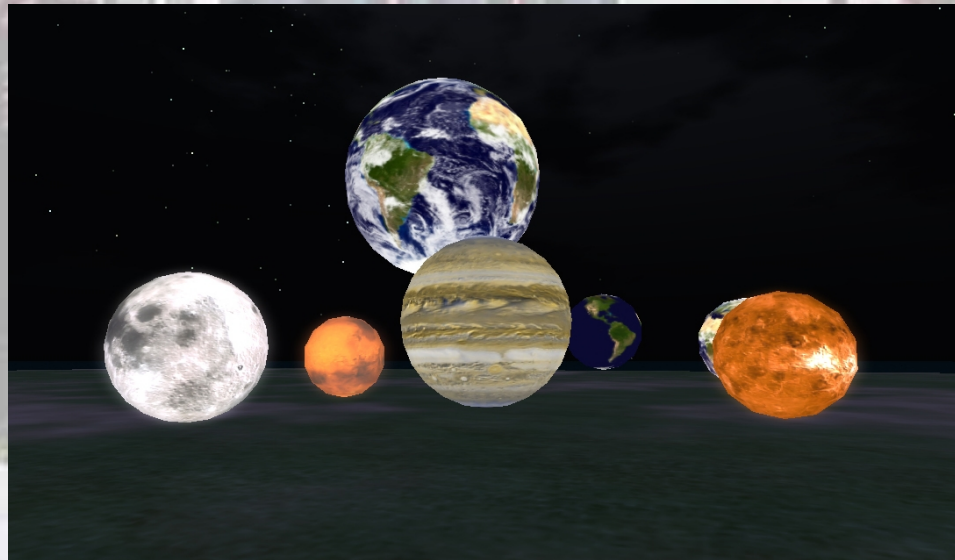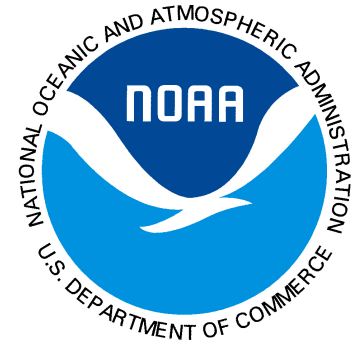# Spherical Visualizations
in Virtual Worlds

Spherical Displays in Virtual Worlds

We are experimenting with datasets from the
National Oceanic and Atmospheric Administration
(NOAH)'s Science on a Sphere (SOS) program.

Science On a Sphere Datasets

Science on a Sphere (SOS)

Science on a Sphere is a room sized, global display system that uses computers and video projectors to display planetary data onto a six foot diameter sphere, analogous to a giant animated globe.

Researchers at NOAA developed SOS as an educational tool to help illustrate Earth System science in a way that is both intuitive and captivating and to increase public understanding of the environment.

It is used as an instrument to enhance informal educational programs in science centers, universities, and museums across the world. It is currently installed at 47 sites worldwide.

http://sos.noaa.gov/

Discovery Science Center, Santa Ana, California

We are partnering with the Discovery Science Center, a local science museum in Santa Ana, which recently completed its own SOS installation.

Our goal is to bring the NOAA datasets to a broader audience using virtual worlds. We are looking to create a self-contained, open source solution that can easily be brought into the classroom.

SOS SphereCasting

An additional goal is to be able to receive SphereCasts from within a virtual world.

Viewing the first international SphereCast, live from COP15, the United Nations ClimateChange Conference in Copenhagen, Denmark from the Discovery Science Center in Santa Ana, CA.

What is SphereCasting?

A SphereCast is an SOS presentation done simultaneously at multiple sites by a single presenter, via the Internet. Many sites can receive the SphereCast, but only one site is the host. There are two components to a SphereCast: remote control of a presentation on an SOS system, and a live video (or audio) lecture that accompanies the SOS presentation.

