Earth System Research Laboratory
Global Systems Division
Data Visualization and Education

Making Earth System Data Accessible to Everyone

How Does ESRL's Global Systems Division Data Visualization and Education Work Benefit the Nation?

ESRL's Global Systems Division (GSD) develops visual display systems for both the public and scientists to explore and understand climate, weather, ocean, and coastal data. These systems organize vast amounts of data into ways that help us learn about and understand our diverse and complex world and help educate and prepare the next generation of NOAA scientists.

www.esrl.noaa.gov/gsd/

GSD Data Visualization and Education Research Highlights:

Science On a Sphere® (SOS): A revolutionary system to communicate climate, weather, ocean, and other Earth sciences to all ages.

GSD's Science On a Sphere® (SOS) is a room-sized display system that uses computers and video projectors to show "movies" of Earth processes on a six-foot diameter sphere suspended from the ceiling by invisible wires so Earth appears as it would from space. SOS uses four video projectors and a basic personal computer to operate. ESRL Director Dr. Sandy MacDonald invented SOS in 1995 and a patent was awarded to NOAA for SOS in August 2005. SOS is available to any institution around the world from NOAA and its nine licensed distributors.

Environmental data is presented on SOS in ways that help all ages understand the global and local impacts of natural events. SOS provides NOAA with an educational platform to increase understanding of the world around us. SOS is in 117 museums, zoos, aquariums, schools, and visitor centers worldwide, educating more than 33 million visitors in 21 countries and 28 states. GSD's SOS development team and the Users Collaborative Network are adding data sets to expand SOS's educational capabilities, plus supporting material such as educational scripts and lesson plans. The SOS Data Catalog includes atmosphere, ocean, land, astronomy, models, and simulation data and movies.

www.sos.noaa.gov

SOS Explorer™ Powered by TerraViz™: Climate, weather, ocean, and other Earth sciences education for the next generation.

GSD's SOS Explorer™ uses the NOAA-developed TerraViz™ visualization engine to create an interactive Earth for flat screen displays. It provides teachers and students in the classroom access to over 500 SOS datasets and movies. The visualizations show information provided by satellites, ground observations, and computer models, and rapidly animate through real-time data. Tools included in the system allow users to zoom, probe, and graph data, as well as add extra material, such as websites, videos, pictures, and placemarks. Educational lesson plans and pre-programmed tours will be included and available to teachers. SOS Explorer™ is set for release in the Fall of 2015.

www.sos.noaa.gov/SOS_Explorer/

SOS® at the Smithsonian National Museum of Natural History in Washington, DC. Source: Chip Clark

The SOS Data Catalog includes more than 500 animated datasets and movies including data from major events such as Hurricane Sandy and the March, 2011 Japan earthquake and tsunami. Source: NOAA

The SOS Explorer™ interactive search screen allows users to customize and animate displays for flat screen viewing. Source: NOAA

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More Data Visualization Research and Education Highlights:

NOAA Earth Information System™ (NEIS) Powered by TerraViz™ is a prototype display system framework that ingests and synchronizes NOAA data from different sources in 4D time and space. NEIS™ displays the data through GSD's multi-platform tool, TerraViz™.

The NEIS™ framework provides the technology that allows users to answer questions requiring data from different data sources regardless of format or location.

NEIS™ provides:
- access to all NOAA data for all time scales;
- data in an understandable format; and
- information to all computer systems, laptops, and hand-held devices.

Scientists use NEIS™ to search, analyze, manipulate, and interact with NOAA data to make new discoveries about our diverse and complex world.

www.neis.noaa.gov

TerraViz™ Visualization Tool: TerraViz™ for NEIS™ and SOS Explorer™ harnesses the power of 3D graphics card technology to render and display data.

TerraViz™ uses the sophisticated Unity™ video gaming engine to render and display millions of NEIS data points on a variety of platforms including Windows, Mac, Web browsers, iOS and Android devices, and on game systems such as Wii and Xbox 360.

