



## Cross-Dataset Analysis and Visualization Driven by Expressive Web Services

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The deluge of data that is hitting us every day from satellite and airborne sensors is changing the workflow of environmental data analysts and modelers. Web geo-services play now a fundamental role, and are no longer needed to preliminary download and store the data, but rather they interact in real-time with GIS applications. Due to the very large amount of data that is curated and made available by web services, it is crucial to deploy smart solutions for optimizing network bandwidth, reducing duplication of data and moving the processing closer to the data.

In this context we have created a visualization application for analysis and cross-comparison of aerosol optical thickness datasets. The application aims to help researchers identify and visualize discrepancies between datasets coming from various sources, having different spatial and time resolutions. It also acts as a proof of concept for integration of OGC Web Services under a user-friendly interface that provides beautiful visualizations of the explored data.

The tool was built on top of the World Wind engine, a Java based virtual globe built by NASA and the open source community. For data retrieval and processing we exploited the OGC Web Coverage Service potential: the most exciting aspect being its processing extension, a.k.a. the OGC Web Coverage Processing Service (WCPS) standard. A WCPS-compliant service allows a client to execute a processing query on any coverage offered by the server. By exploiting a full grammar, several different kinds of information can be retrieved from one or more datasets together: scalar condensers, cross-sectional profiles, comparison maps and plots, etc. This combination of technology made the application versatile and portable. As the processing is done on the server-side, we ensured that the minimal amount of data is transferred and that the processing is done on a fully-capable server, leaving the client hardware resources to be used for rendering the visualization.

The application offers a set of features to visualize and cross-compare the datasets. Users can select a region of interest in space and time on which an aerosol map layer is plotted. Hovmöller time-latitude and time-longitude profiles can be displayed by selecting orthogonal cross-sections on the globe. Statistics about the selected dataset are also displayed in different text and plot formats. The datasets can also be cross-compared either by using the delta map tool or the merged map tool. For more advanced users, a WCPS query console is also offered allowing users to process their data with ad-hoc queries and then choose how to display the results. Overall, the user has a rich set of tools that can be used to visualize and cross-compare the aerosol datasets.

With our application we have shown how the NASA WorldWind framework can be used to display results processed efficiently – and entirely – on the server side using the expressiveness of the OGC WCPS web-service. The application serves not only as a proof of concept of a new paradigm in working with large geospatial data but also as an useful tool for environmental data analysts.