ENVI & IDL Services Engine
For Web-Accessible Multi- & Hyperspectral Applications

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Introduction

- The geospatial community, including the field of environmental imaging spectroscopy, has a growing need for online on-demand analytic capabilities.

- Work previously done on desktop workstations will migrate to a web-accessible environment to mitigate growing data volumes, bandwidth usage, and end user requirements.

- Web based applications (or 'apps') are intended to apply analytic methods, procedures, and routines to image datasets stored within centralized server repositories.

- Exelis Visual information Solutions (Exelis VIS) developed an enterprise-enabled processing engine, the ENVI & IDL Services Engine (ESE), that provides remote users access to the power of ENVI image analysis and IDL applications from a web or mobile client interface.

- HySpeed Computing is building applications for use with ENVI and ESE, as well as creating a framework for the remote sensing community to develop, deploy and exchange their own applications.

Background

- The ENVI and IDL Services Engine (ESE), deploys data access, analysis, and visualization capabilities to the enterprise, either in the cloud, or within the data storage enterprise.

- ESE can interoperate with any middleware (e.g. ArcGIS Server or GeoServer), meaning users can readily implement this capability using their current enterprise architecture.

- Once an ENVI or IDL routine (i.e. application) is developed, it's simple to wrap it as a service and deploy it in ESE for consumption by remote end users, other apps, or services running in the enterprise.

- The ENVI Services Engine provides REST-compliant web services. In particular, it is based on ESRI's GeoProcessing REST specification, which is expected to be adopted by the Open Geospatial Consortium (OGC).

- ESE responds to processing requests by listening for HTTP calls in a RESTful state. HTTP REST requests made to the ESE from a middleware component will subsequently call and run ENVI and IDL routines, with the results being pushed back through the middleware components to the requesting application. See **Figures 1 & 7**.

- The ENVI Services Engine is able to **scale** and **load balance** because of its REST architecture and is designed to run on a cluster. As requests arrive from any number of clients, the master web server will accept and route the request. If the request is for information about a task (or the system in general) then the master will return the requested information to the client. If the request is to perform a task, then the master will give the request to one of its worker processes. See **Figure 2**.


