Introduction to the NOAA Earth Information System (NEIS)
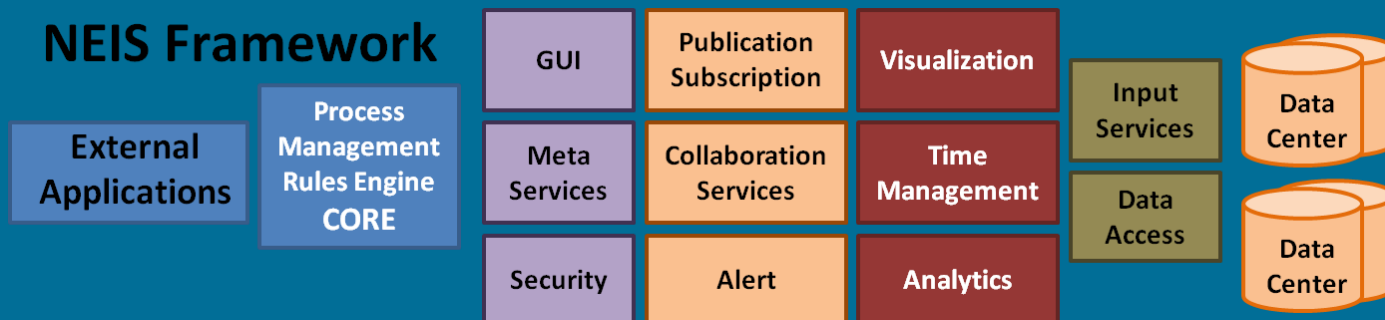

Climate Diagnostics and Prediction Workshop
**October 23rd, 2012**

Jebb Q Stewart

CIRA in collaboration with
NOAA/OAR/ESRL/GSD

Take advantage of existing technology where we can to quickly find and access to data 100 of years in the past to 100 years in the future, from the top of the atmosphere to the bottom of the ocean in a single application.


NEIS Framework

External Applications	Process Management Rules Engine CORE	GUI	Publication Subscription	Visualization	Input Services	Data Center
Meta Services	Collaboration Services	Time Management	Data Access	Data Center
Security	Alert	Analytics

Framework provides capability to answer questions that require data from different data sources.

