NOAA ROSES Semi-Annual Report

Reporting Period: September 2020 – February 2021 (1st report)

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Project Title: Development of a Next-Generation Science-Quality Geostationary Satellite Active Fire Product

Executive Summary

Our focus during this first reporting period was to 1) produce a large quantity of extensive training and test data needed for the machine learning component of the project, 2) begin initial machine learning experiments, 3) develop a basic ABI-ingest and scan-processing software with which to implement and test "hand-crafted" ABI fire-detection algorithm experiments, and 4) compile a large quantity of ABI imagery for testing.

Progress toward FY20 Milestones and Relevant Findings

As part of our initial machine learning (ML) experiments, we have considered both a shallow neural network (multi-layer perceptron) and a random forest model, and found a modest performance advantage for the former. While our initial experiments are considering a broad spectrum of ML options, for the sake of traceability we will ultimately focus on those ML methods that more easily allow the reasons for the rendering of a particular output class to be determined.

A custom ENVI/IDL software interface (Figure 1) was developed jointly by OSPO/SAB (Wilfrid Schroeder) and L3/Harris Contractor to help optimize the generation of training data using GOES-16/17 Full Disk imagery and a new land/water mask. The custom interface builds on the Hazard Mapping System (HMS) software that is used operationally by OSPO/SAB to detect fires across North America, with major modifications to (i) allow handling of native GOES satellite projection/resolution and (ii) specific input/output training data format. Using the new interface, two initial samples consisting of 24h of GOES-16 Full Disk data were produced coinciding with opposing Summer/Winter seasons in order to adequately capture seasonal variations in observation conditions and fire regimes across northern and southern hemisphere. In total, over 70K training points were generated consisting of fire-affected ABI pixels in addition to billions of fire-free (land, water, cloud) pixels.

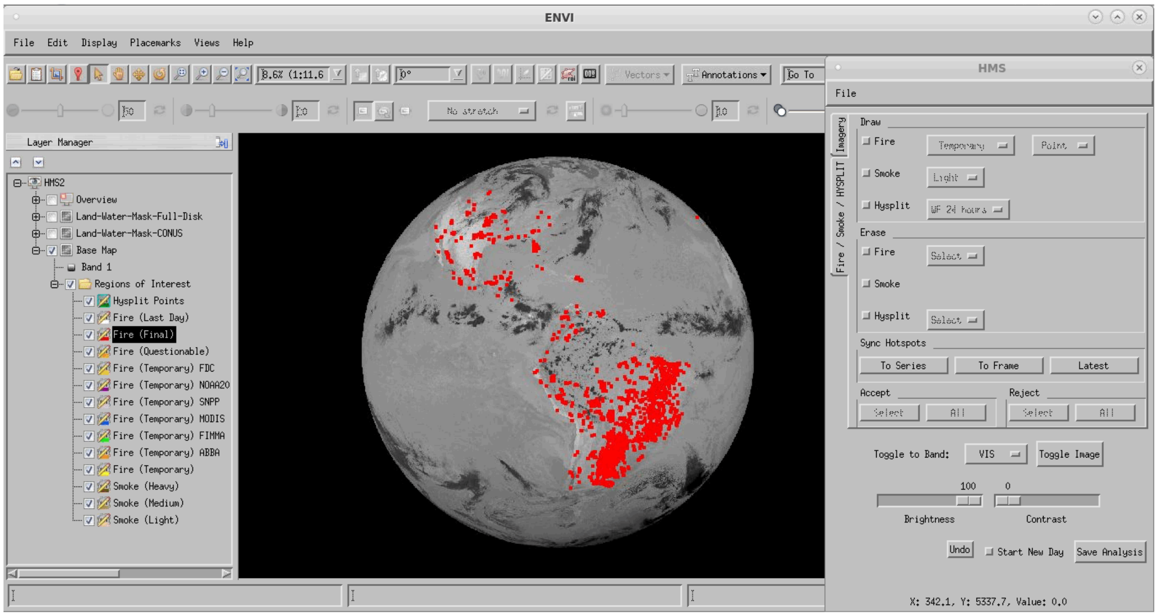

Figure 1: ENVI/IDL custom software interface used to generate training data, here displaying GOES-16 ABI Full Disk image acquired on 14 July 2020 at 1800 UTC overlaid with fire-affected pixels (shown as enlarged red icons for clarity).

Plans for Next Reporting Period

Following extensive discussions with NOAA management, Christopher Schmidt (UW-Madison/SSEC/CIMSS), and our NOAA program manager, the focus of our effort going forward will be to refine and update the existing operational FDC fire detection/characterization algorithm, production software, and product. With this project realignment we expect to achieve a much more rapid deployment of product improvements while simultaneously leveraging and coordinating what up until this point have been separate but overlapping product development efforts within NOAA. Under this realignment our plans for the next semi-annual reporting period will include the following activities:

1. Continue production of our extensive training data set to support the machine-learning component of the project.
2. Obtain and evaluate the most recent version of the “master” research-grade FDC software used.
3. Incorporate general code improvements and targeted algorithm refinements into the FDC software, returning it to NOAA for implementation with the operational production system.
4. Finalize the first planned revision of the FDC project in collaboration with existing NOAA/NESDIS efforts toward this goal.
5. Compile separate test and validation reference data sets from Landsat imagery.
6. Commence FDC product validation.
7. Commence GOFC regional coordination.