# A Suite of Tools for Continuous Land Change Monitoring in Google Earth Engine

**NASA**

**NASA CMS**
CARBON MONITORING SYSTEM

## Background

The availability of cloud computing power and free satellite data has enabled new and exciting approaches to studying the environment. We can now move away to from traditional change detection to more comprehensive continuous monitoring of environmental change. Still, bottlenecks have prevented the use of such techniques outside selected research groups. To increase the accessibility of more advanced monitoring tools, we have created a suite of easy-to-use-tools in Google Earth Engine.

## Analysis

The following tools have been implemented:

(1) time series viewers of time segments generated by analysis of time-series of satellite data;

(2) a spatial data viewer to explore coefficients and derivatives of a time series-based model, and visualize change information;

(3) tools to create land cover and land cover change maps from time series outputs;

(4) a tool for sampling, reference data collection, and sample data analysis for unbiased estimation of map accuracy and area of key climate-related variables such as deforestation extent; and

(5) an API for accessing the functionality underlying these tools.

## Significance

We believe that the tools will facilitate the exploration and visualization of time series of satellite observations, and streamline the creation of land cover and land cover change maps. By removing barriers that have prevented users from tapping into the vast repositories of satellite data now available, we expect that users will extract new useful information that can
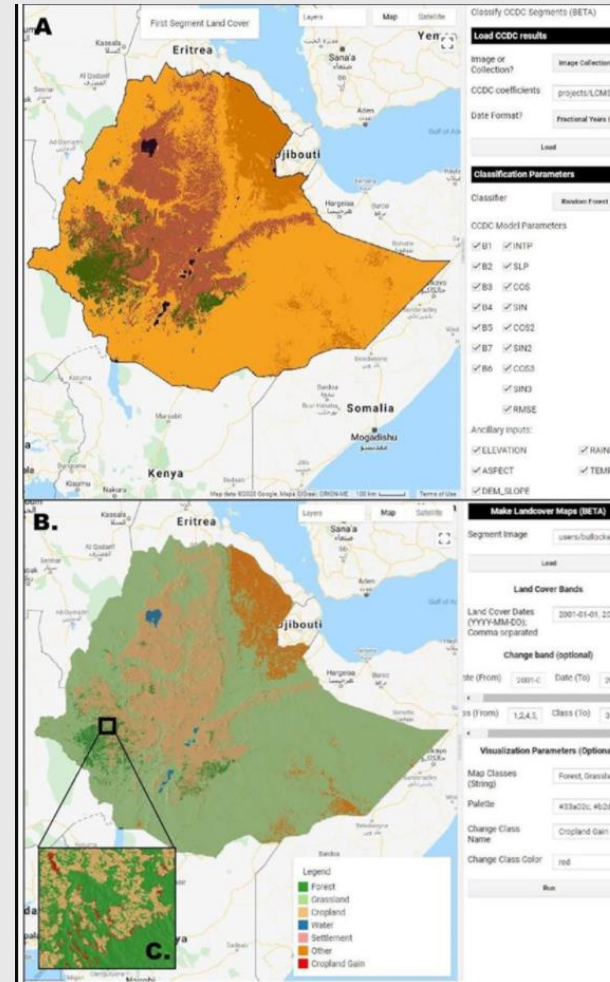


Fig. 1: The Classification Tool used to classify time segments for Ethiopia **(A)**, the Land Cover Tool which allows users to extract categorical maps, including maps of change, for any desired date or dates **(B)**, and a subset of **(B)** that shows pixels classified as cropland gain due to displacement of forest **(C)**.
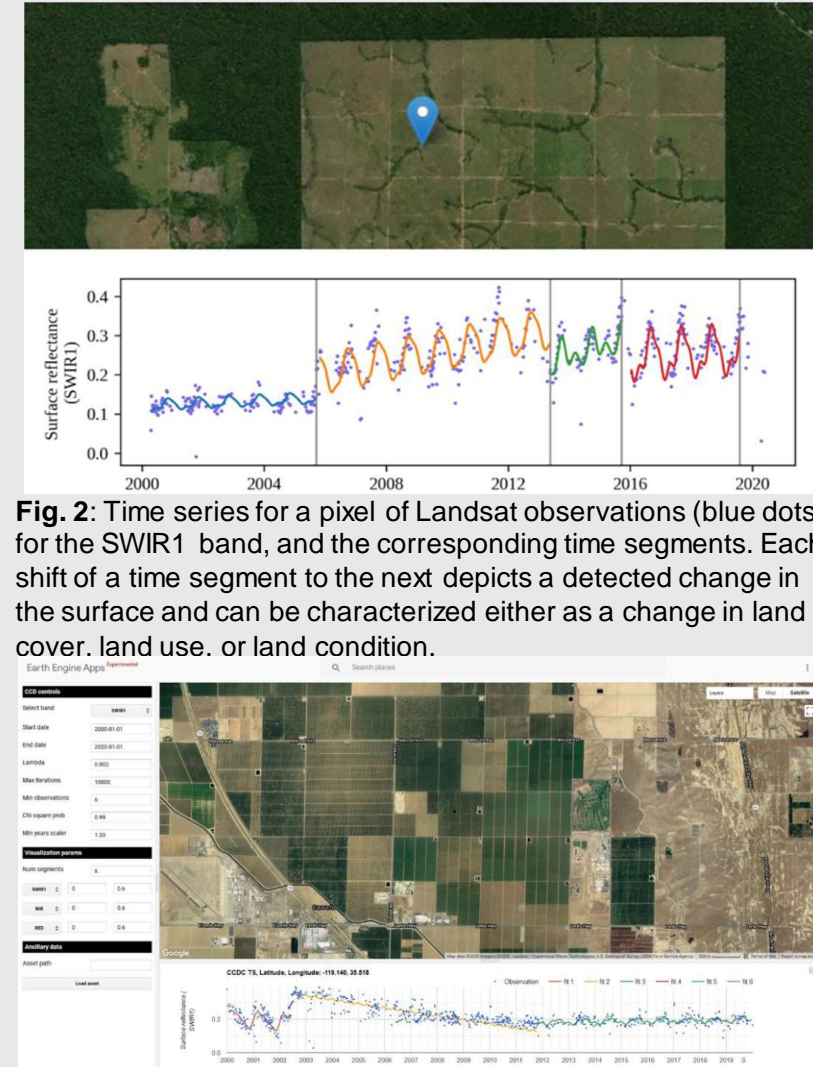


Fig. 2: Time series for a pixel of Landsat observations (blue dots) for the SWIR1 band, and the corresponding time segments. Each shift of a time segment to the next depicts a detected change in the surface and can be characterized either as a change in land cover. land use. or land condition.



Fig. 3: Screenshot of the *Advanced time series tool* showing the controls in the left panel. The time series of the clicked pixel represents long term agricultural cycles in California.