Data Cube Support to GFOI Early Warning

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Session 1

*Agenda Item 7*

GFOI Alert Demo Case Study

- **Objective:** To demonstrate a deforestation alert tool that utilizes diverse moderete resolution datasets and a Data Cube infrastructure.

- **Location:** Vietnam (TBD). In order to take advantage of the current Vietnam HLS test sites, the following locations are suggested (see figure on the right). It is expected that the final selected site will be of high interest to the Vietnam Forest Inventory and Planning Institute (FIPI).

- **Datasets:** Several analysis-ready datasets are needed, including: Landsat 7/8, Sentinel 1/2, Harmonized Landsat-Sentinel (HLS), ALOS/ALOS-2 PALSAR and Radarsat.

- **Change Detection Algorithms:** The identification of potential deforestation sites will be determined by various land change detection algorithms, including:
  - JJ-FAST (applied to PALSAR) from JAXA
  - PyCCD (initially only Landsat, but plans to test with other datasets)
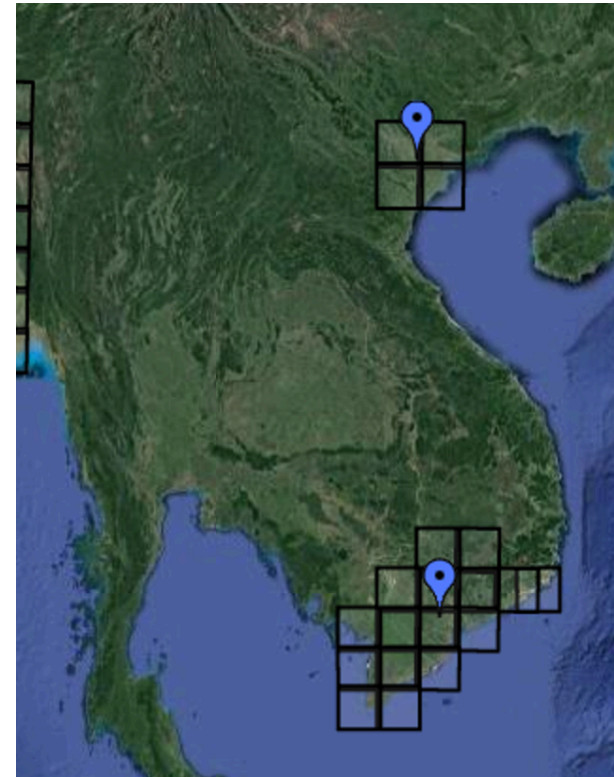
Existing Data Cube pilots

- The **CEOS Data Cube** initiative has established over 16 sample Data Cubes in South America (Colombia, Uruguay), Africa (Kenya, Ghana, Chad) and Asia (Vietnam, Bangladesh).

- Most Data Cubes are Landsat 7/8, but new Sentinel-1 and ALOS/ALOS-2 Data Cubes exist in Vietnam.

- The CCDC change detection algorithm has been adapted to run on the Data Cube (now called **PyCCD**) using Landsat data. CEOS plans to test this code with Sentinel-1 in the coming months.