The SphereCast is setup with a client-server architecture where the server is a specialized site (usually from NOAA headquarters) but any SOS installation can register to be a client/receiver of the SphereCast. Any commands the presenter issues to the SOS system at the host site are immediately replicated on all the SOS client systems. When the presenter loads a new dataset, that data is loaded on all the watching systems. When the presenter uses the remote control to start or stop animation, or orient the sphere, all the remote spheres behave identically.

All datasets must be pre-loaded in each client site. The streaming video component uses Apple Quicktime.

SOS Datasets/Playlists

- ## SOS Datasets include:

    Images

    Video

    Animations

    PIP (picture in picture overlays)

    Audio

    Slide presentations

    - Displayed on wall mounted displays, not on the SOS sphere

- ## SOS Playlists

    Playlists organize and group together content for a presentation.

    They can define the tilt and/or rotation of the sphere

    They are simple text files that are read and interpreted by the main SOS application interface.

    Playlists directly access the files in the datasets

OpenSim Platform

- We are experimenting with visualizing the SOS datasets in OpenSim.

- OpenSim is an open source server platform for hosting virtual worlds. It is compatible with the Second Life client.

- For the client, we are using the open source Hippo OpenSim viewer. It is compatible with the Second Life grid while taking advantage of OpenSim features and extensions.

- An OpenSim platform allows us to create a self-contained open source solution that can easily run on a portable computer.

Goals

1. Display the SOS datasets in a virtual world using OpenSim.

2. Allow avatars to control which datasets are displayed.

3. Control the datasets from an external application.

4. Interpret SOS playlists and use them to control the datasets from an external app.
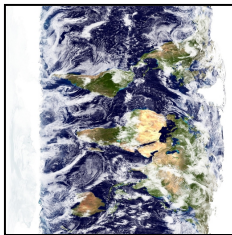
Datasets in OpenSim

- ## Images

   SOS images and video must have a 2:1 aspect ratio.
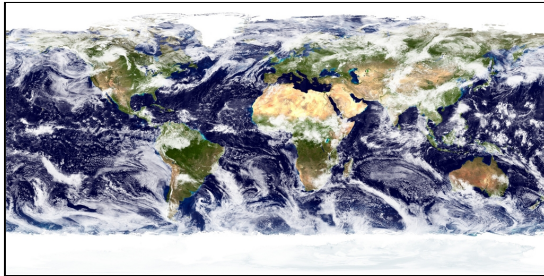
   This "Blue Marble" image is an example image
   From the SOS dataset.

   Images must be imported into OpenSim as textures that can be applied to the
   spherical prim object that implements the SOS sphere.

   SOS images must be converted to 512X512
   pixels and rotated before then can be imported as
   textures for the sphere (left). Note that the
   distortion created by scaling the image to a
   square format is counteracted when it is
   "stretched" around a spherical prim (right).
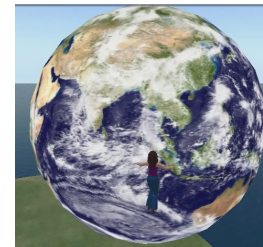
Datasets in OpenSim