TerraViz™ can be used to display environmental data at a global scale, visualize regional data in "scenes," or rotate a coastal ecosystem on three axes.

Within a single computer system, laptop, or hand-held device, TerraViz™ can be used to simultaneously display different weather forecasts or combinations of forecasts against the true weather.

Ongoing TerraViz™ research and development includes screen-to-screen collaboration, holographic displays, and new user input technologies involving the movement of hands and fingers to manipulate data and displays.

www.esrl.noaa.gov/neis/library/terraviz-video.html
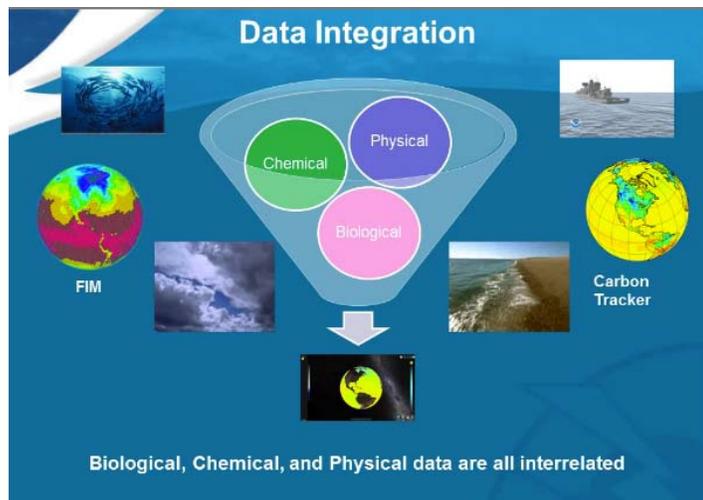
The diagram depicts the NEIS™ data integration framework that incorporates NOAA's vast sources of data and organizes the information for easy access to users. Source: NOAA
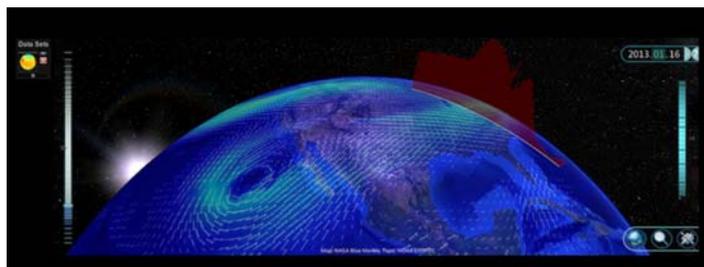
NEIS™/TerraViz™ display of wind vector fields, a dynamic line transect, and land surface topography taken from GSD's FIM (Flow-Following Finite-Volume Icosahedral Model). Source: NOAA
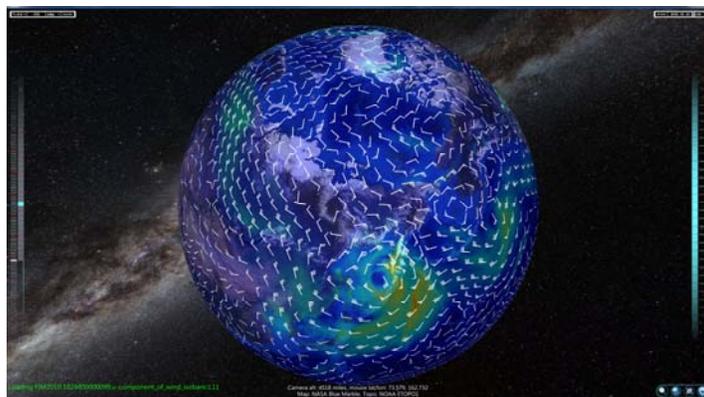
NEIS™/TerraViz™ display of the North Pole wind vector field, an IR display, and land surface topography taken from GSD's FIM (Flow-Following Finite-Volume Icosahedral Model). Source: NOAA

For more information on the Global Systems Division, visit http://esrl.noaa.gov/gsd/