Figure 1. Notional architecture diagram for an ESE deployment in the enterprise
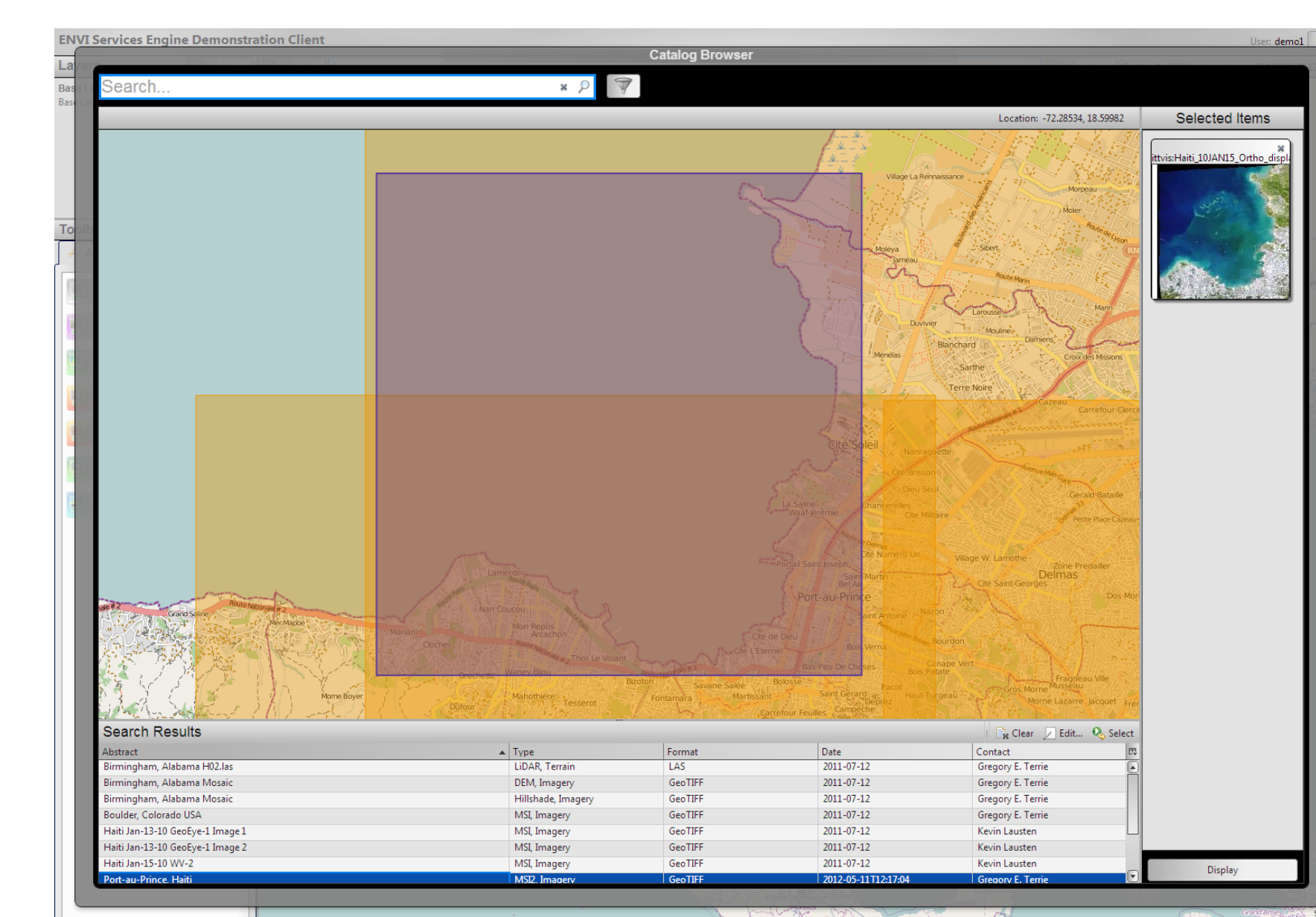