- ## Video

    In OpenSim, mp4 video can be streamed from an external URL onto any object covered with a predefined "media texture".
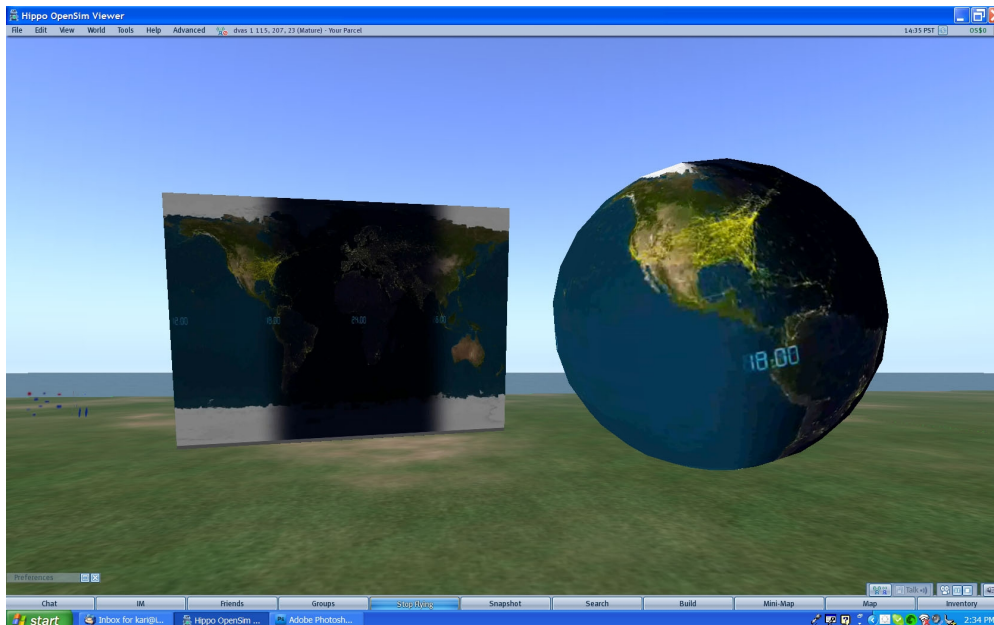
Here a video showing international aviation flight paths relative to time is being streamed simultaneously to both a rectangular and a spherical prim. The video is adjusted to wrap seamlessly around the sphere.

# Controlling Datasets

- ## Using an avatar
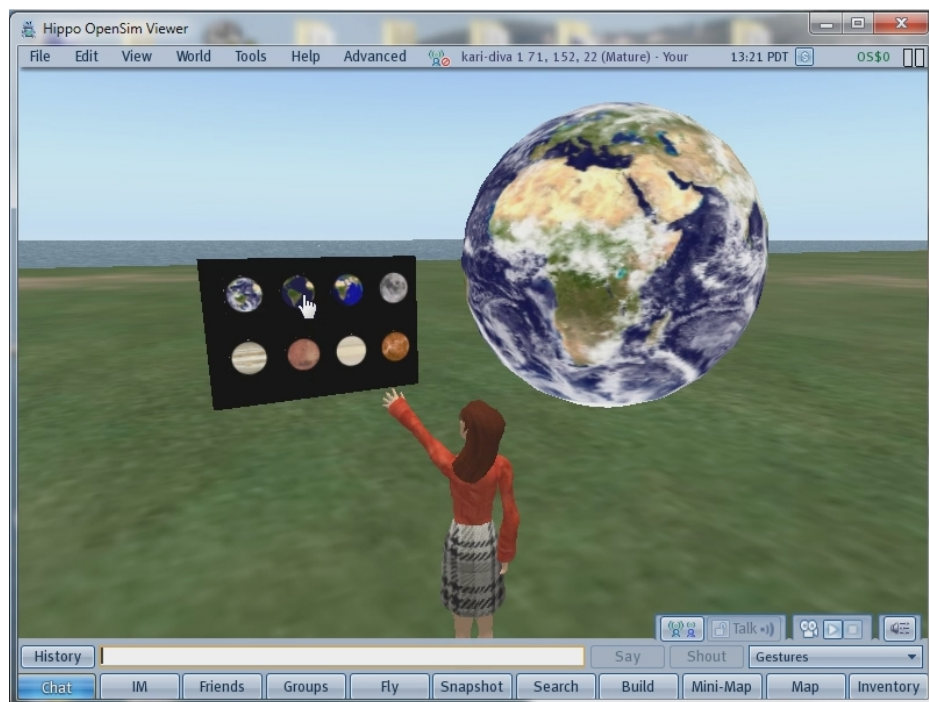
Here an avatar controls which dataset is displayed by "touching" a kiosk with a variety of planet display options.

The avatar can also "touch" the sphere to start and stop its rotation.

