WebWorldWind, achievements and future of the ESA-NASA partnership

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PeerJ Preprints | https://doi.org/10.7287/peerj.preprints.2134v1 | CC BY 4.0 Open Access | rec: 15 Jun 2016, publ: 15 Jun 2016

Abstract

WebWorldWind is a 3D virtual globe API for HTML5 and JavaScript developed by NASA with support of the European Space Agency (ESA) and other partners. In this paper, the results of the first year for the on-going collaboration between ESA and NASA on WebWorldWind development are presented, highlighting concrete examples built with the newly introduced features and putting them in relation to possible research and education use cases. Finally, the next steps and roadmap are briefly introduced.

Introduction

Since its first stable release in 2011, the increased availability of WebGL as part of HTML5, including on mobile platforms, makes it an ideal candidate for powerful 3D virtual globes serving the needs of geospatial activities. Relying on Web technologies enables new paradigms in terms of distribution, portability, access to data sources and ease of use in general that can greatly benefit the research and education activities.

At the end of 2014, capitalizing on its experience building WorldWind technologies over the last decade, NASA started a new project called WebWorldWind that brings their famous 3D virtual globe to the Web via a JavaScript API. Mid-2015, ESA - via the “Fast Prototyping” consortium - joined the project by contributing with software development and requirements in order to support the development of features enabling the visualization of data produced by its Earth Observation missions. Since then, the partners have been steadily building a full-fledged solution in the spirit of true open-source software. All the code is freely available to any interested developer anywhere in the world.

Results of the First Year

Based on the already available feature-set including navigation, viewing and picking, the collaboration began with the addition of new file formats in complement to Shapefiles, JPEG and PNG. File formats for external data were deemed key enablers for the intended use of the framework. The following formats were added:

- GeoJSON for shapes
- GeoTIFF for both strip- and tile-based imagery
- Collada for 3D models
- KML (geometries, placemark, styling, overlays, time primitives, network link…)

The team then focused on implementing visual effects: atmosphere, sun illumination and day/night layers. They not only make the Earth globe very appealing to any user, but also contribute to the analysis of phenomena where the distinction between day and night is relevant.

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Figure 1 – Satellite tracker combining some of the abovementioned features

In addition to the direct contributions to the WebWordWind framework and the examples related to these contributed features, the ESA-funded team developed reference applications for its own purposes. Figure 1 shows a satellite tracker for the Sentinel satellites part of Copernicus, the European Programme for the establishment of a European capacity for Earth Observation**.** In the development of this application, particular attention is given to performance and compatibility with mobile platforms.

A second reference application presents statistics on the availability of Earth Observation products for specific missions and instruments. Density maps resulting from this application, for Sentinel-1 and Sentinel-2 data, are shown in Figure 2 below. There are other demo applications, and more continue to be built, highlighting how easily various types of data (not necessarily space-related) can be displayed on WebWorldWind: for example, the Sentinel-1 and Sentinel-2 acquisition plans, weather data from EUMETSAT, country data following the INSPIRE directive, etc.

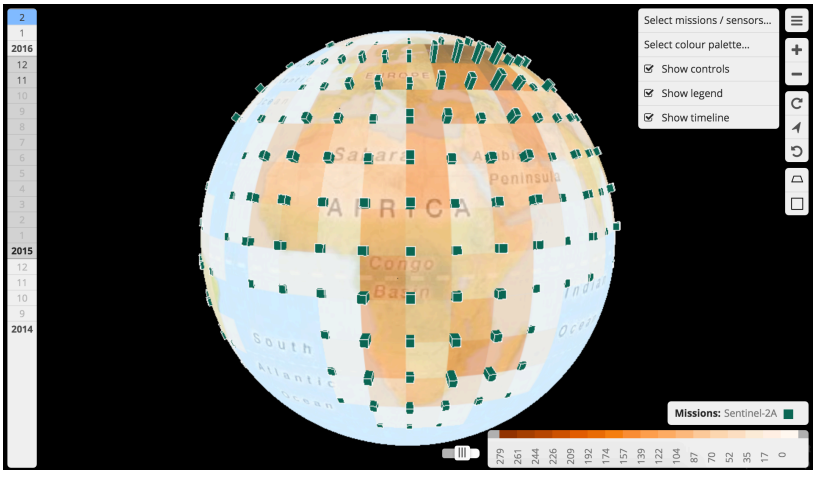

Figure 2 – Statistics on the availability of earth observation products

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Another important aspect for such solutions is the ability to handle the large amounts of data commonly found in geospatial information sources. In order to demonstrate this, a viewer for the Normalized Difference Vegetation Index (NDVI) was developed. The data is acquired and processed directly by the client. Raw NDVI values, which are floating point values, are scaled for generating an image that can then be seen on the globe at the proper coordinates and clamped to the terrain as show in Figure 3 below.

