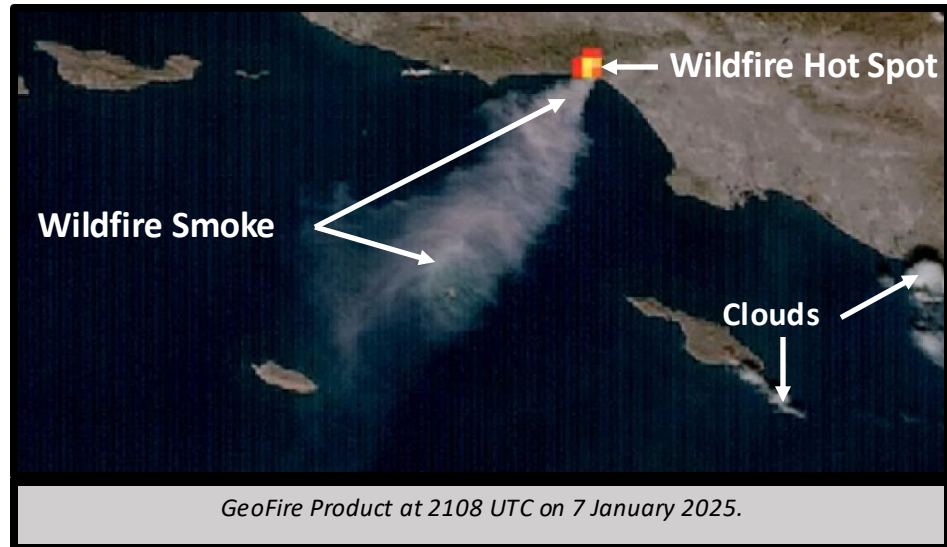# GeoFire Product

Quick Guide

Why is the GeoFire Product Important?

GeoFire imagery blends information from the Fire Temperature RGB into GeoColor imagery to combine the best qualities of both products into a single imagery product designed primarily for public relations. The daytime True Color component of GeoColor is the best imagery product for detecting and monitoring smoke plumes, while the Fire Temperature RGB provides qualitative information on hot spot / fire intensity and is most useful for monitoring actively burning fires.

GeoFire Product at 2108 UTC on 7 January 2025.

How is the GeoFire Product Created?

GeoFire uses the Shortwave Albedo algorithm (also known as the 3.9 µm reflectance) to identify active hot spots. Pixels identified as active hot spots are colored according the Red, Green, and Blue components of the Fire Temperature RGB (3.9 µm, 2.2 µm, and 1.6 µm reflectance, respectively), while all other pixels retain the original coloration of GeoColor. During the daytime, two fire detection thresholds are applied to the Shortwave Albedo Algorithm and used to identify active hot spots. First, any pixel with 3.9 µm reflectance at least 10% greater than its neighboring pixels is classified as a hot spot. Second, a sliding scale is used based on the 3.9 µm brightness temperature, such that, for 3.9 µm brightness temperatures < 323 K the threshold is 49% and for 3.9 µm brightness temperatures > 340 K the threshold is 60%. Pixels with a 3.9 µm reflectance greater than this threshold are classified as active hot spots. During the nighttime, the only signal from the 2.2 µm and 1.6 µm bands comes from active hot spots. In this case, the 3.9 µm reflectance is scaled linearly between 0 and 30% to create the Red component, the 2.2 µm reflectance for the Green component and the 1.6 µm reflectance for the Blue component, for identification of hot spots. All other pixels retain the original coloration of GeoColor at night.

Impact on Operations

Daytime Combined Hot Spot and Smoke Identification: Identify hot spots and smoke in one imagery product during the daytime.

Nighttime Cloud Detection: GeoColor provides cloud information not available from the Fire Temperature RGB alone, making it useful for identifying clouds that may be obscuring the radiant emissions from hot spots.

Nighttime Geo-Location: Locating hot spots relative to light-emitting infrastructure (cities / towns) can aid firefighting efforts.

Intuitive Interpretation: Since the colors of features in the daytime are what we intuitively expect them to be, the product requires little to no training, and has proven to be excellent for social media posts.

