The GOES-R ABI Wild Fire Automated Biomass Burning Algorithm

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The Global WF_ABBA

CIMSS is working with the international community to create a global geostationary fire monitoring system. Coverage will continue to expand as new satellites come on-line.

Current coverage:
• GOES-16 /-W-6 (130°-150°W) 5 min CONUS / 15 FD coverage
• Met-8 /-8 SEVIRI (9.5°E / 0°)
• METOP-S -1R (IAMU) / METOP-2 (HRIT) (140°E / 145°E)

Future coverage:
• GOES-18 /-W-6 (150°-170°W)
• GOES-R ABI (launch est. FY 2015)
• FY-2C/2D SVISSR (105°E / 86.5°E)
• GOMS Elektro-L N1/-N2 (76°E / 14.5°S)
• COMS (128°E)

Improved ABI Resolution

Fire detection and characterization will benefit from the improved spatial, spectral, and temporal resolution provided by GOES-R ABI. Spatial resolution of the 3.9 µm brightness temperature is illustrated below. On the left, 4km GOES-12 data from Oct 27, 2003 is shown, and on the right, the corresponding 2km simulated ABI 3.9 µm brightness temperature data. Greater contrast between fire and background is achieved due to improved spatial resolution.

The above chart illustrates WF_ABBA fire detection and classification as a function of the CIRA model simulated ABI fire size and fire temperature. This example is from the Oct 23, 2007 California case. Notice that WF_ABBA is quite successful in detecting fires with fire radiative power (FRP) > 75 MW.

The above table depicts the WF_ABBA detection statistics for multiple case studies of simulated ABI data (developed at CIRA). The algorithm is able to detect nearly 100% of the detection of fire clusters – groups of individual fire pixels. The performance is not quite as good for the detection of individual fire pixels or fire characteristics in large part due to subpixel fire detection and characterization issues described under the “Subpixel Fire Detection and Characterization” section.

Sub-pixel Fire Detection and Characterization

Fire Size and Temperature

To solve fire size and temperature, a system of two equations (4 and 11 micron radiance) with two unknowns (fire temperature and fire size) can be solved numerically.

FRP

Fire radiative power (FRP) is a parameter widely used in emissions modeling as studies have shown a linear relationship between fire emissions and FRP.

The image to the below shows GOES-R ABI nominal pixels (grid) overlaid on coincident 30m resolution ASTER image (RGB 8-3-1) acquired on 19 Oct 2002 14:21:59UTC. WF_ABBA fire pixels are marked in red (credit: Wilfried Schroeder).

Subpixel hotspot features can appear in multiple full-resolution pixels as an artifact of the shape of the imager response function and relative position of the subpixel feature.

The examples to the above show the 2007 Oct. Southern California fire outbreak. Simulated ABI and MODIS source data are presented in the top two image sets. A numerically based simulated ABI model data from CIRA is also shown with the corresponding GOES-11 data in the bottom two image sets.

The images below and right show a case study from Sep 7, 2004. ABI data (left) is simulated from MODIS (lower right). WF_ABBA is run using the simulated data and the results are shown run on the right. In red the ABI fire detections are plotted while in blue the MODIS fire product detections are shown.