

When will I get new VIIRS hotspot data?

Satellite data for fire management in Canada

Satellite data are valuable sources of information for fire managers, especially in remote areas, to detect new fires and monitor ongoing ones. Satellites are the only technology that can provide daily observations for all of Canada. Given Canada's high latitude, the country benefits most from polar-orbiting satellites. These satellites travel on a near North-South orbit, passing close to the poles, which is ideal for monitoring Canada's northern areas. Most polar-orbiting satellites used for fire monitoring pass over a point on Earth at approximately the same time each day. Because of this, when we talk about these satellites, it is common to refer to their typical overpass time. Overpass times are usually expressed as the time that a satellite crosses the equator in solar time, rather than a local time zone. For fire management, overpass time data are more helpful in local time because:

1. We are interested in the overpass time for a specific fire management area, not at the equator.
2. Overpass time needs to be expressed in the time zone that fire managers are used to working in, not solar time.
3. The actual overpass time on any given day differs from the typical time by approximately ± 90 minutes due to cyclical variations in satellite orbits.

We address points 1 and 2 (above) for the widely used Visible Infrared Imaging Radiometer Suite (VIIRS) satellite instrument (**Box 1**) by mapping the typical range of historic overpass times for different parts of Canada while accounting for the local time zone in **Figure 1**. Looking at these maps, you can estimate a time frame for VIIRS data arrival for specific areas and time zones. To address point 3 (above), web-based tools are used to make predictions (**Box 2**) for exact satellite overpass times in the coming hours or days. **Figure 2** shows the 12-day prediction of VIIRS overpass times for a location near Pickle Lake, Ontario, in July 2025. Remember that VIIRS is not the only instrument that can provide hotspot data (**Box 3**); **Figure 3** provides a summary of other polar-orbiting satellites that can provide useful fire information.

Our approach to estimating VIIRS overpass times

We used historical VIIRS hotspot data from the *S-NPP* satellite to map overpass times in the afternoon, when fire management personnel are on duty.

Here is what we did to map satellite overpass time:

- We divided Canada into grid cells and assigned each a local time zone based on the grid cell centroid.
- For all historical fire observations in a grid cell, we calculated the average (mean), and 5th and 95th percentile observation times in coordinated universal time (UTC). These times were then converted to the grid cell local time.
- For clearer visualization, all times were rounded to the nearest 10 minutes and extreme values (<2nd and >98th percentiles) within a time zone were truncated.

This method helps fire managers know when to expect VIIRS data in the afternoon by simply providing a time frame in which to look for updated hotspot data.

Good to know...

As of November 2024, *NOAA-21* is the primary satellite that carries VIIRS; *NOAA-20* is secondary, and *S-NPP* is tertiary (i.e., a backup, lowest priority for maintenance). *S-NPP* is having frequent technical problems resulting in data outages, so it should not be relied on to provide data for operational fire management. The actual time the VIIRS hotspot data is available also depends on how it is accessed. Not every data platform pulls the data in real-time (e.g., your local system may only pull data on the hour). If you are using NASA FIRMS, the time delay should be around 5 minutes.

