Rapid Prototyping of NASA Next Generation Sensors for the SERVIR System of Fire Detection in Mesoamerica

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Goals

Evaluate the potential of the next generation of NASA sensor for active fire detection.

PROJECT OVERVIEW

This Rapid Prototyping Capability (RPC) experiment explores the feasibility of using NASA's next generation of sensor Visible/Infrared Imager Radiometer Suite (VIIRS) to support the Rapid Response Fire Products within the SERVIR architecture. The VIIRS data is intended to replace current Moderate Resolution Imaging Spectroradiometer (MODIS) products. SERVIR is a NASA managed program integrating satellite and geospatial data with the aim to develop scientific and decision making knowledge for issues affecting Mesoamerica. The issues addressed by this program include disasters, ecosystems, biodiversity, weather, water, climate, oceans, health, agriculture and energy of the region. The Rapid Response Fire Products include Mesoamerican Web Fire Mapper and MODIS Rapid Response Fire Mapper. Both have been effectively implemented in recent years to monitor hot spots and active fires (Figure 1) that threaten the natural resources of Mesoamerica.

Figure 1. Active fire in Guatemala during the 2003 fire season

The MODIS-based Rapid Response Fire Products of the SERVIR program were selected for the application of a NASA-funded Rapid Prototype Capability experiment. Our goal in this experiment was to compare the value of the MODIS-based tool to the planned VIIRS-based algorithm that may one day be used as a substitute fire detection system for the SERVIR program.

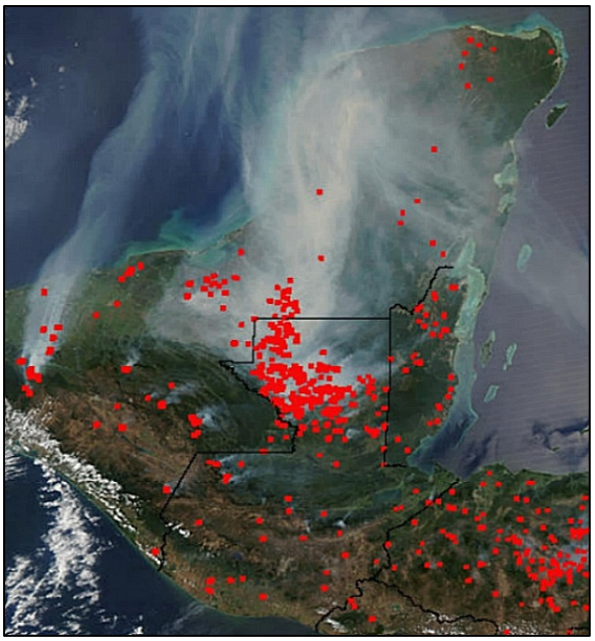

Figure 2. Example of the fire product produced by the MODIS Rapid Response System of Guatemala

CONCLUSIONS

To compare the results obtained from the MODIS- and VIIRS-based fire detection tools, we performed three independent evaluations: (1) MODIS- to VIIRS-based fire products on a pixel-by-pixel basis, (2) both detection tools compared to higher resolution imagery (ASTER) derived fire maps following pre-established procedures (Figure 3), and (3) both detections tools compared to visually interpreted higher resolution imagery (Figure 4).

We find that there is reasonable agreement between the MODIS- and VIIRS-based products on the basis of direct comparison. The highest values were obtained when the MODIS- and VIIRS-based assessments of high confidence fires were compared. The VIIRS-based fire products results in relatively few nominal-confidence fires and almost no low-confidence fires. The excellent agreement on the location of high-confidence fires provides encouragement regarding the continued value of SERVIR's fire-detection program beyond the life of the MODIS sensors.

We also compared the accuracy of both the MODIS- and VIIRS-based products against fires observed in both ASTER and Landsat-7 imagery. The MODIS-based

products compared reasonably well with the ASTER imagery, with results roughly comparable to those reported by other investigators. When the VIIRS-based products were compared to the same fires detected using ASTER imagery, distinctly poorer results were observed. This indicates that the challenge of detecting small fires, which presumably may translate to lower confidence fires, is particularly problematic with the VIIRS data and the current VIIRS-based algorithm.