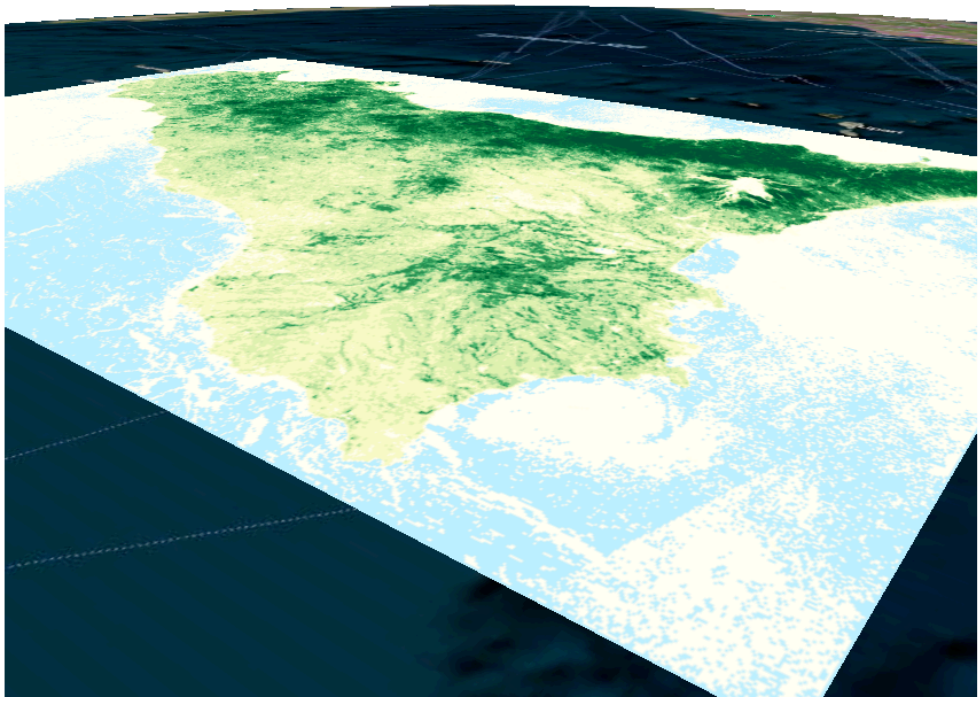

Figure 3 – NDVI over Sicily

The operation uses JavaScript Web Workers for processing the data without blocking the globe and the web interface. Moreover, multiple scenes creating a timeline can be processed in parallel using this method, making use of multiple threads. When clicking on the surface, the rescaled values for the location are presented for the entire timeline as depicted in Figure 4.

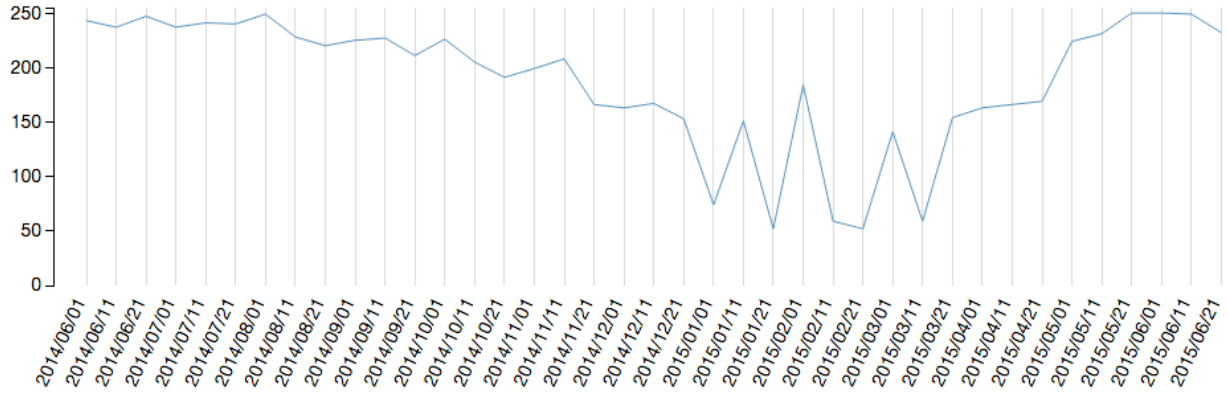

Figure 4 – Plot of the rescaled NDVI values for a particular location

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Outlook and Conclusion

The contractual framework for the team supporting the collaboration between ESA and NASA was recently renewed for a year, with plans not only to contribute to the extension of the WebWorldWind framework itself but also to build rich, interesting and useful applications that promote and help visualize ESA data on top of it. Backed by these two agencies, WebWorldWind has a bright future with a growing user and developer community and many promising features in the pipeline.

The team, recently enlarged by an industrial partner, is now working on the support of additional OGC standards including WMTS and WCS. The latter is foreseen for both imagery and local elevation models.

The roadmap also includes WPS, WFS, Measurement, Line of Sight, Analytic Surface, HDF and FBX, among others. Inputs from the community as contributions to the roadmap are welcome and important to assure that the framework continues evolving and serving the real needs of geospatial users all over the world, who wish to rely on free and open-source technologies rather than expensive license schemes.

Finally, this venture also opens new doors for education and research purposes. In fact, as mentioned in the introduction, open source Web technologies make access to data and building prototypes much easier and productive. For example, combine WebWorldWind with JS Bin and you get an open platform for education.

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