Figure 2. An ENVI and IDL Services Engine compute cluster, illustrating scalability and load balancing
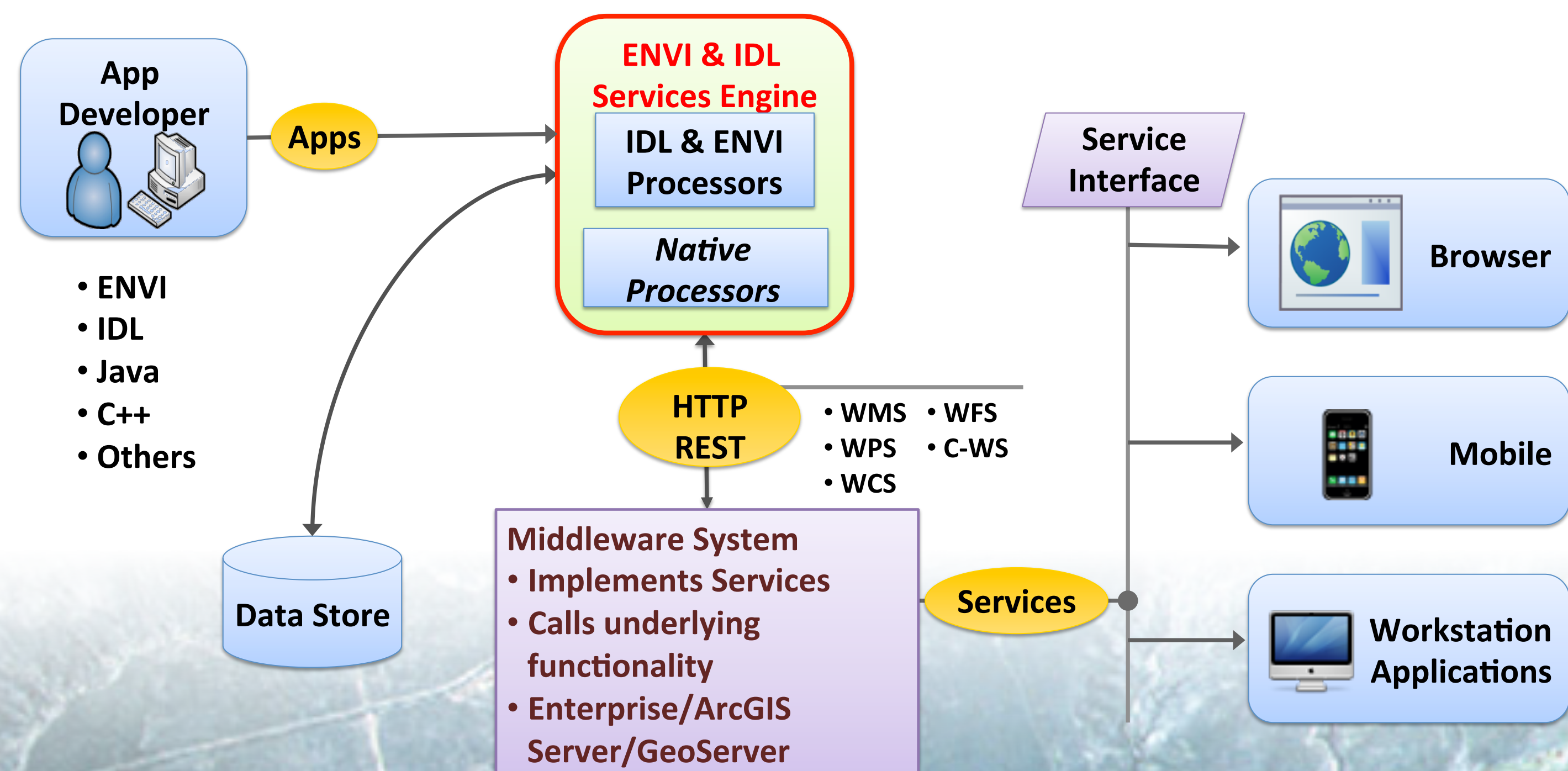