Data Integration

FIM

Carbon Tracker

Chemical · Physical · Biological
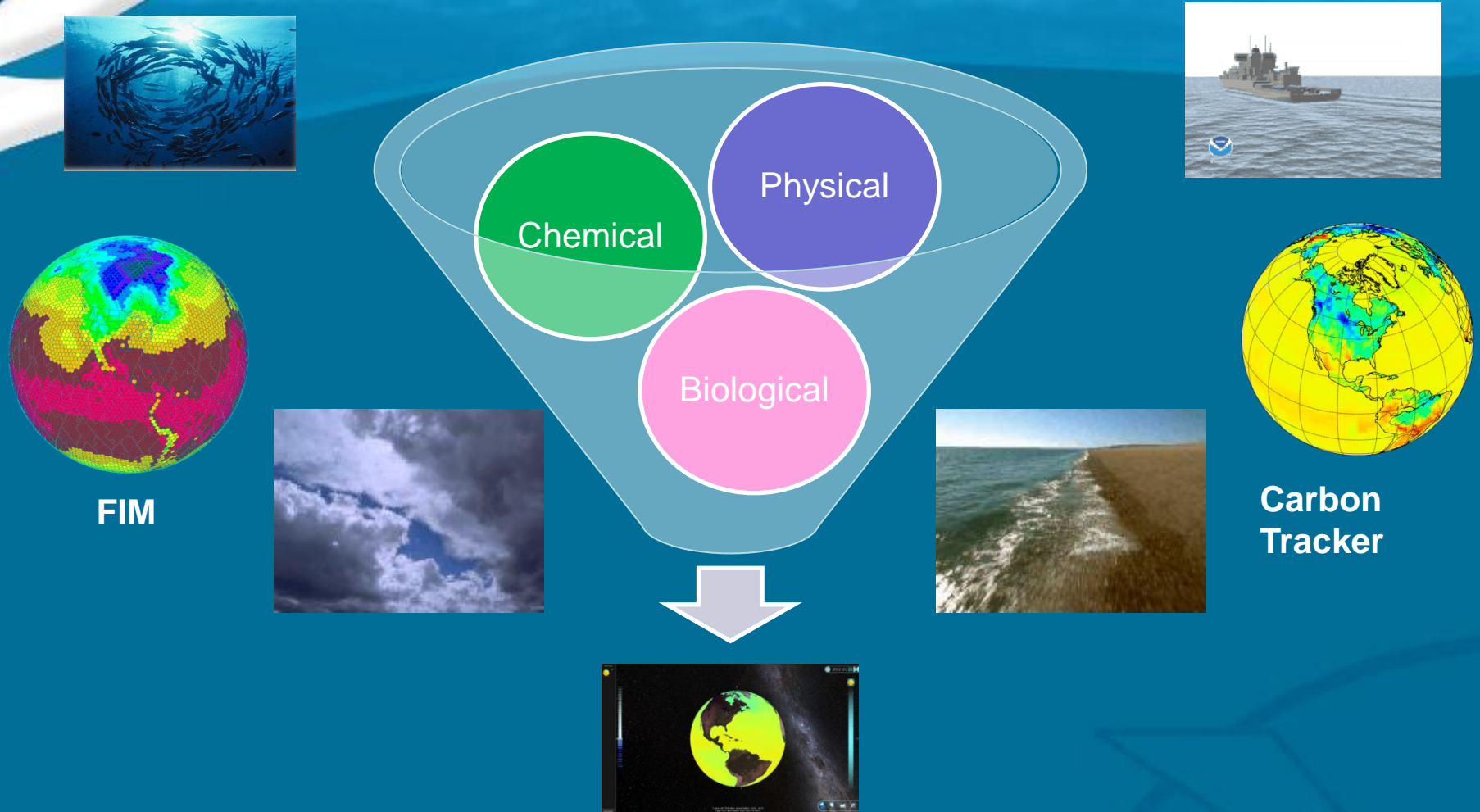
**Biological, Chemical, and Physical data are all interrelated**
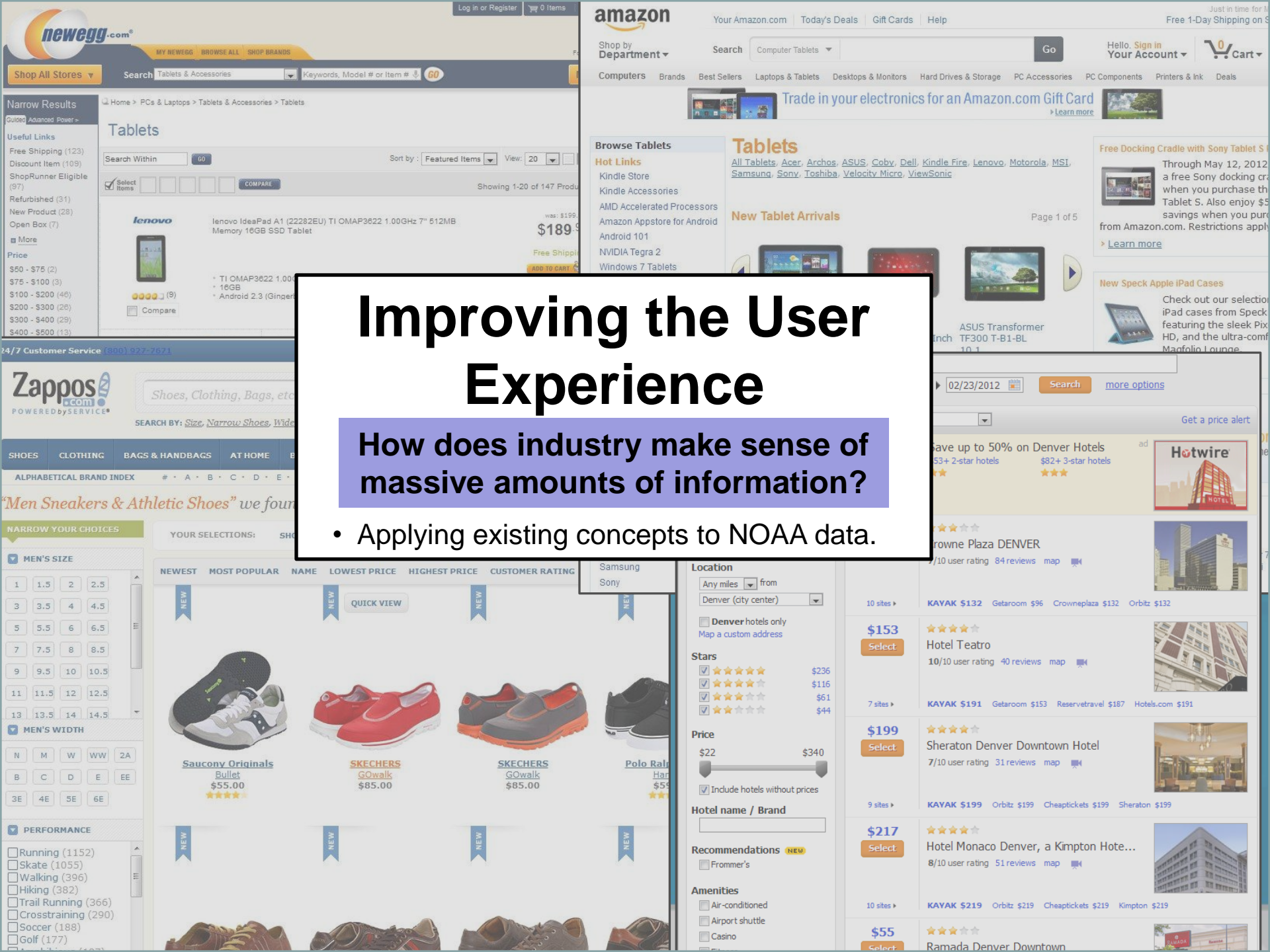
Improving the User Experience

