FIRMS FAQ Quick Sheet:

Note: For full FAQs sheet, please go to https://earthdata.nasa.gov/faq/firms-faq#ed-attributes

Are all active fire hotspots vegetation fires?

No, an active fire represents the center of a pixel flagged as containing one or more actively burning hotspots /fires. In most cases fires are vegetation fires, but sometimes it is a volcanic eruption or the flare from a gas well. There is no way of knowing which type of thermal anomaly is detected based on the MODIS or VIIRS data alone.

Are there ever false fire detections or data artifacts?

To avoid the occurrence of false alarms over bright/reflective surfaces (e.g., metallic factory rooftops), the VIIRS and MODIS algorithms use slightly more conservative tests to avoid the effects of sun glint.

What is the detection confidence?

For MODIS, the confidence value ranges from 0% and 100% and can be used to assign one of the three fire classes (low-confidence fire, nominal-confidence fire, or high-confidence fire) to all fire pixels within the fire mask. In some applications errors of commission (or false alarms) are particularly undesirable, and for these applications one might be willing to trade a lower detection rate to gain a lower false alarm rate. Conversely, for other applications missing any fire might be especially undesirable, and one might then be willing to tolerate a higher false alarm rate to ensure that fewer true fires are missed. Users requiring fewer false alarms may wish to retain only nominal- and high-confidence fire pixels, and treat low-confidence fire pixels as clear, non-fire, land pixels. Users requiring maximum fire detectability who can tolerate a higher incidence of false alarms should consider all three classes of fire pixels. The confidence value is application specific. This isn't very helpful, I know, but unfortunately there's no way to establish an optimal cutoff a priori. Users must adopt an empirical approach -- what threshold works best for what I'm trying to do? Unfortunately, the confidence values in the product do not directly correspond to the statistical confidence levels in reference to Type I and Type II errors.

How are fires detected by satellite?

Fire detection is performed using a contextual algorithm that exploits the strong emission of mid-infrared radiation from fires.

How often are the active fire data acquired?

The MODIS instrument aboard the Terra and Aqua EOS satellites acquire data continuously providing global coverage every 1-2 days. Terra (EOS AM) passes over the equator at approximately 10:30 am and 10:30 pm each day, Aqua (EOS PM) satellite passes over the equator at approximately 1:30 pm and 1:30 am. There are at least 4 daily MODIS observations for almost every area on the equator, with the number of observations increasing (due to overlapping orbits) closer to the poles.

What are the different sources of fire data in FIRMS?

- MODIS NRT C6 (MCD14DL) are the NRT MODIS (Terra and Aqua) Collection 6 data processed by NASA LANCE FIRMS.
- MCD14ML provided by FIRMS are a subset of the standard quality data processed by the MODIS Fire Team Science Computing Facility at the University of Maryland. These are available with a 2-3 month lag through the Archive Download Tool and can be viewed and queried in Fire Map.

What does a fire detection mean on the ground?

The satellites take a 'snapshot' of events as it passes over the earth. Each hotspot/active fire detection represents the center of a pixel flagged as containing one or more fires, or other thermal anomalies (such as volcanoes). For MODIS the pixel is approximately 1km and for VIIRS the pixel is approximately 375m. The "location" is the center point of the pixel (not necessarily the coordinates of the actual fire). The actual pixel size varies with the scan and track. The fire is often less than the size of the pixel. We are not able to determine the exact fire size, what we do know is that at least one fire is located within the flagged pixel. Sometimes you will see several active fires in a line. This generally represents a fire front.

What are the key differences between NRT and Standard quality fire data?

Standard data products are an internally consistent, well-calibrated record of the Earth's geophysical properties to support science. Near real-time (NRT) fire products are generated within approximately 3 hours of satellite observation to meet the needs of the applications community. To facilitate this several changes have been made to the standard processing approach: data downlinked from the satellite are sorted, processed and delivered in an expedited manner (as Session-based Production Data Sets). When the Standard Fire product are later processed, the best available satellite position data is used, and the quality assurance team removes data degraded by spacecraft maneuvers. In addition, the Standard Fire products are typically later reprocessed, and the Fire positions may be even more accurate in the reprocessed products. Routines used to derive Level 2 products, such as fire do not make use of ancillary data and so their codes are identical to the ones used in standard operations. However, please note:

- the data distributed via the FIRMS download tool does not contain the static sources / inferred hotspot "type" (described in page 36 of the MODIS Active Fire User Guide)
- the day/night column (also described on page 36 of the MODIS Active Fire User Guide) is currently calculated differently. The standard processing algorithm uses the solar zenith angle (SZA) to threshold the day/night value; if the SZA exceeds 85 degrees it is assigned a night value. SZA values less than 85 degrees are assigned a day time value. For the NRT algorithm the day/night flag is assigned by ascending (day) vs descending (night) observation. It is expected that the NRT assignment of the day/night flag will be amended to be consistent with the standard processing.

What is the brightness temperature?

The brightness temperature of a fire pixel is measured (in Kelvin) using the MODIS channels 21/22 and channel 31. Brightness temperature is actually a measure of the photons at a particular wavelength received by the spacecraft but presented in units of temperature.

What size fires can be detected?
In any given scene the minimum detectable fire size is a function of many different variables (scan angle, biome, sun position, land surface temperature, cloud cover, amount of smoke and wind direction, etc.), so the precise value will vary slightly with these conditions. MODIS routinely detects both flaming and smoldering fires 1000 m^2 in size. Under very good observing conditions (e.g. near nadir, little or no smoke, relatively homogeneous land surface, etc.) flaming fires one tenth this size can be detected. Under pristine (and extremely rare) observing conditions even smaller flaming fires 50 m^2 can be detected. There is no upper limit to the largest and/or hottest fire that can be detected with MODIS.

Can you use the active fire data for detecting volcanoes or volcanic eruptions?
The algorithm routinely detects active volcanoes, but the active fire product has not been validated against independent data for its ability to detect volcanoes.

Fire Radiative Power

The Fire Radiative Power product (FRP, in megawatts) provides information on the measured radiant heat output of detected fires. It has been demonstrated in small-scale experimental fires that the amount of radiant heat energy liberated per unit time (the Fire Radiative Power) is related to the rate at which fuel is being consumed. This is a direct result of the combustion process; whereby carbon-based fuel is oxidized to CO2 with the release of a certain heat yield. Therefore, measuring this FRP and integrating it over the lifetime of the fire provides an estimate of the total Fire Radiative Energy (FRE), which for wildfires should be proportional to the total mass of fuel biomass combusted. Geostationary observations allow high temporal frequency FRP measurements, and thus a much-improved ability to estimate FRE via temporal integration when compared to the far less-frequent observations made from systems in low-Earth orbit. The FRP product is derived every 15 min at the native SEVIRI pixel resolution. The disseminated product includes for each processed pixel, the FRP (MW), the corresponding uncertainty in the FRP retrieval based on the variability of the background radiance estimation, and a confidence measure (representing the level of confidence that the observation is indeed a true fire). Applications: The FRP product is intended to support emerging operational atmosphere and climate-related applications, such as Air quality forecasting, Carbon cycle assessment and modelling, and Fire activity models.