Visualizing GEDI Forest Height Data

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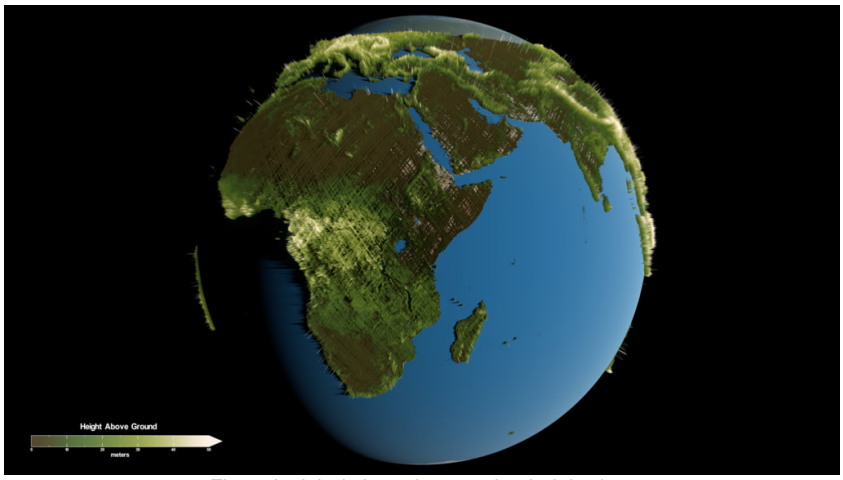

Fig 1: A global view of vegetation height data

ABSTRACT

A visualization depicting data from the Global Ecosystem Dynamics Investigation (GEDI) instrument aboard the International Space Station is used as an example to discuss audience comprehension and other design considerations when creating visualizations for general audiences.

Keywords: Data Visualization, Earth Science

Index Terms: Human-centered computing—Visualization—Visualization application domains—Scientific visualization; Human-centered computing—Visualization—Visualization design and evaluation methods

1 INTRODUCTION

The GEDI instrument produces high resolution laser ranging observations of the 3D structure of the Earth. GEDI's precise measurements of forest canopy height, canopy vertical structure, and surface elevation greatly advance our ability to characterize important carbon and water cycling processes, biodiversity, and habitat.

The NASA Scientific Visualization Studio (SVS) was tasked with creating a data visualization to help communicate capabilities of the GEDI instrument and to provide an initial view of vegetation height data. The canopy height data layer RH100 (mean height in meters above the ground) was selected for the visualization. Data files were processed with Interactive Data Language (IDL) and exported as .sav files which were then referenced by a render-time procedural to create particles and stems representing each measurement. Data from all eight GEDI beams were used, though total percentage shown for each beam varied depending on the camera view. A filtering algorithm was developed with GEDI scientists to cull outliers in the data. Occasional outliers are visible in the final visualizations as more aggressive filtering would have resulted in valid data being culled. A complete global view of the data was produced along with several closer views of locations that were of particular interest to the mission scientists. The close-up views depict data that is exposed over time, representing the temporal nature of the data as they are collected by the instrument.

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2 VISUALIZATION COMPREHENSION

Canopy height is represented in the visualization with both color and position above the Earth surface (altitude exaggerated so variations are visible at camera view distance). The redundant representations of the data were utilized to give viewers ample opportunity to understand what the visualization is depicting. Position is an intuitive way to depict height, while color changes provide additional visual cues for variation that may be difficult to see if the data were represented with a single color.

In some views, the data in the visualization is exposed over time to communicate how these measurements are taken by the instrument over the course of several satellite orbits. The goal is to provide an appreciation for how the data is collected and to explain the visual structure of the data that may be confusing to some viewers (crisscrossing lines of data that appear denser at higher latitudes).

3 OUTCOME

The visualizations have been used extensively in both technical and non-technical outreach, helping convey the significance of studying global carbon cycles and their impact on climate change. Clips of the visualization were used during a national news television segment on GEDI (NBC). The scientists have also requested additional visualizations depicting new locations and more data (these visualizations were created when just one year of data was available).

4 DATA USED

GEDI - RH100 (relative height) is the 100th percentile of waveform energy relative to ground elevation. Derived from the L2B LIDAR metric RH100 data product. https://gedi.umd.edu/