Figure 3. The ENVI and IDL Services Engine Management Console, illustrating upload of bathymetry application
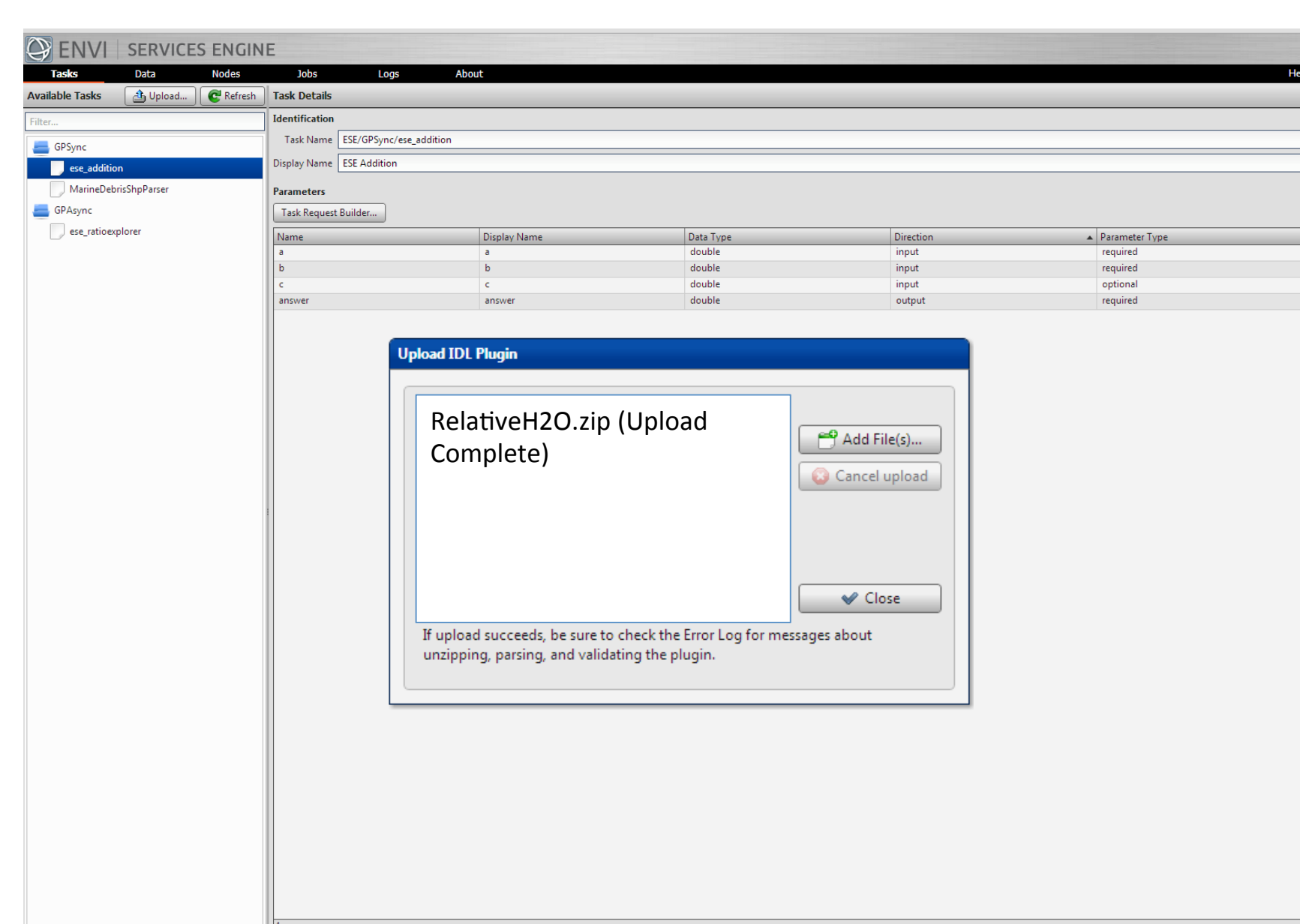
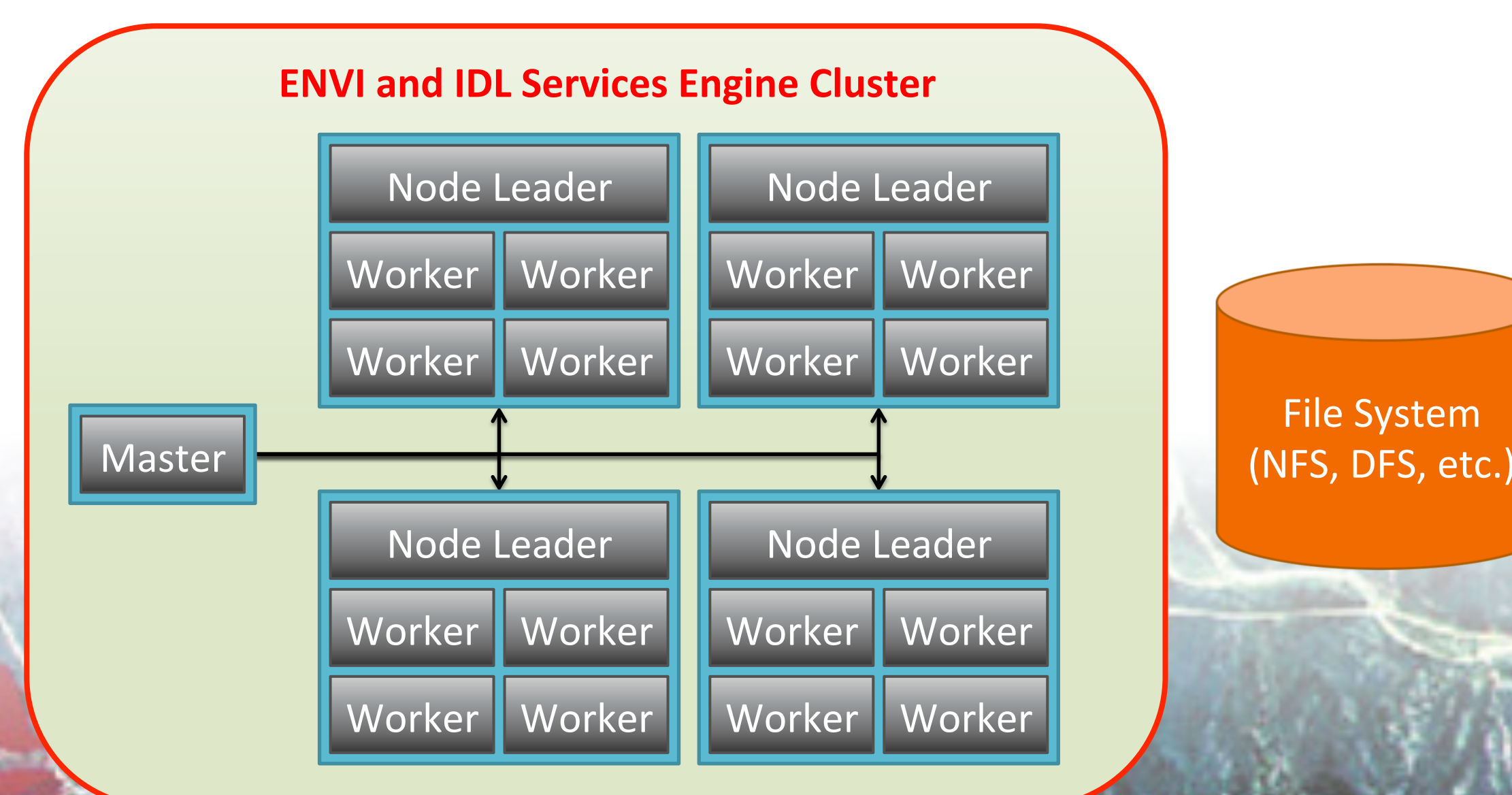*Figure 