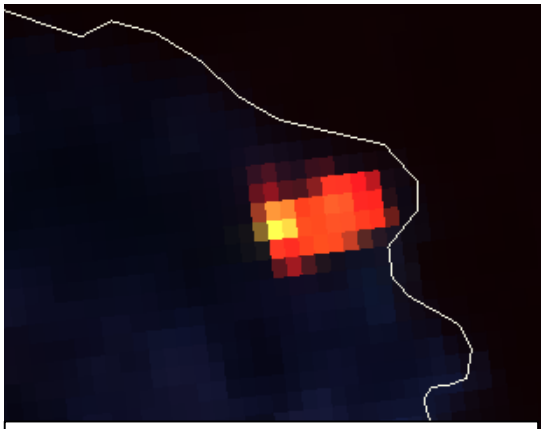
Fire Temperature RGB Quick Guide

The Fire Temperature RGB is a candidate to become a standard RGB, to be created using the imager (FCI) on future Meteosat Third Generation satellites. It uses the 2.25 µm channel, which will be new with FCI. The FCI IR3.8 channel is not new, but has been redesigned (extended dynamical range, slight shift) especially to improve fire detection. In this Quick Guide, VIIRS images are used as proxy data for the FCI. Currently, the VIIRS Fire Temperature RGB can be used for the Meteosat region.

Aim: Detection and monitoring of fires.
Main application area and time period:
Full disk, day and night.
Applications and guidelines: This RGB is useful for ***fire detection*** and provides a qualitative estimation of ***fire temperature***.
The smoke of the fire is usually not seen in this RGB.
During the night, fires are seen against dark background, while clouds are not seen. Colour contrast is high between the fire and the background. During the day, some surface features, water and ice clouds can be identified. (However, other RGBs are better for analysing clouds.) The colour contrast is sometimes low, particularly with hot land not covered with much green vegetation.



NPP VIIRS Fire Temperature RGB, fire on the cloud-free Peninsula Sithonia, Greece, 25 October 2018, 10:43 UTC

Background

The table below shows which channels are used in the Fire Temperature RGB. These channels are all sensitive to fires. At shorter wavelengths, signals become stronger as the fire temperature increases. The 3.7 µm channel is sensitive even to fires that are much smaller than the pixel size. Small/"cool" fires show up only at 3.7 µm and appear red. Moderately intense/large fires are detected at both 3.7 µm and 2.25 µm and appear orange to yellow. Very intense fires are detected by all three bands and appear white.
The appearance outside the fire is different during the day from during the night. During the night the background is mostly dark, whereas during the day one can differentiate sea, land, water and ice clouds.
The **bold** text in the table below applies to both day and night images, and the *italic* text to day imagery only.

Colour	Channel [µm]	Physically relates to	Smaller contribution to the signal	Larger contribution to the signal
Red	IR3.7	**(Fire) temperature** *Cloud top microphysics*	**Cold land surfaces** *water, snow/ice, cold clouds*	**Low fire temperature, hot spots** *Warm land surfaces*
Green	NIR2.25	**Fire temperature** *Land type, cloud top particle size*	*Green vegetation, water, snow/ ice, large cloud particles*	**Medium fire temperature**, *Dry grass, bare ground, small cloud particles*
Blue	NIR1.6	**Fire temperature** *Land type, cloud top phase*	*Green vegetation, water, snow/ice, ice clouds*	**High fire temperature** *Dry vegetation, bare ground, water clouds*

Notation: IR: infrared; NIR: near-infrared; number: central wavelength of the channel in µm (for VIIRS).

Benefits

- Useful for fire monitoring during both the day and the night. It detects even those fires that are much smaller than the pixel size.
- It provides information on fire intensity. The pixel colour is related to fire temperature: 'cooler' fires appear more red, hotter fires appear yellow to white.
- During the day ice and water clouds are seen in the image in different colours.

Limitations

- Fires are seen only in cloud-free areas.
- Smoke is usually not detectable in this RGB.
- Clouds are not seen at night.
- The colour of the surface during the day strongly depends on temperature and land type. Arid, dry regions and hot land surfaces may both appear reddish, making fire detection more difficult.
- If the red component saturates at a relatively 'low' temperature, false alarms can appear as red colours without fire at the surface.