VIIRS overpass times at a single location

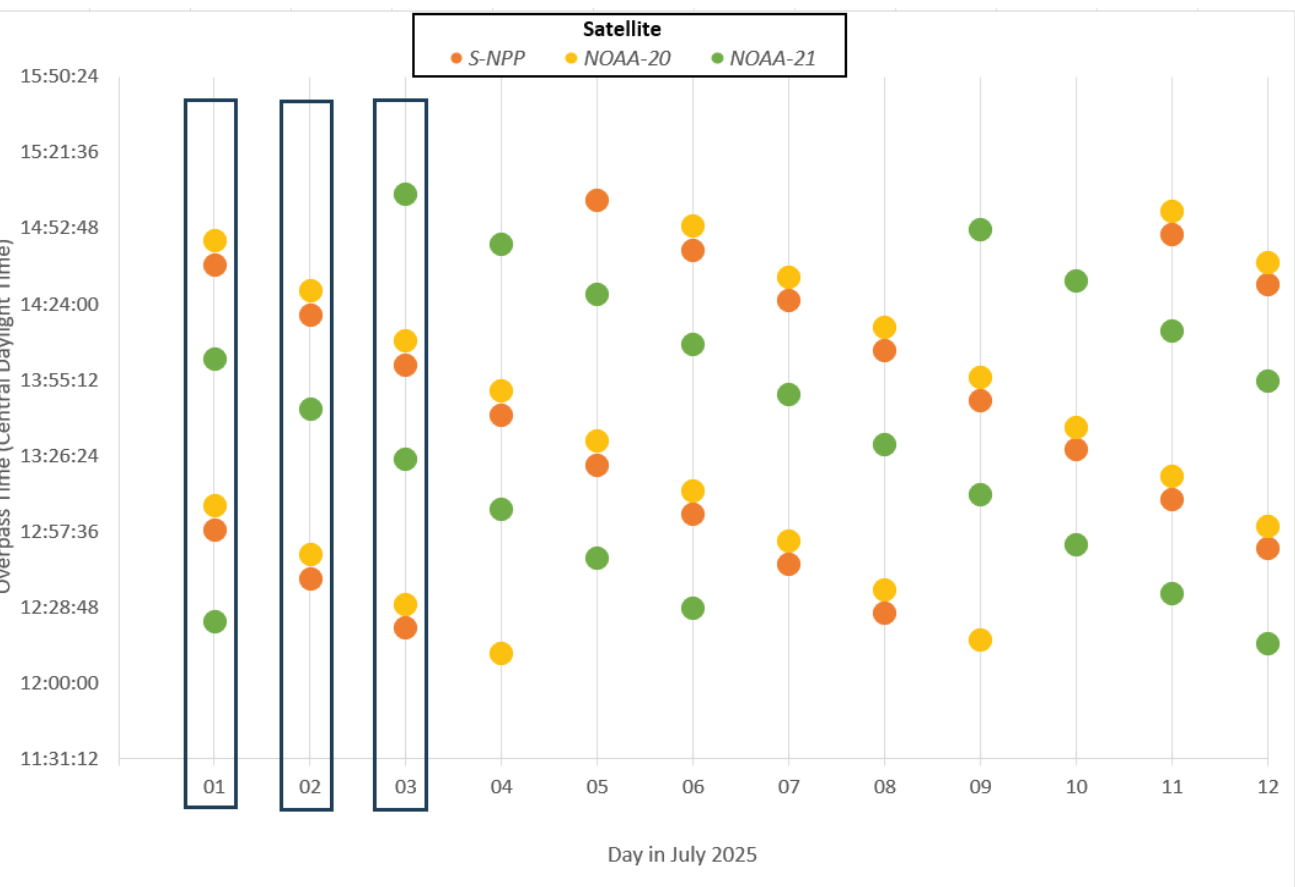


Figure 2. Overpass times for 3 VIIRS sensors for a location near Pickle Lake, Ontario (early July 2025), showing the variance in day-to-day observation times. Boxed data are referred to in the main text.