- Using a Data Cube for an **Early Warning Alert** system has some advantages. The solution could be commonly applied to anyone with a Data Cube and the results controlled locally. In addition, it is computationally efficient to run time series analyses.
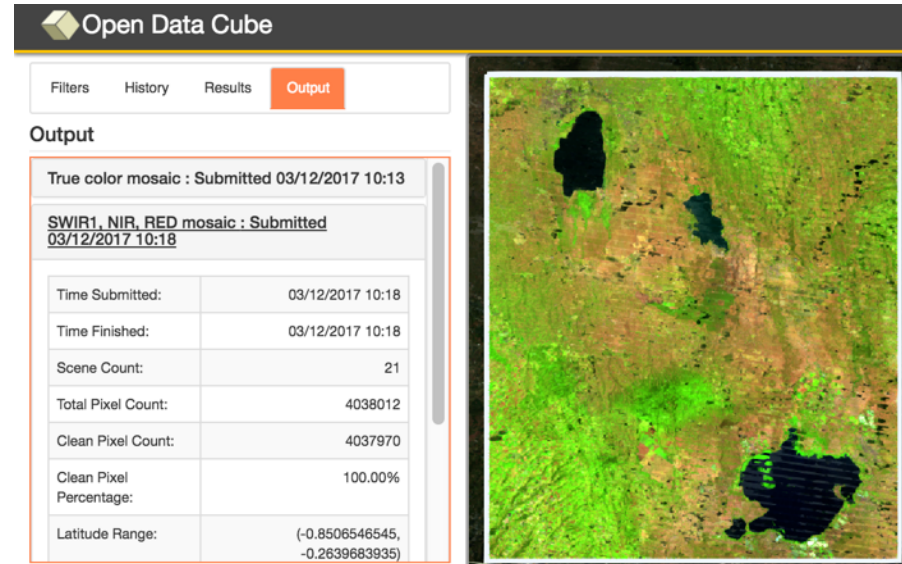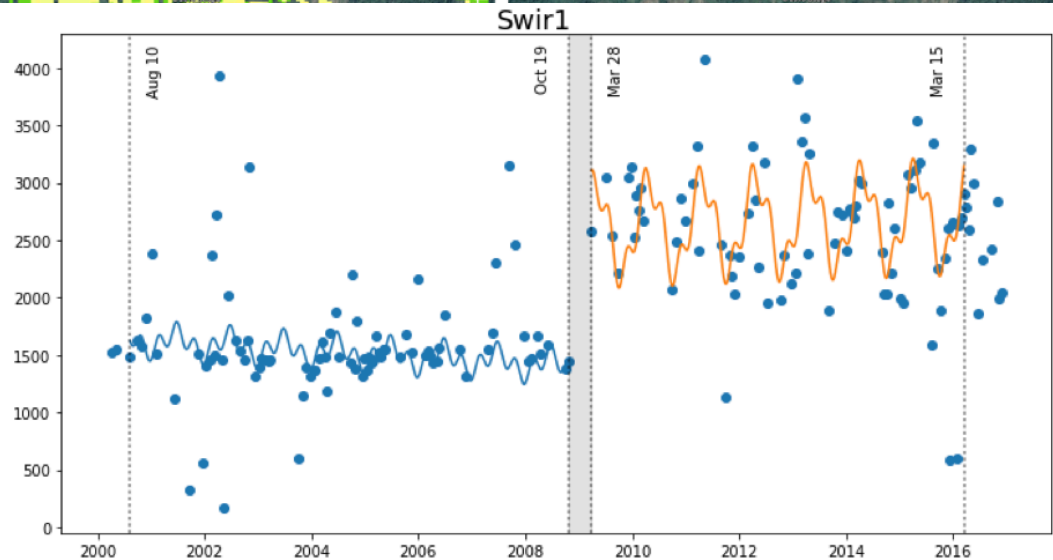
Land Change Detection