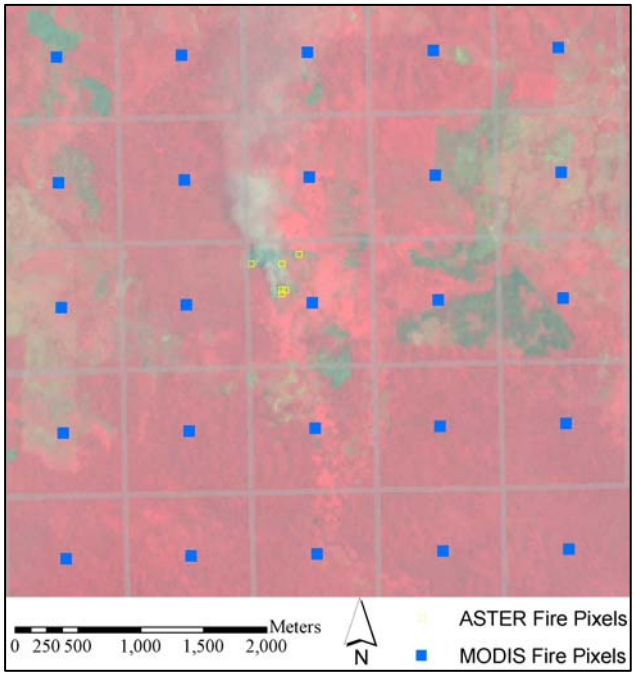

Figure 3. Example of fires points detected with higher resolution image (shown in yellow) used as reference to evaluate the MODIS-based and VIIRS-based fire algorims (represented by the blue dots)

IMPACTS

We used simulated VIIRS imagery where the current MODIS sensor was used to generate the pseudo-VIIRS dataset and we did not examine the consequences of the improved resolution associated with the expected VIIRS sensor.

However, the results obtained in this project provided important information to be used by NASA's scientists in the design of the next generation of sensors. Based on the overall outcome of this project the SERVIRS's fire-detection decision support tool is expected to perform well at detecting fire currently being detected at the high-confidence level. Small fires or fires of low intensity do not appear to be as readily detected using the combination of the planned VIIRS sensor and the fire-detection algorithm designed for that sensor.

Finally, the findings also provide SERVIR stakeholders valuable information regarding the continuation of the fire detection tools and how it will impact the matters covered by the SERVIR project related to disasters, ecosystems, biodiversity, weather, water, agriculture, and energy of the region.

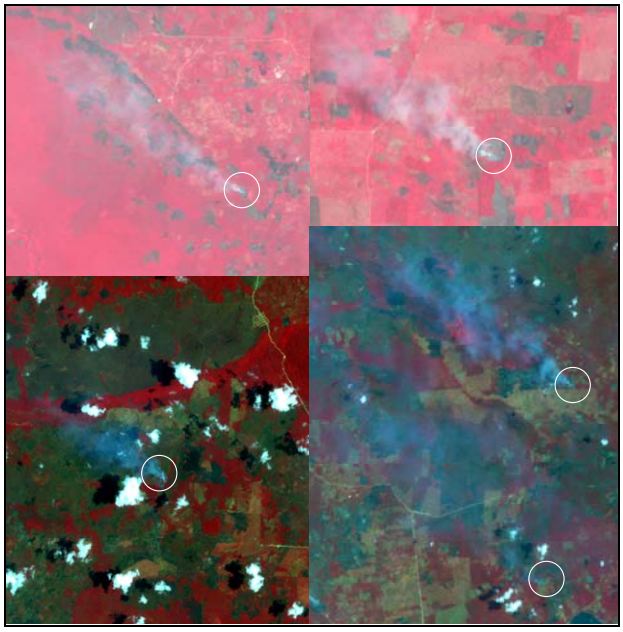

Figure 4. Example of active fires mannualy identified in higher resolution imagery during the 2003 fire season in Guatemala

Collaborators

NASA's Marshall Space Flight Center

Centro del Agua del Trópico Húmedo para América Latina y el Caribe (CATHALAC)

Science Systems and Applications, Inc.

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