How does industry make sense of massive amounts of information?

- Applying existing concepts to NOAA data.

- 3D visualization tool for Earth datasets developed in conjunction with NEIS

- Developed in Unity, a popular 3D game engine

- Leverages the power of GPUs (graphical processing units). For example, TerraViz can load (and render) 2.6 million polygons from the FIM G9 global model and performs quickly

- Our source code is written in C# (a natively compiled language very similar to Java in syntax)
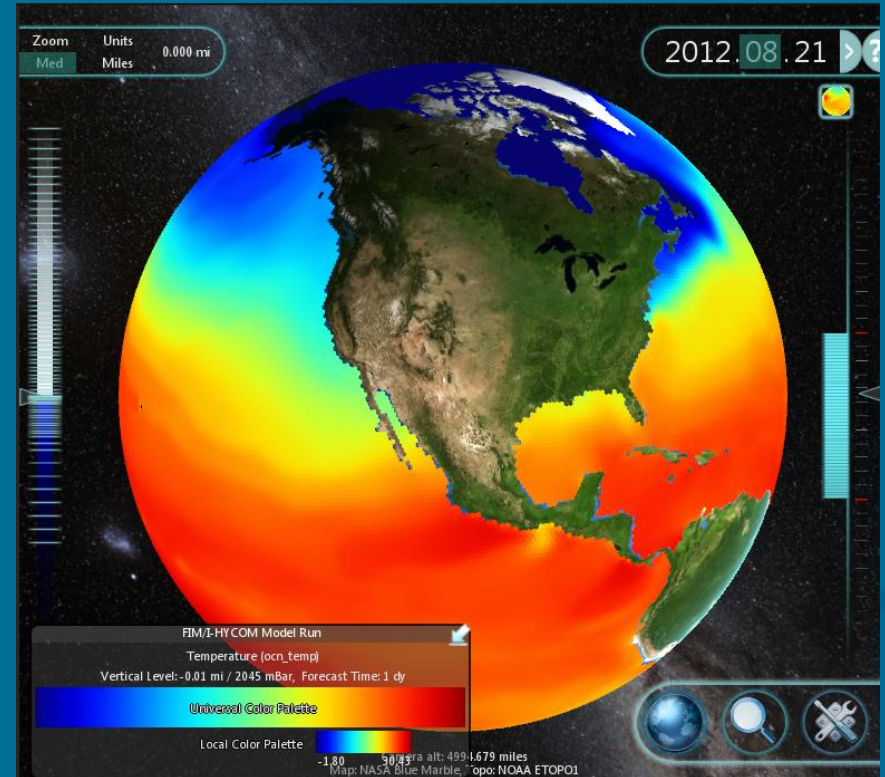
- Since we control the source code, we can customize TerraViz however we wish and add any feature we need
- Develop once, then will run on Windows, Mac, web browsers, iPhones, iPads, Android devices, and even game systems (Wii, Xbox 360, etc.)
- Unity/C# development environment is designed for 3D development, making it easy to create multiple perspective views, create 3D meshes representing environmental objects, etc.
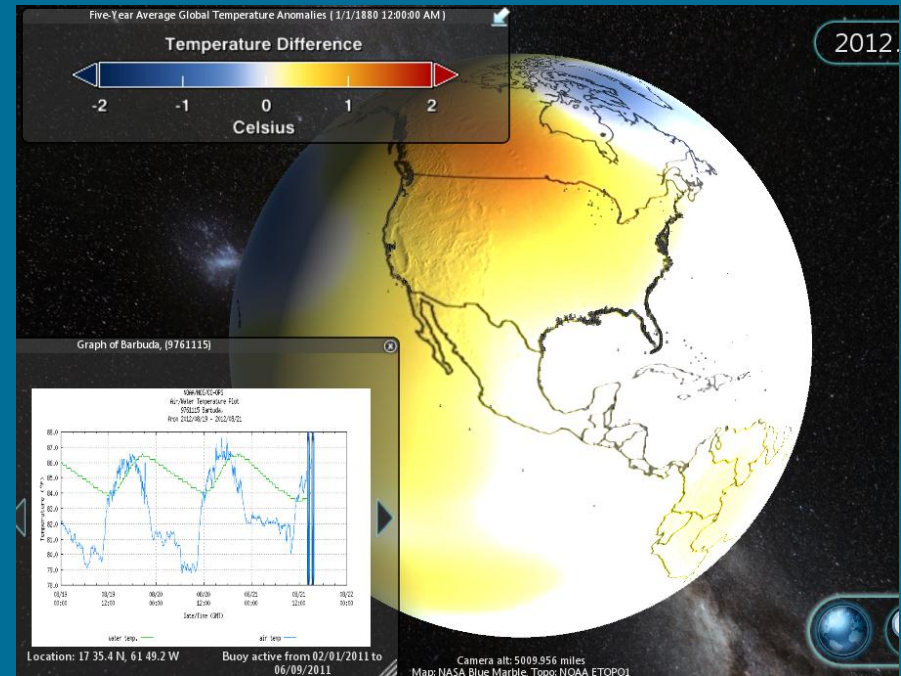
NEISCORE Activities