Remark: With FCI, fewer false alarms are expected due to the extended dynamic range of the IR3.8 channel.

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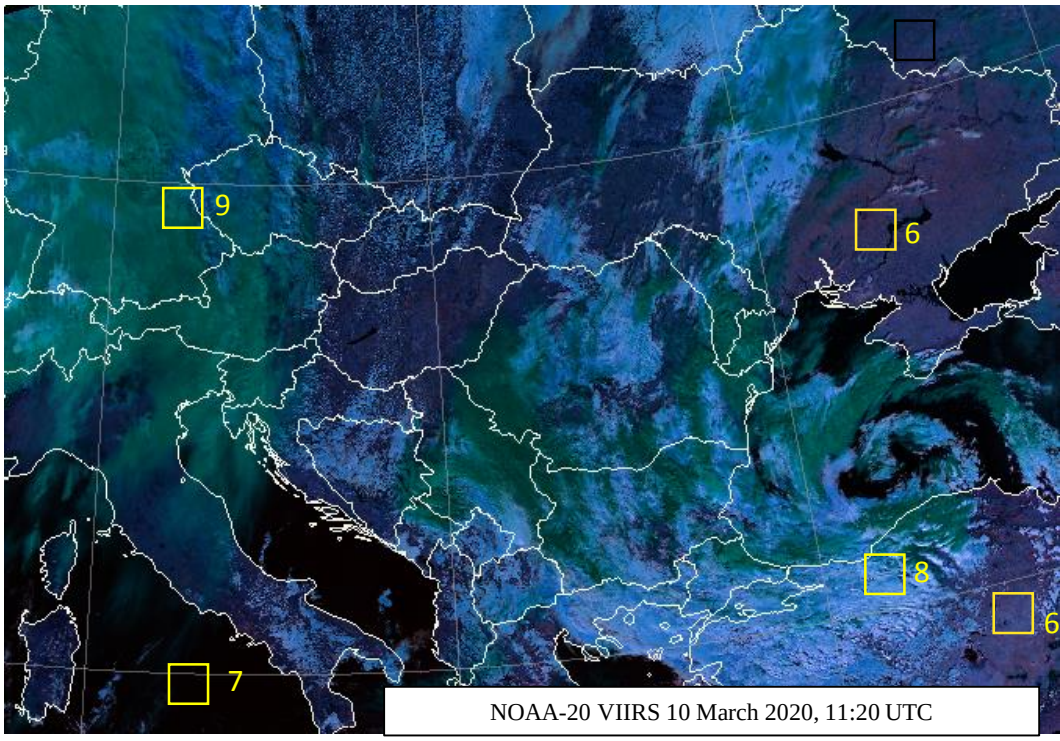
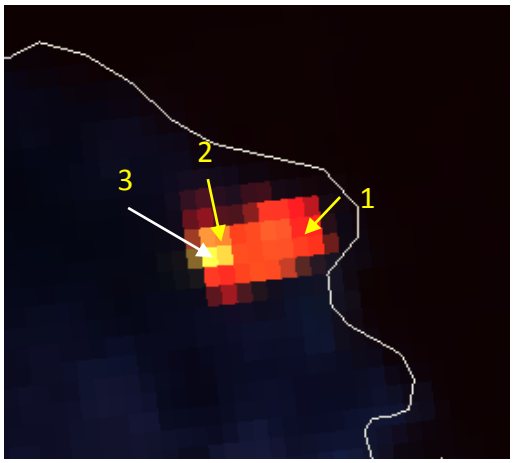
Interpretation

1	warm fire, hot spot
2	very warm fire
3	hot fire
4	extreme intense fire
5	burn scars (day)
6 6	land surface (day)
7	water, snow, ice, night-time
8	water cloud (day)
9	ice cloud (day)