4. The ENVI and IDL Services Engine 'Reference Implementation'…. Implemented in GeoServer*
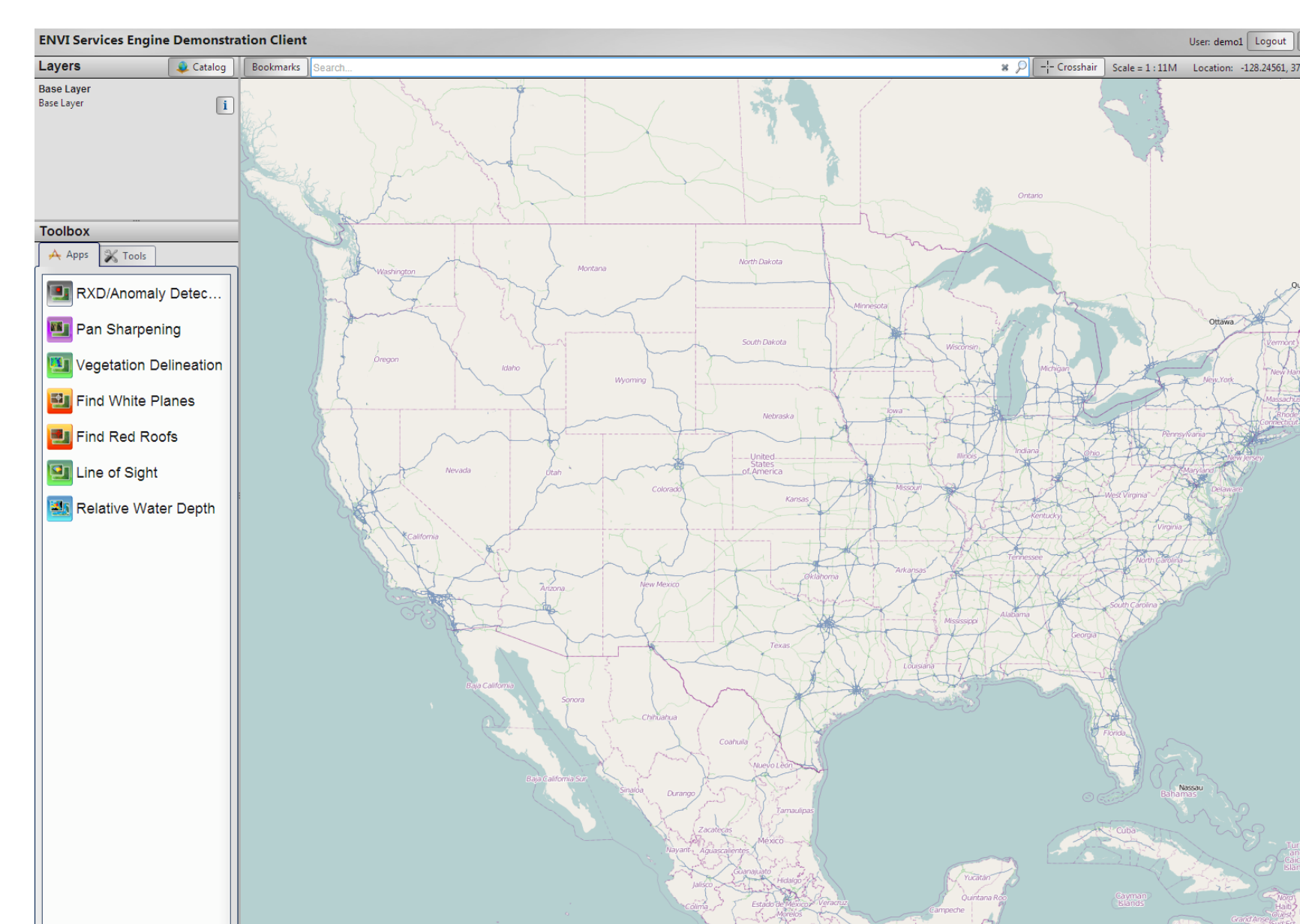
A Reference Implementation