NEIS team is looking at emerging technologies to discover and visualize data from standardized services, including OGC. Program can provide valuable feedback to system design from user perspective.

Current Development Activities:

- Exploring and evaluating 'Cloud Technology', currently NEIS backend services are hosted on Amazon EC3 cloud.

- Harvest metadata information from metadata repositories (using OGC CSW standard), and data access services.

- Use Apache Solr to structure this information to create better searching and discovery functionality.

- Building data access services to simplify requests for time sequences of rendered data making them available to NEIS/TerraViz.

- Proxy and cache image requests to improve speed and reliability.

Dealing with Data

Data are ever increasing in size.
- New Polar Orbiting NPP data (~ 4 TB / day)
- GOES-R
- New Global Forecast Models, rapidly increasing in size.
- Vast amounts of historical data.

We want to:
- Provide tools allowing seamless integration of data across time and space.
- Minimize data we transfer and avoid data duplication.
- Allow users to collaborate with these data.
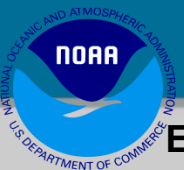
Impacts

- An infrastructure is available allowing users to discover, access, and integrate relevant information regardless of data location and file format.

- An visualization system is available to simultaneously compare ensemble members, different models, with historical observations within a single platform.

- NOAA data ready for action. Services model facilitates agile response to events. Services can be combined or reused quickly.

- Any data available through NEIS system can be operated on or combined with other data. Integrated standardized formats and access.

- New and Existing systems have access to wide variety of NOAA data. Any new data added, easy incorporated with minimal to no changes required.
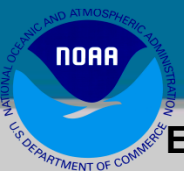
TerraViz Search Screen

Geographic extent   Date / Time Range

Keywords

Facets

Search For Data

Keywords:
NOAA

Lat 50
Lon -70
Radius Km 2739

Left click to drag Earth to desired location and then right-click and drag to create a bounding circle

Min Date:

Max Date:

Search

Clear

Available Tags

ocean (882)
noaa (727)
altitude (539)
surface (533)
water (527)

Include

◉ local data (6)
◉ online data
  ◉ active now (1040)
  ☐ all servers (1046)

Servers

coastwatch.pfeg.noaa.gov (9
oos.soest.hawaii.edu (42)
motherlode.ucar.edu:8080 (8