CCDC (Zhu and Woodcock, 2012) was converted to Python by USGS and recently tested by the SEO on the Vietnam Data Cube. We now call this "**PyCCD**".
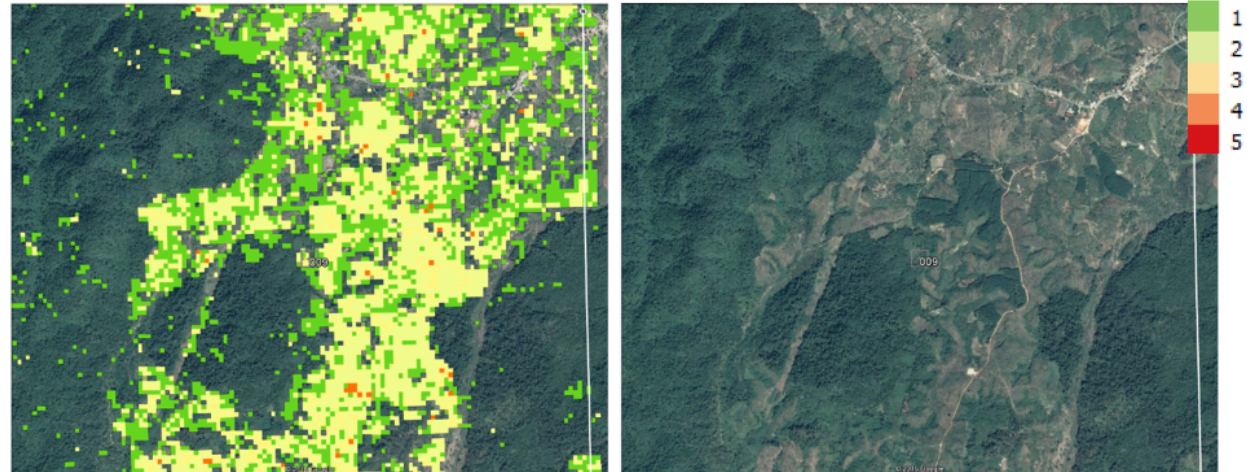
PyCCD time series model fits 7 bands to 6 weighted SINE and COSINE functions in order to find "breaks" that equate to potential land change.
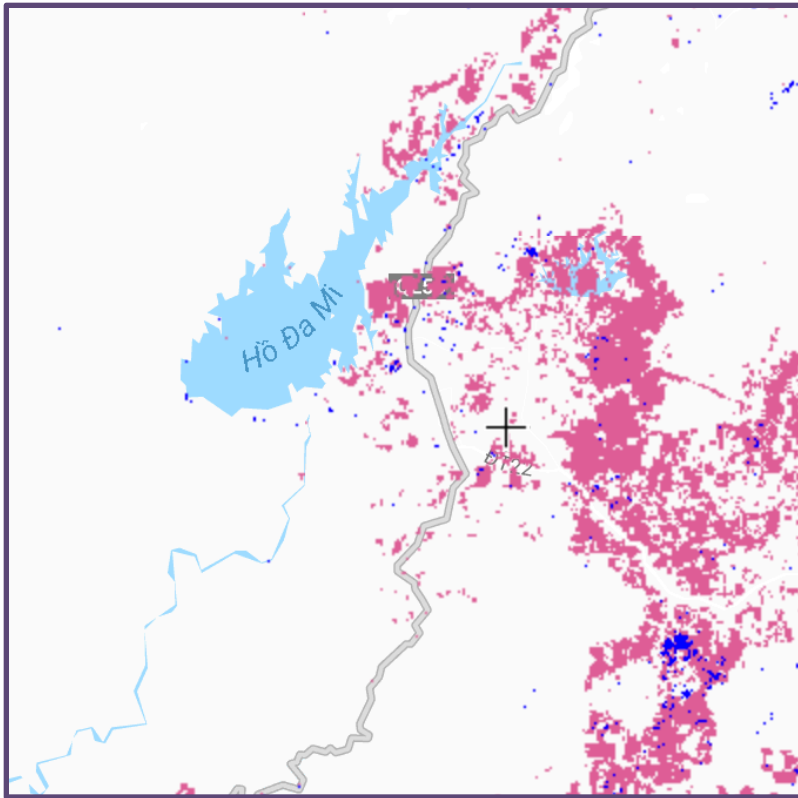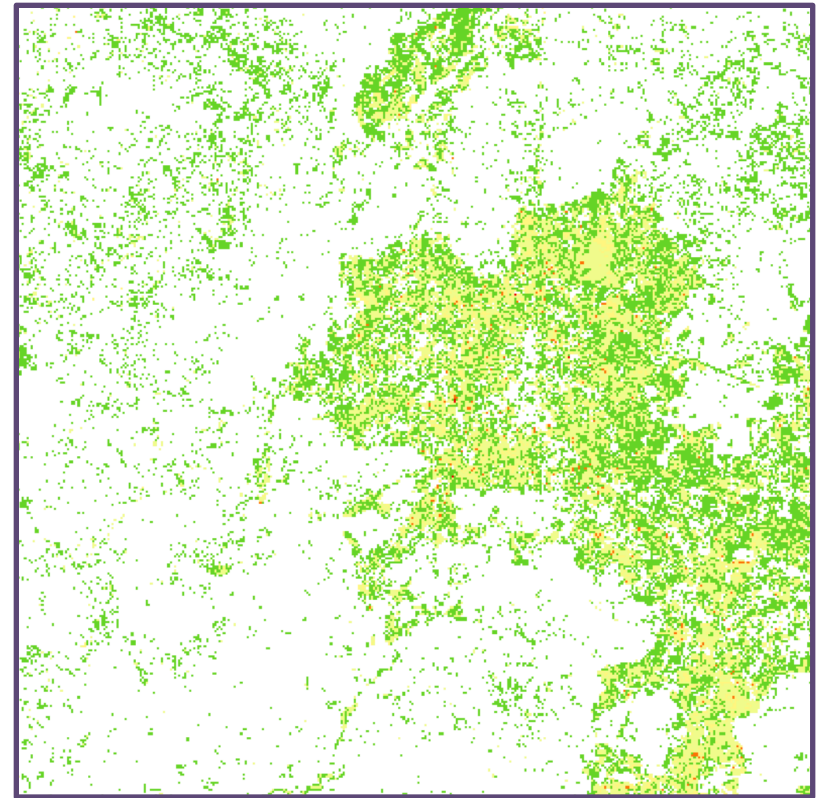
Vietnam Land Change