The touch events are detected and handled via scripts (written in LSL-Linden Scripting Language). Communication between objects is via internal chat channels.

Controlling Datasets
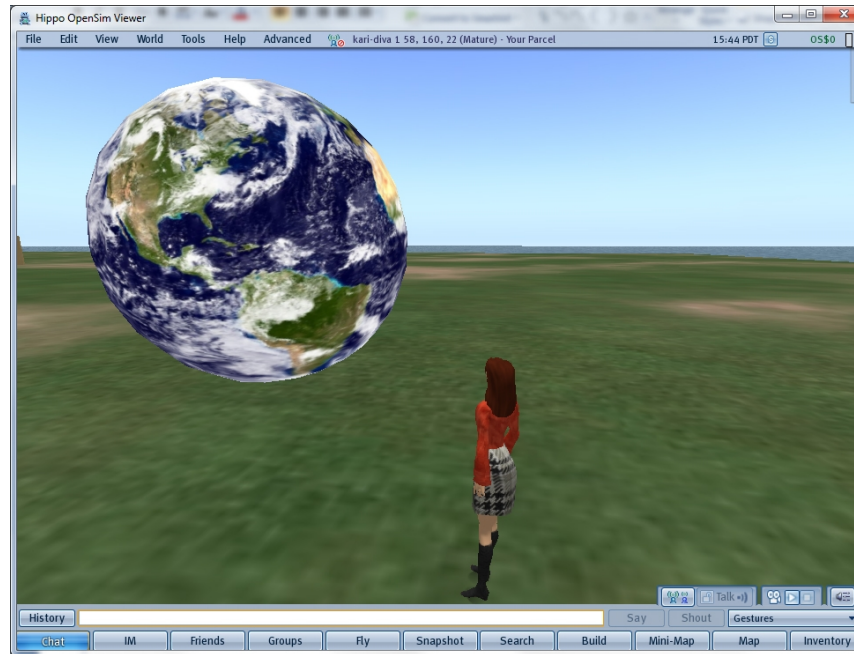
- ## From an external chat channel
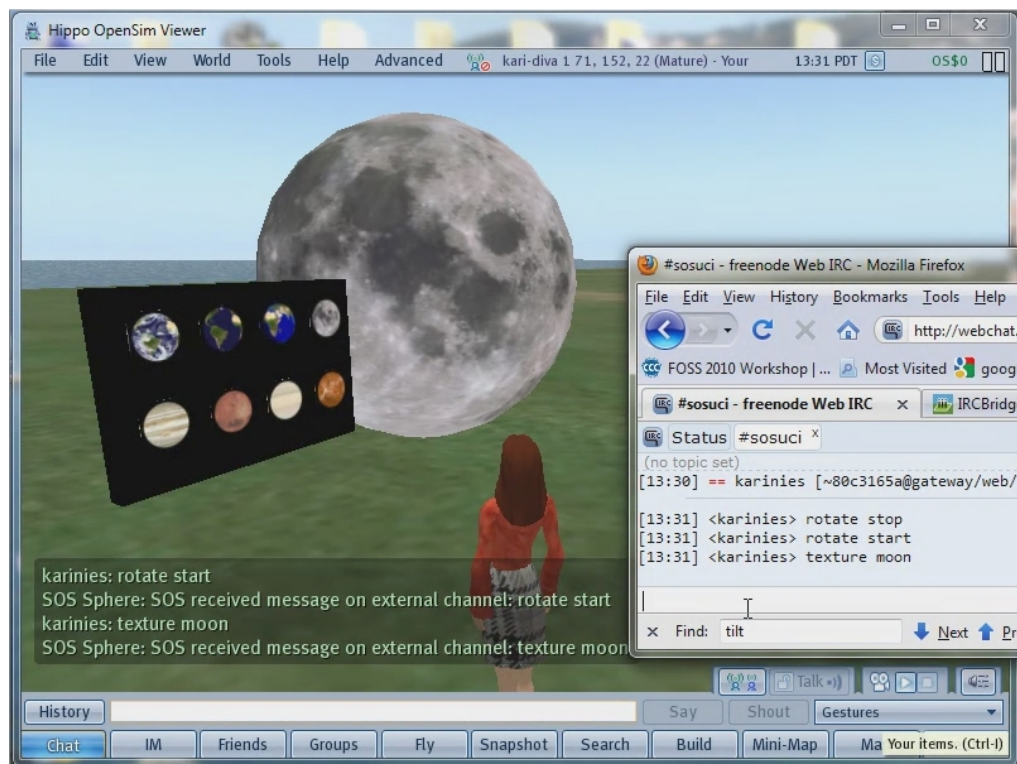
Here the client has been configured to listen to an external chat channel on freenode.net.