1 - 50 of 1046 Matching Data Sets   Prev   Next

NOAA Global Buoy Observations
NOAA Tides and Currents Information Center

NOAA Marine Obs on 4-24-2012 (KML)
NOAA National Data Buoy Center

NOAA Ship Locations on 4-6-2012 (KML)
NOAA

NOAA Tagging Of Pacific Pelagics
NOAA TOPP

NOAA Fisheries Locations
NOAA Fisheries

NOAA Okeanos Explorer
NOAA Ocean Exploration

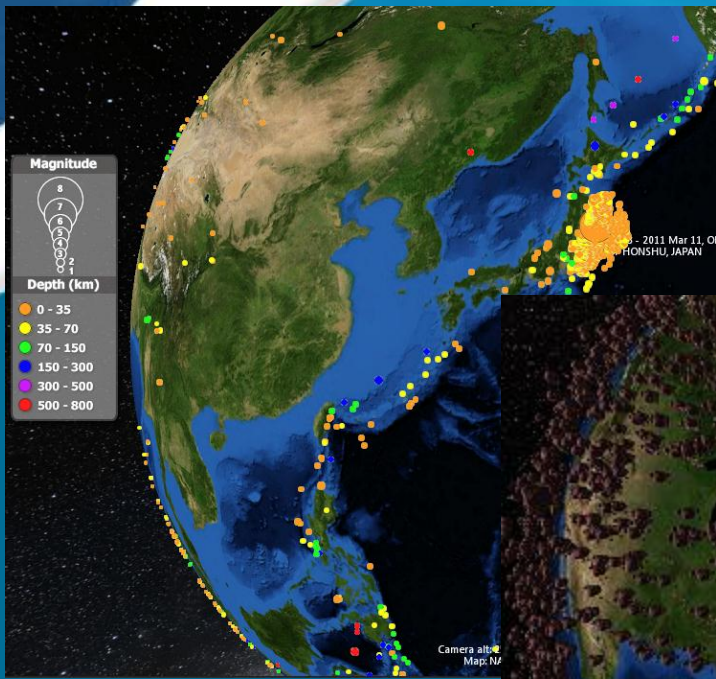TerraViz can load local datasets or search the NEIS backend (> 1100 datasets)

TerraViz Collaboration

Annotation – Basic drawing capabilities on top of the globe (and any loaded datasets)

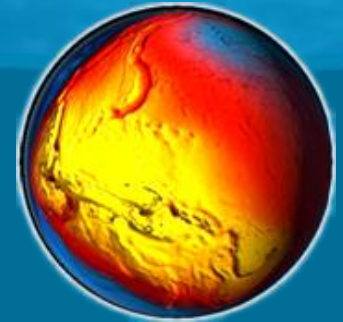Multiuser/Collaboration – real time screen sharing with web cams
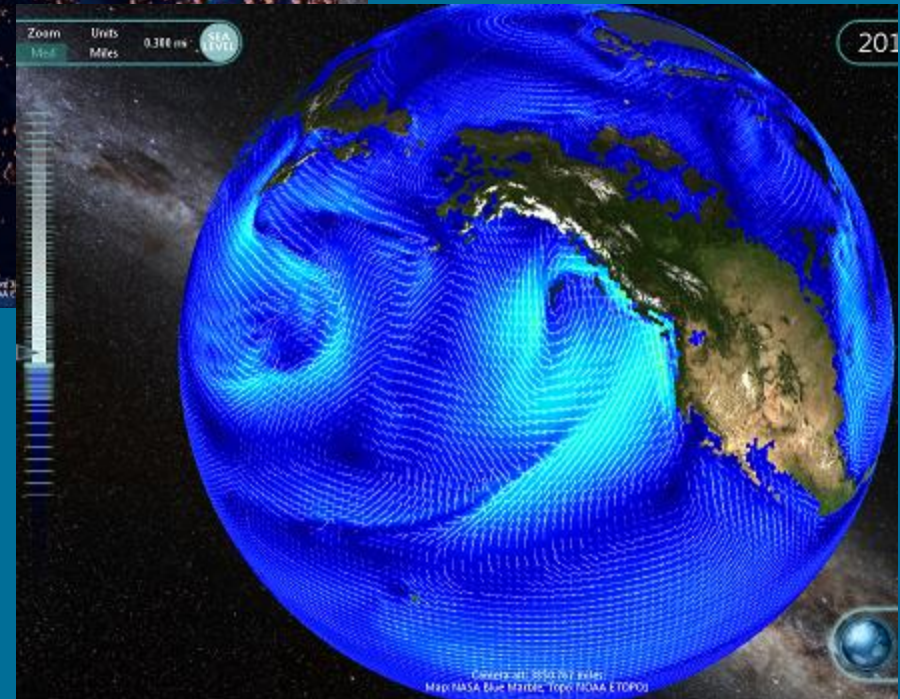
TerraViz Datasets