- To provide an example of how ESE can be used, Exelis VIS created a reference implementation that deploys ENVI multi- and hyperspectral processing routines as 'apps'. See **Figures 3-7**. These include:
  - RXD/Anomaly Detection for detection of spurious material from a large image.
  - Vegetation Delineation utilizing the NDVI algorithm for identifying photosynthetic activity.
  - Spectral target identification demonstrating the SAM algorithm for identifying materials in a hyperspectral dataset.
  - Relative Water Depth utilizing a bottom albedo-independent bathymetry algorithm developed by Stumpf and Holderied (2003).

- The reference implementation illustrates a user employing a web based client or a mobile app (Android or iPhone) and calling ESE via a middleware component such as GeoServer. See **Figure 1**.

- The user can discover data using a cataloguing specification such as Web Catalog Service (CS-W) and make Open Geospatial Consortium (OGC)-compliant analysis requests via Web Processing Service (WPS) calls to ESE via the middleware.

- The use case displayed in **Figures 3-7** demonstrates the implementation of the Relative Water Depth App. The user first discovers data in the archive, displays the data in the GeoServer interface, selects the Relative Water Depth App, specifies an area of interest for running the algorithm, and then visualizes the result.

Summary

- The manner in which imagery data is being stored and analyzed is changing. ENVI and IDL have long been tools used in the Earth and Planetary science communities. The ENVI and IDL Services Engine helps scientific data users transition to the cloud while still being able to use legacy code and algorithms.

- The flexible REST implementation makes implementing ESE in existing cloud architecture straightforward, robust, and stable.

