

Hot Spot Detection With MODIS Data

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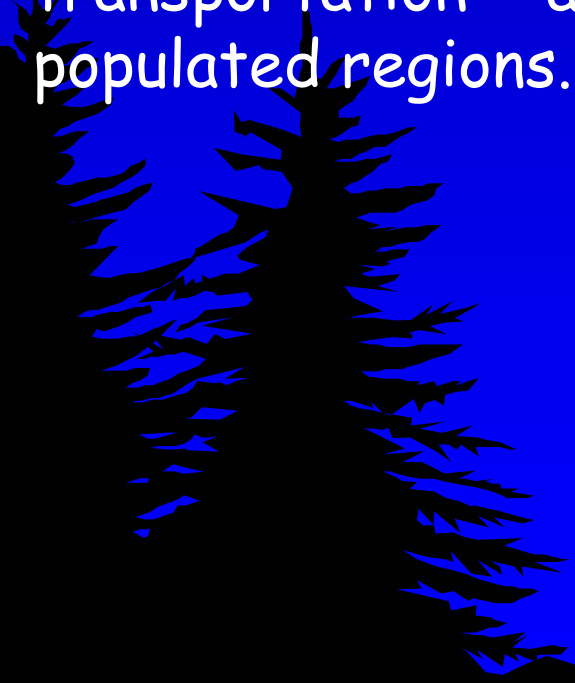
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Hotspots

Hotspots, such as volcanic eruptions , Industrial hot spots pose serious hazards to sensitive ecosystems, transportation and communication networks, and to populated regions.



fires

Relevance to Global Change Issues

Impacts on Atmospheric Chemistry

Vegetation burning is recognized as an important contributor to global climate change because of its potential to modify atmospheric composition and chemistry

Impacts on Ecosystems

Fire can also affect ecosystem by changing carbon, Nitrogen, Phosphorus, sulfur and ...

Impacts on Hydrological Processes

Fire can also affect water resources by changing hydrological processes



Remote sensing

Orbiting Earth-observing satellites gather and relay valuable data on these hotspot hazards as they develop around the globe.

To improve hotspots and fire management, satellite data provide the best tools and devices for experts and managers.

MODIS

The Moderate Resolution Imaging Spectrometer (MODIS) on NASA's Terra platform offers near global coverage every 24 hours and thus is well-suited for monitoring global eruptions and fires.

The sun-synchronous Moderate Resolution Imaging Spectrometer (MODIS, henceforth) offers an additional data set to look at hot spots. One of the important advantages of MODIS data is, sending two images with entire coverage from each area in the Earth as diurnal. (one for day and another one for night).

Hotspot detection flow chart

PDS File Resived With ISA MODIS Station

Un Pack With IMAPP Software: Level 0

Geolocate With IMAPP Software: L1A

Calibrate With IMAPP Software: L1B

Geometric Correction With Satellite Orbital Attitude
With ScanMagic Software

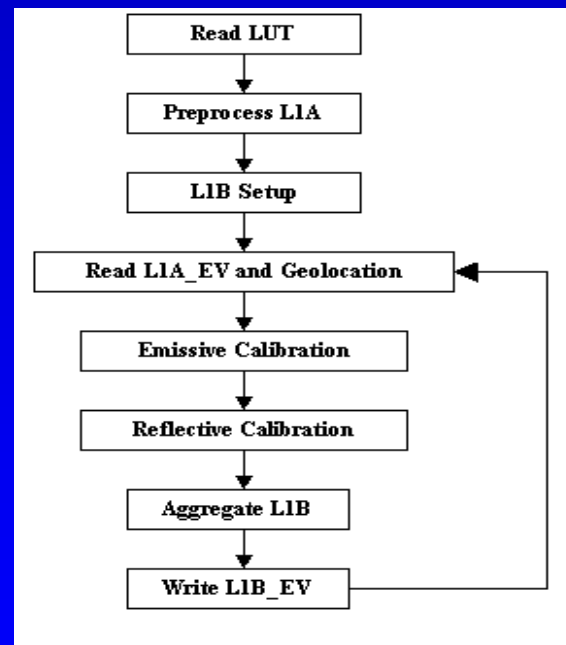
HotSpot & Fire Detection Algorithm With Model Maker
of ERDAS Software (Figure3)

HotSpot & Fire Point And Area

Geometric and Radiometric Correction

Raw data(MODIS receiving station of ISA)

IMAPP software (L0, L1A, L1B)



ScanMagic Software

Algorithm Description

Detection algorithm

Fire and hotspot detection is performed using the MODIS 4 and 11 micrometer channel brightness temperatures, denoted by T_4 and T_{11} , respectively

To avoid **false detection**, all pixels for which $T_4 < 315$ K (305 K at night) or $T_4 - T_{11} < 10$ K (3 K at night) or $R_2 > 0.3$ (daytime only) are immediately excluded as fires.