Earthquakes

NORAD satellites

GOCE gravimetry

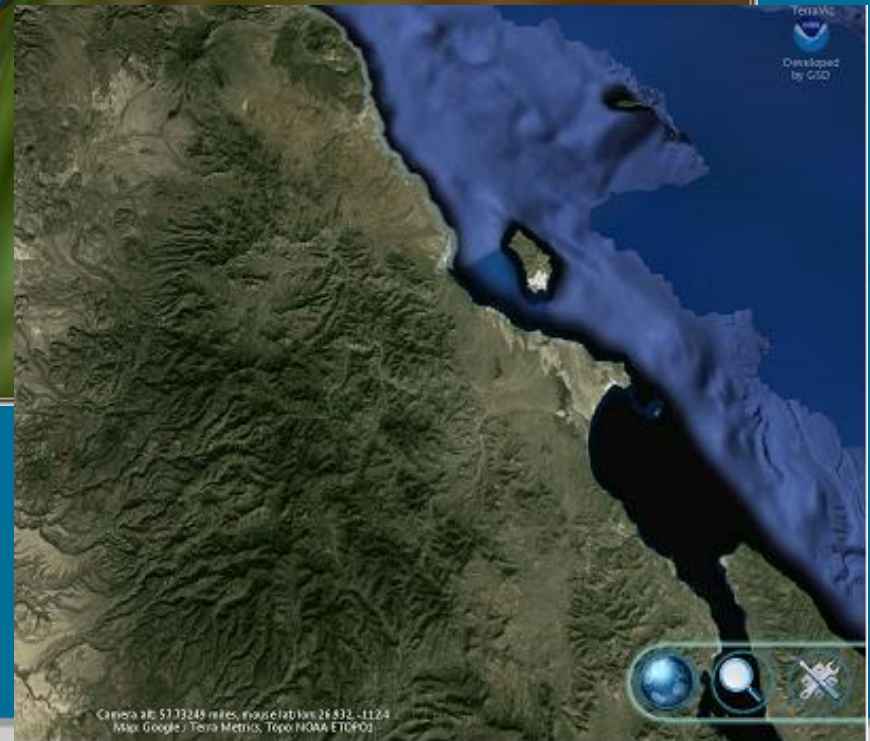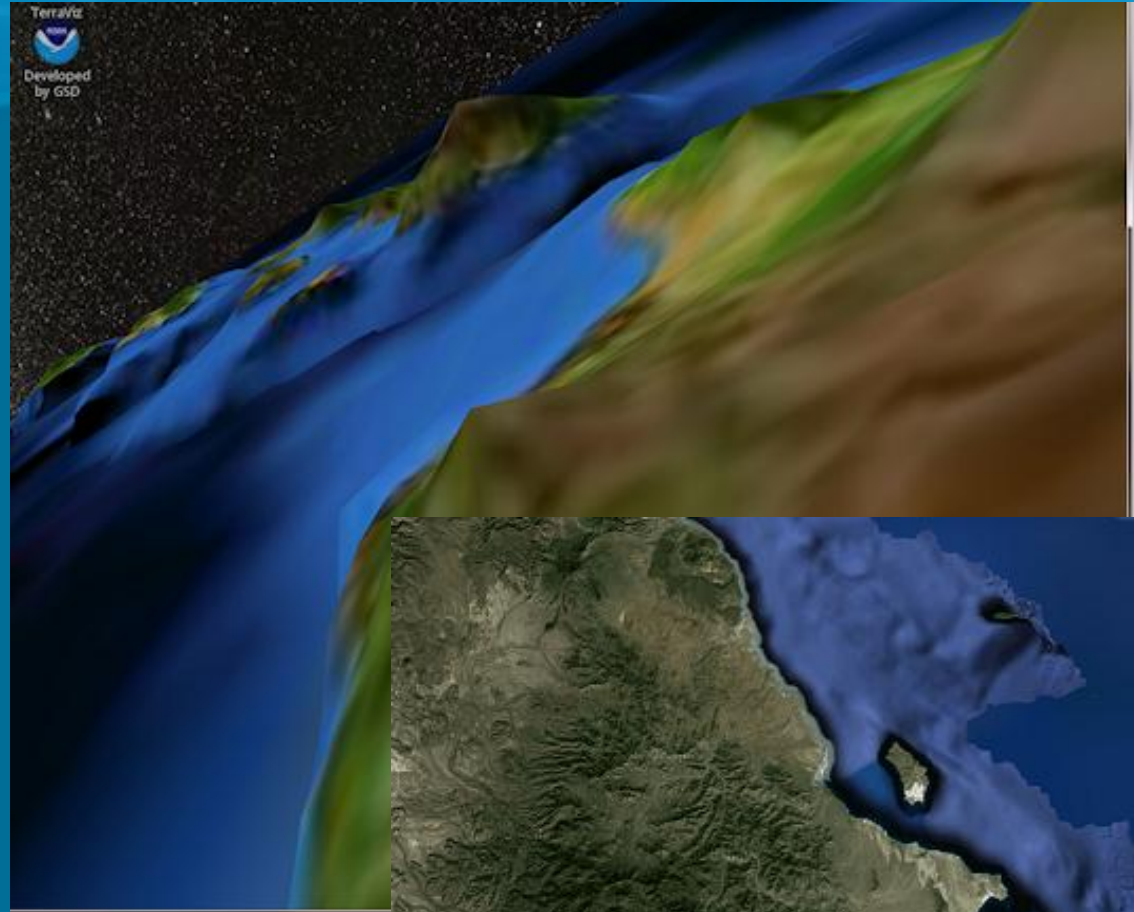FIM global weather model