Figure 5. Accessing imagery data via the data catalogue implemented within the ENVI and IDL Services Engine Reference Implementation

Figure 6. Displaying an RGB color composite within the ENVI and IDL Services Engine Reference Implementation. Note the 'Relative Water Depth' App
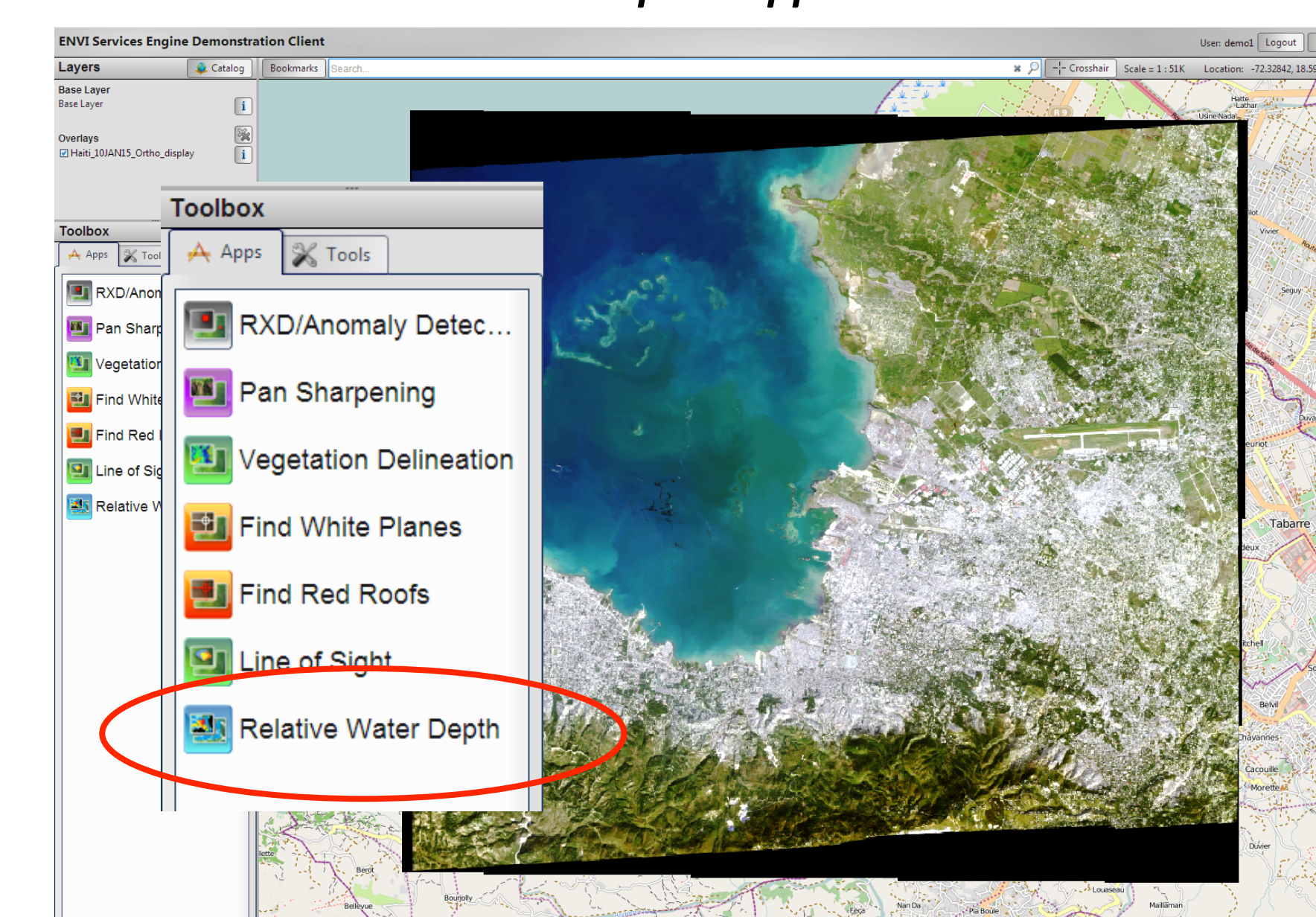
Figure 7. Relative Water Depth result displayed to the web browser