The user can send commands from the external channel. Here a user is controlling rotation and changing the sphere texture remotely.
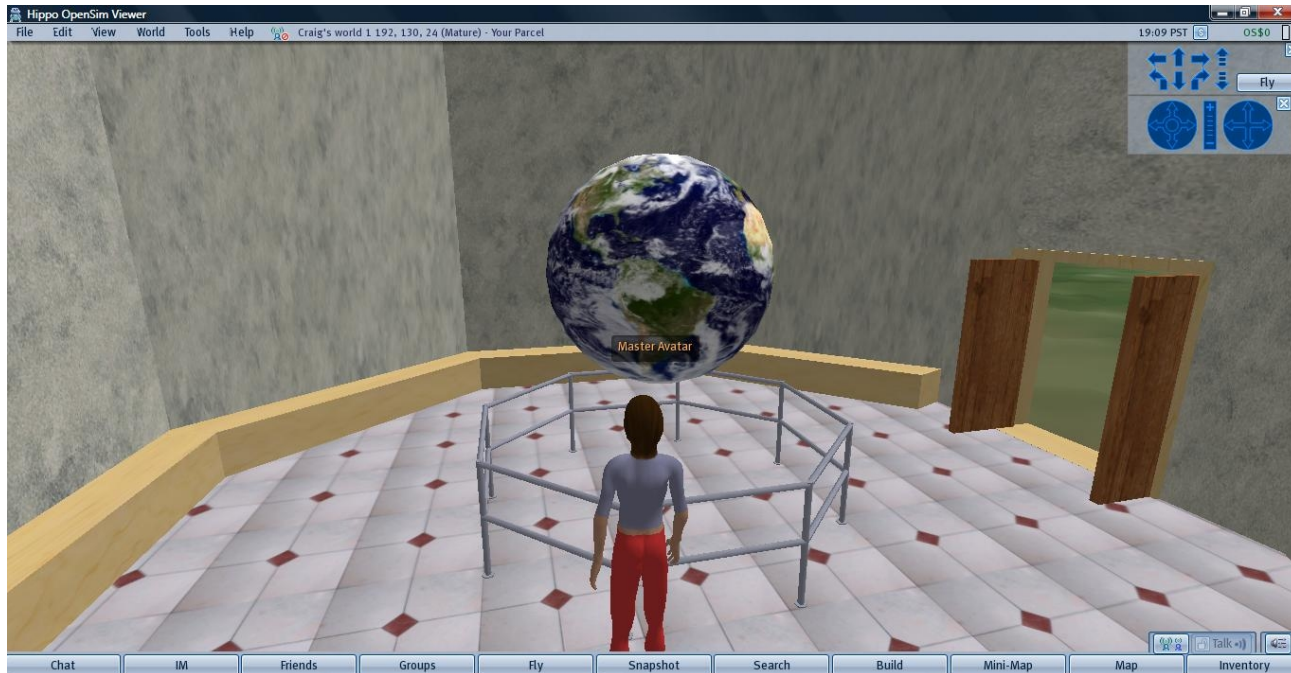
Tilt

- Scripts now support displaying the sphere at a specified x-axis tilt.