For **absolute fire detection**, the algorithm requires to have one of two following conditions at least :

- 1) $T_4 > 360$ K (330 K at night)
- 2) $T_4 > 330$ K (315 at night) and $T_4 - T_{11} > 25$ K (10K at night)

Is either of these absolute criteria are not met, the algorithm allows a relative fire detection in which the fire is distinguished from the background by 4 standard deviation in T4 and T4 - T11:

$$T4 > \text{Mean}(T4) + 3 \text{ StdDev}(T4)$$

AND

$$T4 - T11 > \text{Median}(T4 - T11) + 3 \text{ StdDev}(T4 - T11).$$

Combining all tests into a single expression, a pixel is classified as a fire pixel if the following condition is satisfied:

$$\{T4 > \text{Mean}(T4) + 3 \text{ StdDev}(T4) \text{ OR } T4 > 330 \text{ K}\}$$

AND

$$\{T4 - T11 \text{ Median}(T4 - T11) + 3 \text{ StdDev}(T4 - T11) \text{ OR } T4 - T11 > 25 \text{ K}\}$$

OR

$$T4 > 360 \text{ K}$$

These thresholds are for the daytime algorithm; for the **nighttime algorithm** they become:

$$\{T4 > \text{Mean}(T4) + 3 \text{ StdDev}(T4) \text{ OR } T4 > 315 \text{ K}\}$$

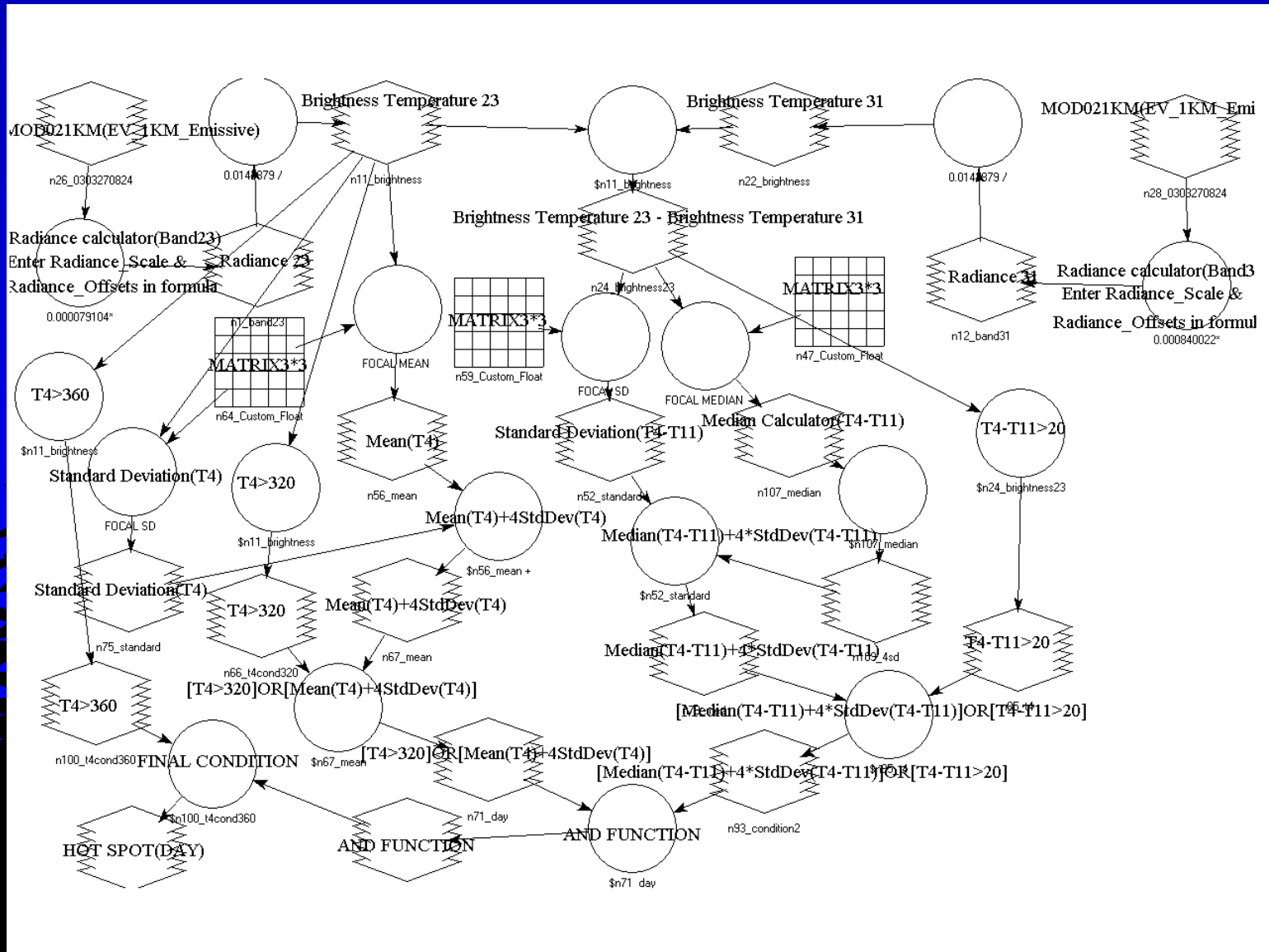
AND

$$\{T4 - T11 > \text{Median}(T4 - T11) + 3 \text{ StdDev}(T4 - T11) \text{ OR } T4 - T11 > 10 \text{ K}\}$$

OR

$$T4 > 330 \text{ K}$$

Hotspot detection model in ERDAS Model maker





Thank you