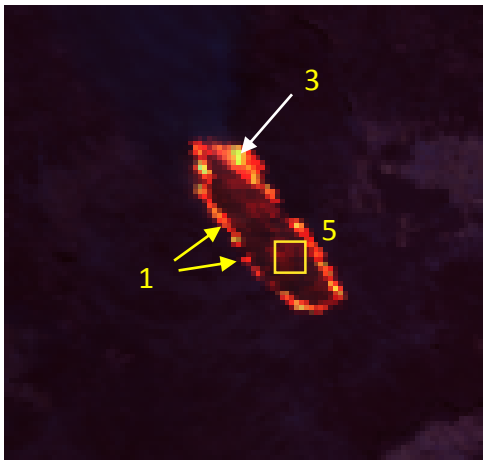


NOAA-20 VIIRS 10 March 2020, 11:20 UTC

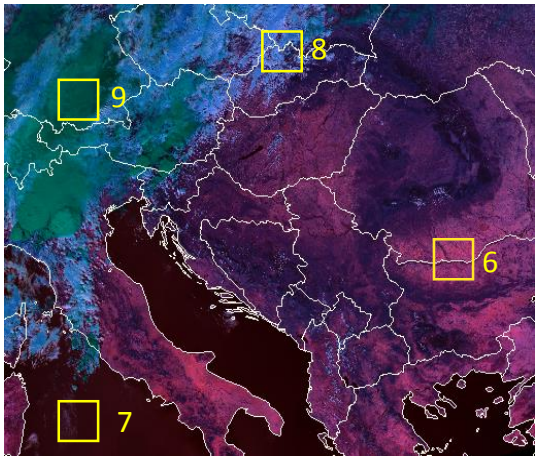
The colours may vary diurnally, seasonally and latitudinally. During the night the fires are seen over a dark background. During the day water/ice clouds and land/sea surfaces can be identified. The colour of the surface strongly depends on surface type and temperature: compare the March and August images (above and below right).



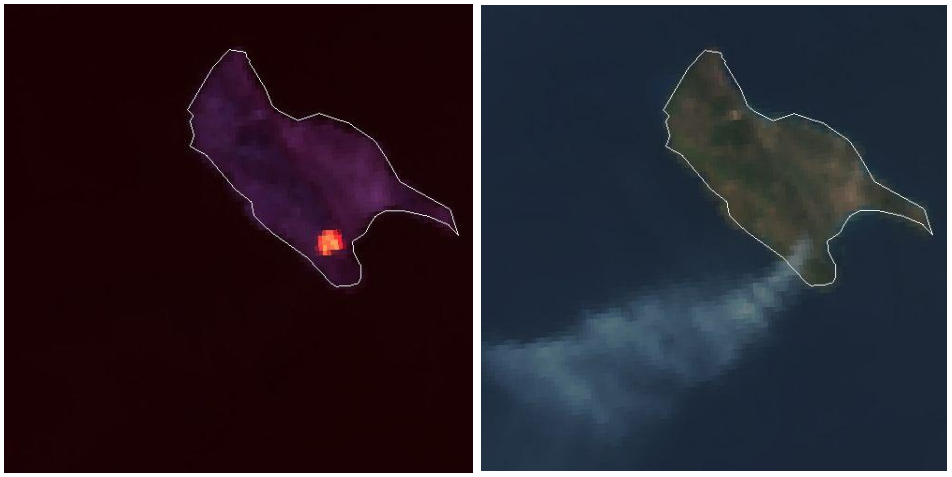
NPP VIIRS Fire Temperature RGB, Sithonia Peninsula, Greece, 25 October 2018, 10:44 UTC



NOAA-20 VIIRS Fire Temperature RGB, Alberta, Canada, 19 May 2019, 19:01 UTC



NPP VIIRS Fire Temperature RGB, 29 August 2020, 11:46 UTC



NPP VIIRS Fire Temperature RGB (left) and True Colour RGB (right), Zakynthos, Greece, 15 September 2019, 10:48 UTC

Comparison to True Colour RGB

Both images on the left show the Greek island Zakynthos. The Fire Temperature RGB image (left) shows a fire in red and yellow, while the True Colour RGB (right) shows the corresponding smoke.
Note that during the night the fire can still be identified in the Fire Temperature RGB, but the smoke is not seen in the True Colour RGB.

More about RGBs at EUMeTrain.org
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