TerraViz can currently display
- KML
- FIM native grids
- movies
- images served up via web map servers (e.g. NetCDF)

Progressive disclosure of terrain (as you zoom in you see higher resolution satellite imagery)
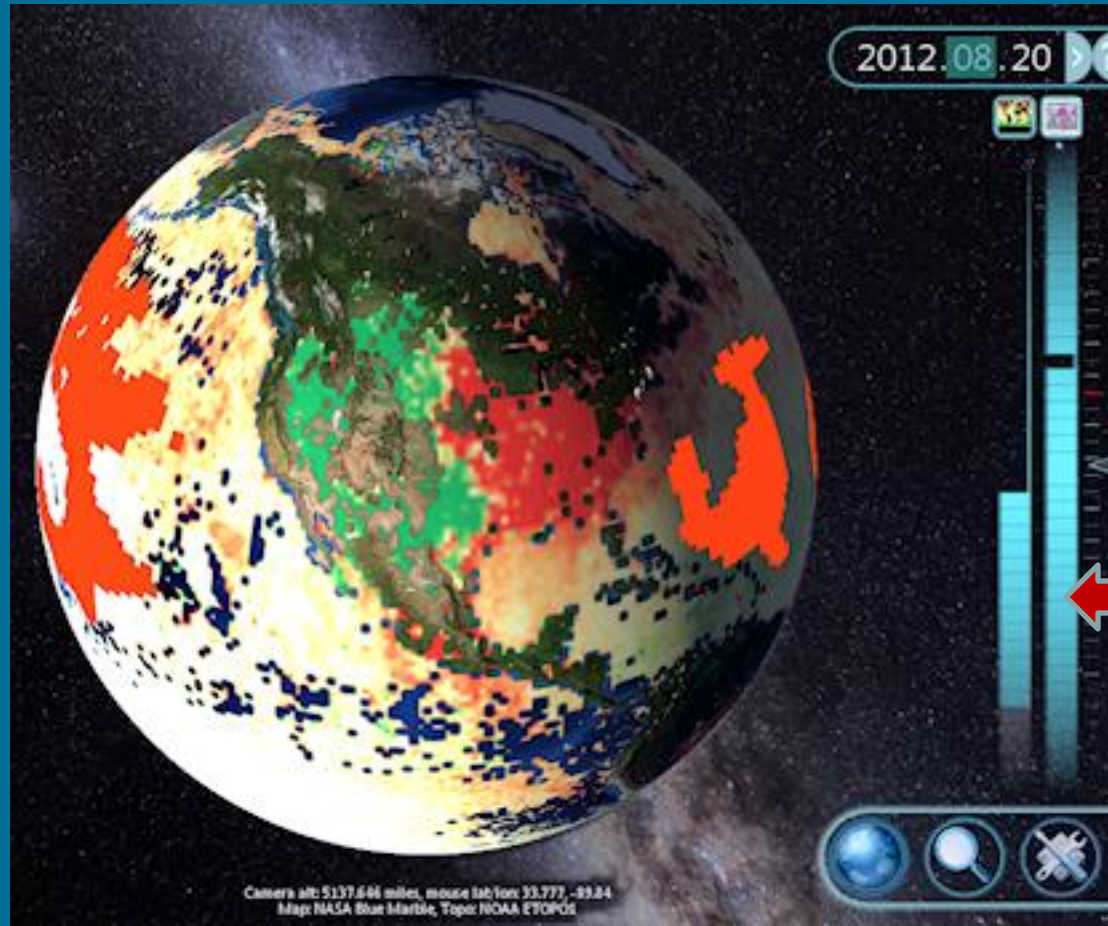
3D topography

