Integrated Web-Based Immersive Exploration of the Coordinated Canyon Experiment Data using Open Source STOQS Software

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Abstract

The Coordinated Canyon Experiment (CCE) in Monterey Submarine Canyon has produced a wealth of oceanographic measurements whose analysis will improve understanding of turbidity current processes. Exploration of this data set, consisting of over 60 parameters from 15 platforms, is facilitated by using the open source Spatial Temporal Oceanographic Query System (STOQS) software (https://github.com/stoqs/stoqs). The Monterey Bay Aquarium Research Institute (MBARI) originally developed STOQS to help manage and visualize upper water column oceanographic measurements, but the generality of its data model permits effective use for any kind of spatial-temporal measurement data.

STOQS consists of a PostgreSQL database and server-side Python/Django software; the client-side is jQuery JavaScript supporting AJAX requests to update a single page web application. The User Interface (UI) is optimized to provide a quick overview of data in spatial and temporal dimensions, as well as in parameter, platform, and data value space. A user may zoom into any feature of interest and select it, initiating a filter operation that updates the UI with an overview of all the data in the new filtered selection. When details are desired, radio buttons and checkboxes are selected to generate a number of different types of visualizations. These include color-filled temporal section and line plots, parameter-parameter plots, 2D map plots, and interactive 3D spatial visualizations. The Extensible 3D (X3D) standard and X3DOM JavaScript library provide the technology for presenting animated 3D data directly within the web browser. Most of the oceanographic measurements from the CCE (e.g. mooring mounted ADCP and CTD data) are easily visualized using established methods. However, unified integration and multiparameter display of several concurrently deployed sensors across a network of platforms is a challenge we hope to solve. Moreover, STOQS also allows display of data from a new instrument – the Benthic Event Detector (BED). The BED records 50Hz samples of orientation and acceleration when it moves. These data are converted to the CF-NetCDF format and then loaded into a STOQS database. Using the Spatial-3D view a user may interact with a virtual playback of BED motions, giving new insight into submarine canyon sediment density flows.

User Interface (UI) is optimized to provide a quick overview of data in spatial and temporal measurement data. The STOQS PostGIS database is facilitated by using the open source Spatial Temporal Oceanographic Query System (STOQS) originally developed STOQS to help manage and visualize upper water column oceanographic measurements, but the generality of its data model permits effective use for any kind of spatial-temporal measurement data.

The STOQS software (https://github.com/stoqs/stoqs) is 100% Open Source, making it easily downloaded in a variety of formats for further analysis...