MONITORING NATURAL EVENTS GLOBALLY IN NEAR REAL-TIME USING NASA'S OPEN WEB SERVICES AND TOOLS

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1. INTRODUCTION

Since 1960, NASA has been making global measurements of the Earth from a multitude of space-based missions, many of which can be useful for monitoring natural events. In recent years, these measurements have been made available in near real-time, making it possible to use them to also aid in managing the response to natural events [1]. We present the challenges and ongoing solutions to using NASA satellite data for monitoring and managing these events.

2. BACKGROUND

There are over 7000 NASA satellite data products from the past 50+ years which are available for studying the Earth over a wide range of scientific domains. They are almost all available online [2][3] in a variety of formats (e.g., HDF, NetCDF, GeoTIFF), processing levels (e.g., 0, 1, 1A, 1B, 1T, 2, 2G), spatial resolutions (e.g., 30m, 250m, 1km), coordinate systems, etc., for a total of about 10 petabytes. Given the challenges of dealing with this very large, heterogeneous data archive, we are taking steps to make its exploration, analysis, and decision support more approachable by non-experts and "outsiders" -- including the natural events community.

3. SOLUTIONS

3.1. Near real-time access to data

Of the current operating satellite fleet, products from several instruments are available within three hours via the Land Atmosphere Near Real-Time Capability for EOS (LANCE) [4]. Through LANCE, users can download data (often in the HDF format) via standard mechanisms over the Internet. This directly supports applications such as numerical weather forecasting, air quality measurements, and monitoring natural hazards for users who need quantitative measurements.

3.2. Visualization of near real-time data

Once LANCE processes these data, they are quickly transformed into imagery via the Global Imagery Browse Services (GIBS) [5]. Its aim is to provide an accurate visual representation of the underlying data to allow a rapid qualitative assessment for near real-time and scientific applications. Applications that are well suited to this type of assessment include fire management, volcanic ash monitoring, and ship navigation through sea ice-laden waters [6].

These imagery are provided at the native resolution of the sensor to provide the highest fidelity possible. It is then openly served via the Open Geospatial Consortium (OGC) Web Map Tile Service (WMTS) to any Internet-connected client - this includes interactive web mapping clients, GIS clients, and batch scripts to retrieve the imagery en masse [7]. The web-based Worldview client [8] has been developed to interactively browse GIBS imagery, download custom subsets, and retrieve the underlying data.

3.3. Tracking natural events

While the Worldview/GIBS system provides a mechanism to rapidly browse the available satellite imagery, the sheer quantity and volume of available products precludes a brute force investigation of a given natural event, especially for newer users. In addition, it is not always obvious where or when a natural event is occurring. The Earth Observatory - Natural Events Tracker (EO-NET) is therefore being developed to aid in focusing users on where, when, and what products are relevant for a given event. It provides an openly available set of event-specific metadata which is curated by domain experts. We seek those experts who would be able to regularly provide event-related metadata to the natural events community.

3.4. Tying the pieces together

While each of the above systems can be used independently, they are also envisioned to be used together. For example, a graduate student starts her day by opening the Worldview web mapping client to see if there are any new volcanic events in the embedded EO-NET feed. While clicking through a few minor events, she notices one with a particularly strong sulfur dioxide signal but weak aerosol and visible reflectance signals. She then downloads the underlying data and compares it to past events at this location to hypothesize over the potential severity of the current event.

In another example, a local journalist wishes to report on natural events that affect his region. He can choose to filter the EO-NET feed for all events that intersect his location or utilize the Worldview client to browse data imagery over his location which he can then download and use to supplement his reporting.

We propose to demonstrate how this multi-tiered approach to the near real-time distribution of data and associated imagery can be accomplished through the deployment of multiple openly-available web services, and that by means of these multiple access points the usage of the data and imagery will increase.

4. REFERENCES

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