Ability to fly to locations on Earth

Can load multiple datasets over the globe and change the transparency between them

Time wheel shows when data is available for each dataset and can handle different time intervals (e.g. one dataset could be daily and another monthly)

2012.08.20

TimeWheel

Drag it up or down to move forward or backward through time

Camera alt: 5137.666 miles, mouse lat/lon: 33.777, -89.84
Map: NASA Blue Marble, Topo: NOAA ETOPO5

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NEIS Committee and Group Involvement

NEIS Team is aware and members of many related organizations

We have active membership in a variety of committees and groups including:
- Open Geospatial Consortium (OGC) Standards Committees
- NOAA Environmental Data Management Committee (EDMC)
- NOAA Data Management Integration Team (DMIT)
- NOAA Unified Access Framework (UAF) group
- NSF Earth Cube
- NextGen/CSS-Wx Programs
- FIM/WRF Modeling
- GIS Committee
- NOAA Climate Program Office (CPO) Data Interoperability Team

GSD Central Facility has vast experience in working with data and standards

ESRL Global Systems Division
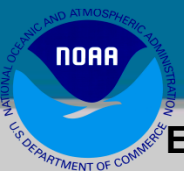
Build new Graphical User Interface system integrating and leveraging new and emerging technologies to meet NEIS goal 'any data, any location, any platform, now'

- Perform processing within cloud environment and with high speed connectivity to data sources, taking advantage of large processing power within clouds.

- Send graphics and server side processed/rendered/streamed data to GUI, improving bandwidth utilization.

- Take advantage of fast networking to make remote requests and processing appear like local application.

- Similar to how the concept of the Amazon Silk Browser.

ESRL Global Systems Division
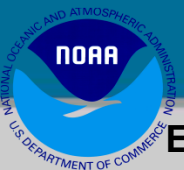
Improve existing Metadata services making information useful.

- Improve searching by understanding what data means and providing improved filtering capability similar to how airline or hotel type search engines work.

- Incentivize/encourage people to use proper Metadata.

- Create a Metadata Dashboard to:

  o Gather information from users on relevance, ratings, usage patterns, search key words used (ie crowd sourcing).
    - This information can be used to determine what users are searching for, how they are finding data, what data they are not finding, etc...

  o Provide feedback on broken links, service uptime

  o Provide feedback on adherence to standards (Services, Metadata).

  o Provide feedback to users of similar or related data sets.
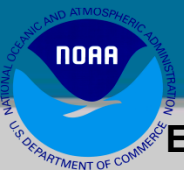
Questions?

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http://www.esrl.noaa.gov/neis

Backup Slides

Why TerraViz and not another tool?

Why not Google Earth?

- Handles ~10,000 kml polygons before slowing to a crawl
- Closed system (Google Earth source code not available) so we can't add needed features
- Google Earth (web) plugin works on Windows and Mac 32-bit browsers only (won't run on iPhones, iPads, or Android devices)

Why not NASA WorldWind / iGlobe?

- WorldWind (and iGlobe offshoot) is now open source (not sure how much NASA will continue to support it)
- Requires Java (so it won't run on iPhones, iPads, Android devices, etc.) and Java numerics are significantly slower than TerraViz native numerics

Why not Integrated Data Viewer (IDV)?

- Open source but is one million lines of code (a lot to learn) and original two developers have now left Unidata
- Requires Java (so it won't run on iPhones, iPads, Android devices, etc.) and Java numerics are significantly slower than TerraViz native numerics
- Very feature rich application, but current user interface is very complicated