Geophysical Research Abstracts
Vol. 19, EGU2017-441, 2017
EGU General Assembly 2017


# Online 3D Visualization of Near Real Time and Production Global Precipitation Measurement Mission Data Using CesiumJS

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Existing methods of interacting with Global Precipitation Measurement (GPM) Mission data primarily focus on two-dimensional static images, whether displaying vertical slices or horizontal surface/height-level maps. These methods limit interactivity with the robust three-dimensional data coming from the GPM core satellite.

Advancements in the capabilities of JavaScript frameworks and web browsing technology have made online visualization of large geospatial datasets such as those coming from precipitation satellites viable. These data benefit from being visualized on and above a three-dimensional surface, as was available through Google Earth prior to the deprecation of their Web API. The open-source framework CesiumJS, developed by Analytical Graphics, Inc., leverages the WebGL protocol to do just that. This JavaScript-based utility has a large and growing user community and is ideal for the aforementioned type of application.

This presentation will describe the technology behind the primary three-dimensional visualization products developed as part of the NASA Precipitation Processing System STORM data-order website. It will also give examples of how these products can be used to improve the data acquisition process as well as provide compelling interactive data visualizations for outreach purposes.

The three primary products include the GPM Near Real Time Viewer (GPMNRTView), STORM Virtual Globe (STORM VG), and STORM Event Viewer. The first leverages small post-processed CZML files derived from various Level 1 through 3 near real time products. For swath-based products, several brightness temperature channels or precipitation-related variables are available for animating in virtual real-time as the satellite observed them on and above the Earth's surface. With grid-based products, only precipitation rates are available, but the grid points are visualized in such a way that they can be interactively examined to explore raw values.

STORM VG reads values directly off the HDF5 files, converting the information into JSON on the fly. All data points both on and above the surface can be examined here as well. Both the raw values and, if relevant, elevations are displayed. Overflights from not only GPM Core, but also constellation satellites can be viewed using this tool.

STORM Event Viewer also reads values directly off HDF5 files, but it focuses on a set of curated GPM overflights where a high-impact event was observed. Three-dimensional Dual-frequency Precipitation Radar (DPR) data can be colored by both altitude and precipitation rate, and they are combined with surface precipitation rate information from the GPM Microwave Imager (GMI) Goddard Profiling Algorithim (GPROF) data. A short description of the event being observed is included to contextualize the data.