Limitations

Smoke Detection at Night: Smoke cannot typically be detected at nighttime, except in extreme cases related to pyro-convection, due to the IR bands lacking sensitivity to smoke.

Be Aware of Thresholds: Fires that do not meet the thresholds stated above won't be detected.

Keep in Mind Known Limitations of Hot Spot Detection by Satellite: Be aware of known limitations of hot spot detection by satellite such as obscuration (cloud, terrain, dust etc.), high background 3.9 µm reflectance (e.g. portions of the Southwest).

Power Outages Not Shown at Night: City lights make use of a static dataset and will not indicate power outages at night.

GeoFire Product

Quick Guide
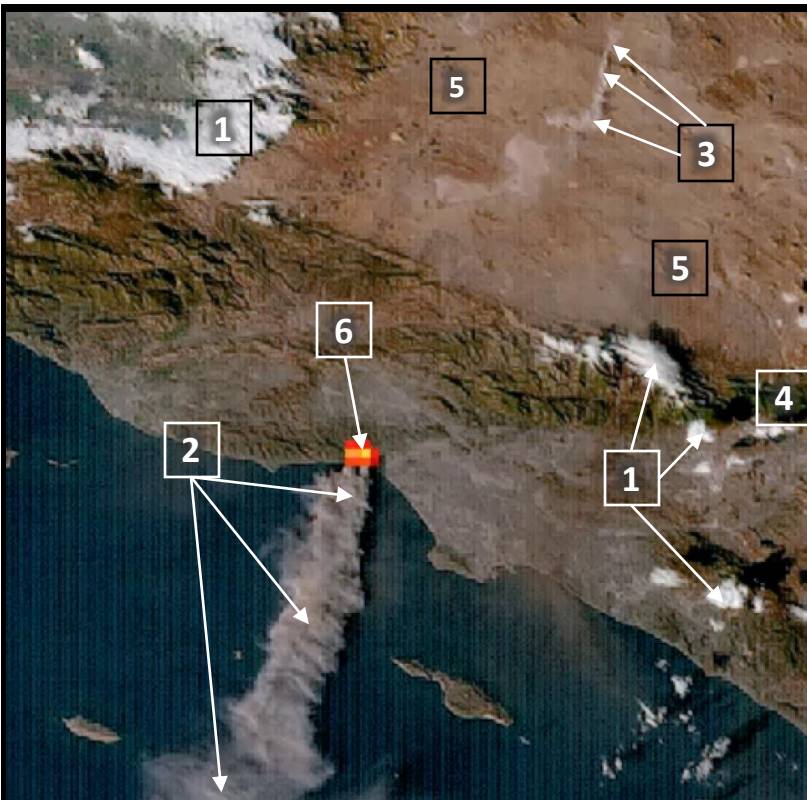
CIRA GeoFire Product at 2336 UTC on 7 January 2025 (Daytime)

CIRA GeoFire Product at 0348 UTC on 8 January 2025 (Nighttime)

Interpretation

1 **High/Thick Clouds** *(bright white)*

2 **Smoke** *(bluish gray)*

3 **Blowing Dust** *(light brown/tan)*

4 **Vegetation/Forest** *(shades of green)*

5 **Dry/Desert** *(shades of brown)*

7 **Low-Level Water Clouds** *(light blue)*

8 **Mid-Level and Cirrus Clouds** *(grayish white)*

9 **City Lights (from Day/Night Band)** *(gold)*

10 **Clear Sky Land** *(dark purple)*

11 **Ocean Surface** *(shades of blue, lighter for cooler SST)*

6 **Hot Spot** *(shades of red/orange/yellow), Daytime and Nighttime*

Smoke detection

- Smoke is typically not detected at nighttime due to the lack of an IR sensitivity to smoke. During extreme cases, such as this event (the Palisades fire shown above), there is a subtle signature of smoke since there is pyro-convection occurring.

- During the daytime, the presence of smoke plumes may be used to identify fires that are too small (or are otherwise obscured) to be detected by the Fire Temperature RGB.

Resources:

GeoFire on
CIRA SLIDER

SBC Webinar