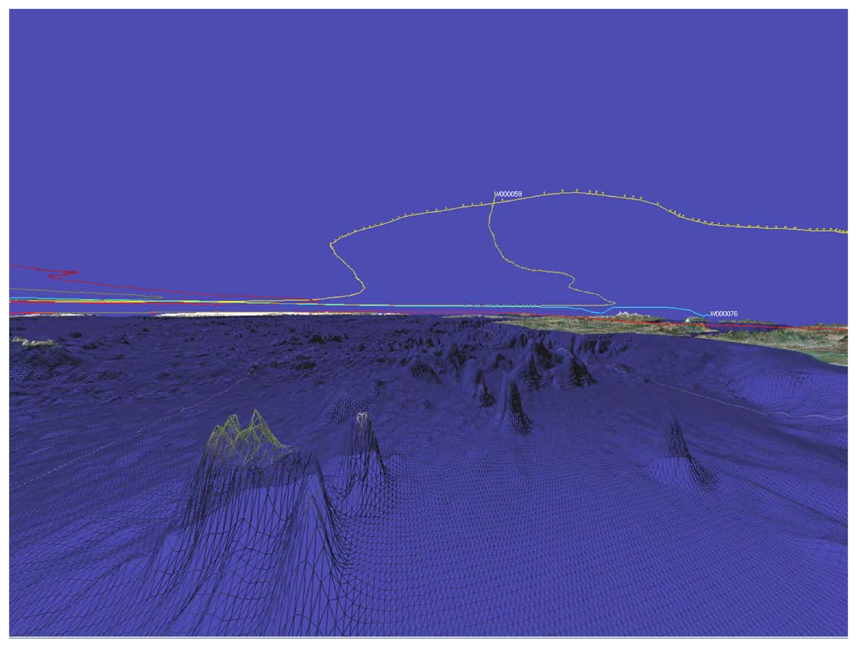
Success Story #2: The improved 3D viewer is able to ingest multiple data types and, in addition to tracking WISDOM balloons, is being explored as a tool for tracking birds. Daily behavior and migration patterns of birds are being tracked as part of a project for preventing airplane-bird collisions.



2009 launch sites.



Several balloons dropping into the Bermuda Triangle



Path over wireframe terrain.

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