Bediaye, Vietnam – Data Cube Median Mosaic (left), **PyCCD Results** (right)

2000 to 2016, 192 Landsat scenes

Global Forest Watch vs. PyCCD

Global Forest Watch
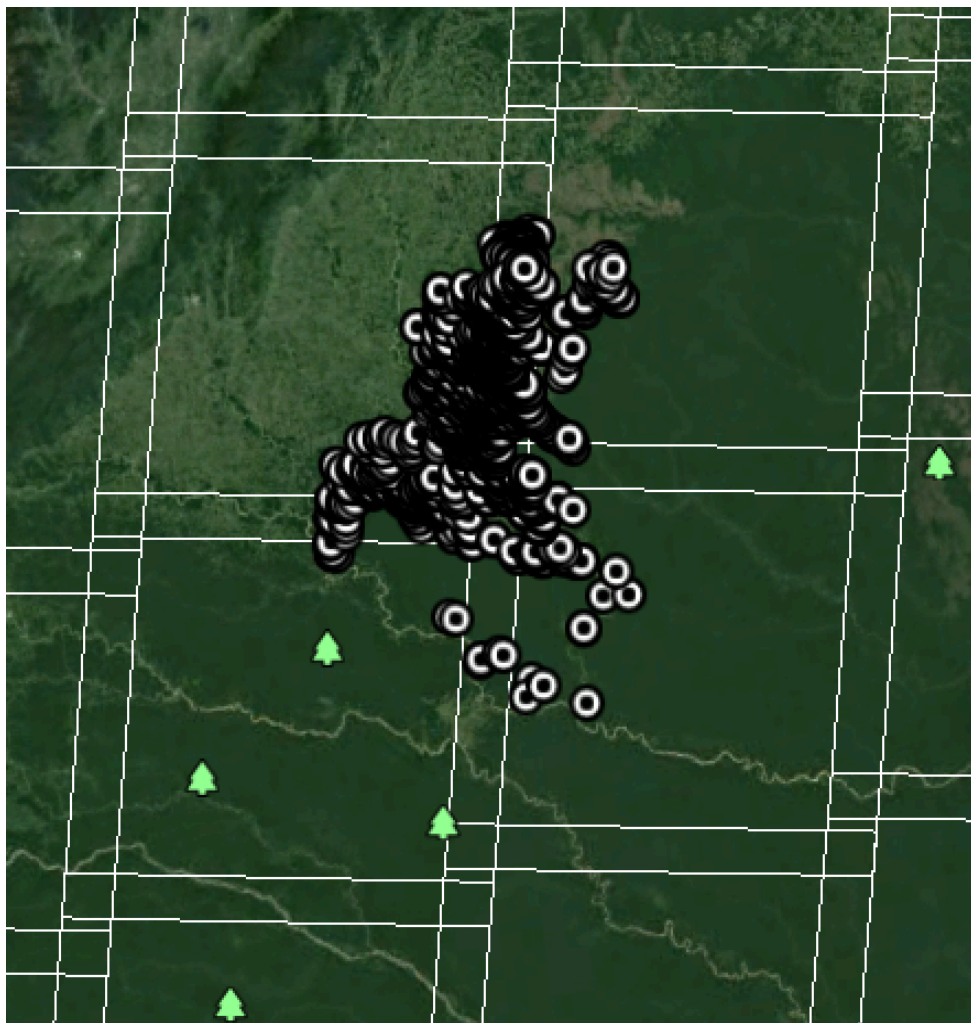**Forest Loss** - 2000 to 2015

PyCCD with a Data Cube
Land Change - 2000 to 2016

PyCCD Execution: 372 x 372 pixels, 8 parallel cores, 2.3 hours (~1 msec / clear pixel)

Example Alerts from Colombia

Deforestation Alert Samples

Data provided by Colombia

February 2017 Alerts in Caqueta, central Colombia

The CEOS SEO plans to investigate these alert locations against Landsat PyCCD results, Sentinel-1 PyCCD results and ALOS JJ-Fast results.