The EUMETSAT Operational Active Fire Monitoring

Hans-Joachim Lutz, Ahmed Yildirim, and Colin Duff

EUMETSAT

Description of the FIR algorithm

Where, when and how

The Active Fire Monitoring (FIR) product is an image-based product in full pixel resolution that displays information on the presence of fire within a pixel.
The FIR algorithm is applied to every clear land surface pixel, which is not a bare soil land surface (e.g. desert or open shrub land, or where the IR10.8-IR8.7 difference is larger than 5 K). The product is generated for every 15 minute repeat cycle. The FIR algorithm uses the following four criteria to check for potential fire and fire pixels:

- Brightness temperature of channel IR3.9
- Standard deviation of channel IR3.9 (3x3 pixel)
- Brightness temperature difference of channel IR3.9 and IR10.8
- Standard deviation of channel IR10.8 (3x3 pixel)

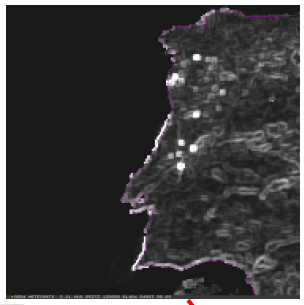
	Potential Fire		Fire	
Test	Day	Night	Day	Night
IR3.9	310 K	290 K	310 K	290 K
StdDev 3.9	2.5 K	2.5 K	4 K	4 K
StdDev 10.8	2 K	2 K	2 K	2 K
IR3.9-IR10.8	8 K	0 K	10 K	5 K

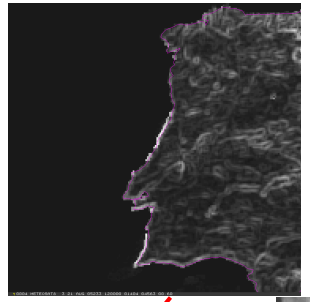
(Day is defined with a solar zenith angles lower than 70º and night with a solar zenith angle of higher than 90º. For solar zenith angles between 70º and 90º the thresholds are linearly interpolated.)

The brightness temperature of channel IR3.9 picks up hot spots caused by the fire. The other SEVIRI channels are less sensitive to hot spots. In this test, simple fixed temperature thresholds are used, which are different for day and night.
The standard deviation of channel IR3.9 is used to identify the real hot spot versus the natural (heated) background temperature of the surface which has not such a high temperature variability.
The difference of channel IR3.9 and IR10.8 takes advantage of the fact that channel IR10.8 is much less sensitive to hot spots than channel IR3.9 which means that the brightness temperature difference is high for fires, compared to the natural background.
The standard deviation of channel IR10.8 is used to correct for mis-classified fire pixels (e.g. missed clouds, highly variable surface types or terrain elevation). The standard deviation is calculated on a 3x3 pixel array around each SEVIRI pixel. Water and cloud pixels are excluded from the calculation.

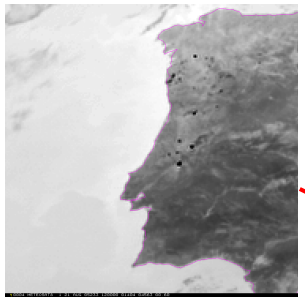
Results for the “Portugal case”, 21 August 2005

Standard Deviation IR3.9
High standard deviation is seen as bright areas. Active fires can be identified as the brightest spots in the image.

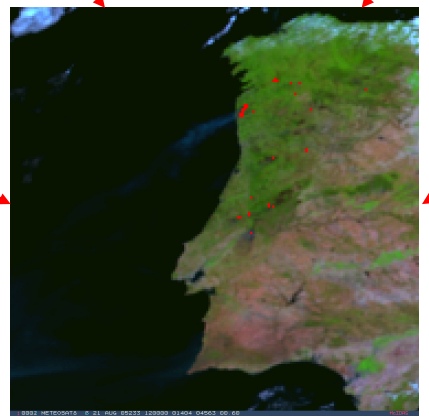




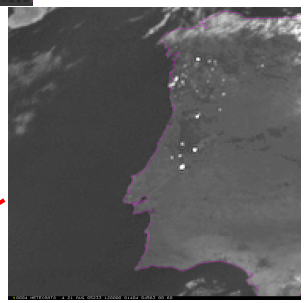
Standard Deviation IR10.8
High standard deviation is seen as bright areas.
Cloud contaminated areas and areas with highly variable surface cover can be identified but active fires cannot.



Brightness temperature IR3.9
“hot spots” are clearly visible as black dots in the image



Fire pixels (red dots) derived from Meteosat-8 over Portugal,
21 August 2005, 12:00 UTC



Brightness temperature Difference IR3.9-IR10.8
Active fires are causing a much higher brightness temperature in channel IR3.9 than in channel IR10.8. In the difference IR3.9-IR10.8 image the active fires can be identified as bright spots (=high differences)

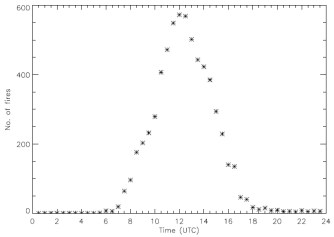
The FIR product

Resolution: pixel (i.e. 3 x 3 km)
Generated: every repeat cycle (15 minutes)
Timeliness: available in near-real time and soon also as archived product
Dissemination: currently FTP, soon also EUMETCast and the UMARF archive
Format: GRIB2 and ASCII text file
Size of data file: between ~10 KB and ~25 KB

To retrieve this product, please go to:
ftp://ftp.eumetsat.int/pub/OPS/out/simon/FIRE/

Strengths

- Near-real time active fire monitoring
- High temporal resolution
- Observation of the diurnal cycle
- Can be very helpful for disaster management



Diurnal cycle of active fires as detected by SEVIRI
28 November 2006

Weaknesses

- Coarse horizontal resolution
- SEVIRI IR3.9 is a “dirty” window
- Many (small) fires will be missed