The SOS datasets display earth images at a 23.5 deg. tilt on the x-axis.
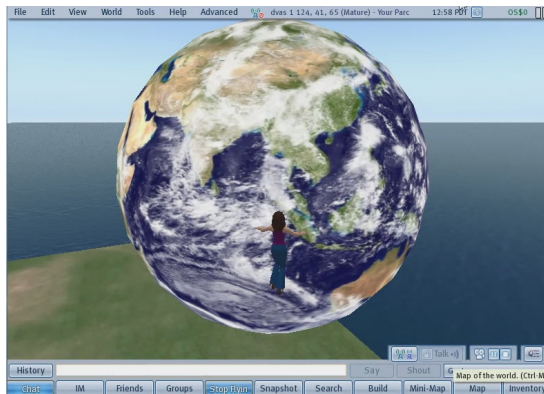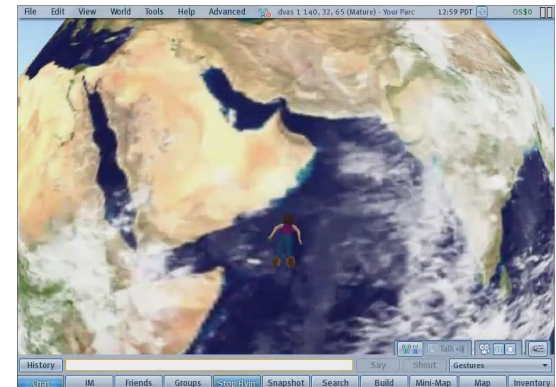
Modeling an SOS Installation

We are in the early stages of modeling the Discovery Science Center's SOS Installation in OpenSim.

More Spherical Visualizations
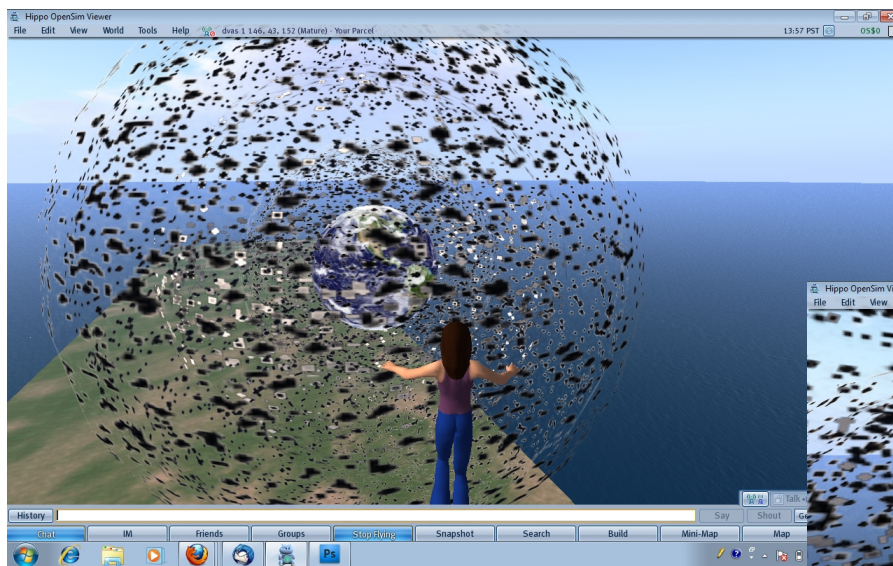
- Hollowed Sphere

Here an avatar is shown entering a hollow sphere that contains a smaller sphere in it's core. Both are textured with SOS data images.

In this view the Avatar has entered the interior of the larger sphere and is looking outward. Note that the texture image is visible for the spheres interior and also that the image is a reversed from the inside looking out.

More Spherical Visualizations

- Space debris visualization using hollowed spheres

We've been exploring visualizations of space debris in virtual worlds.

Here we've simulated a visualization of debris in the earth's atmosphere. Surrounding the earth textured sphere in the center are three concentric hollowed spheres with transparent textures.