Overpass times and resolution of polar orbit satellites

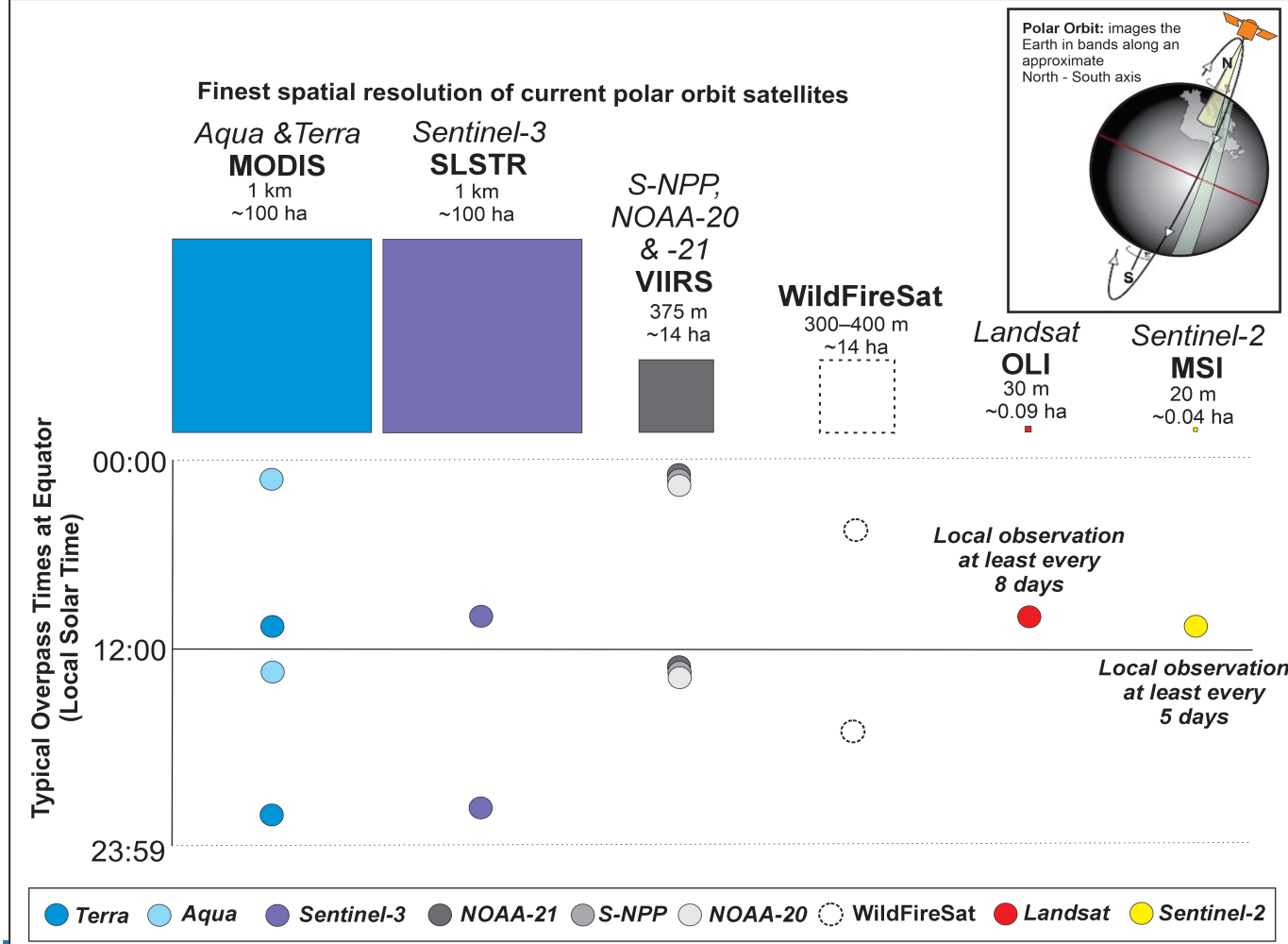


Figure 3. Characteristics of fire monitoring satellites in polar orbit. WildFireSat is awaiting launch. For more information on other satellites, see **Box 3**.

1

The VIIRS satellite instrument is one of the most commonly used for fire data in Canada. VIIRS is currently flown on three satellites: *NOAA-21*, *S-NPP*, and *NOAA-20*, with typical overpass times (in solar time at the equator) at 13:05, 13:30, and 13:55, as well as at 01:05, 01:30 and 01:55, respectively.

2

For a more precise prediction on when a satellite will overpass a specific area, see:

https://oceandata.sci.gsfc.nasa.gov/overpass_pred/



3

Read more about the different satellite missions for active fire monitoring see:

<https://ostrnrcan-dostrncan.canada.ca/handle/1845/218129>



Figure 1 maps the early, average, and late overpass times for VIIRS satellites in different Canadian locations. However, most Canadian locations will actually be observed multiple times each afternoon by each satellite carrying the VIIRS instrument because of overlap between adjacent overpasses. These observations will be at slightly different times due to cyclical variations in the satellite orbits. The exact number of observations made by a satellite increases with increasing latitude (i.e., more observations in the Territories than in the Provinces) as the amount of overlap between successive overpasses increases. For example, **Figure 2** shows predicted overpass times for all three satellites carrying VIIRS for a point location (50°N, -90°E), calculated using the overpass time calculator (**Box 2**). Multiple observations of the location are made daily from approximately 12:00 to 15:00 local daylight saving time. On July 1, two observations were made by each satellite (**Figure 2**, Day 01). On July 2, only one observation was made by *NOAA-21*, whereas two each were made by *NOAA-20* and *S-NPP* (**Figure 2**, Day 02). On July 3, two observations were made by each satellite again, but at different times than on July 1 (**Figure 2**, Day 03).

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VIIRS observation times vary. These maps show the variance in satellite overpasses over space and time, by time zone.

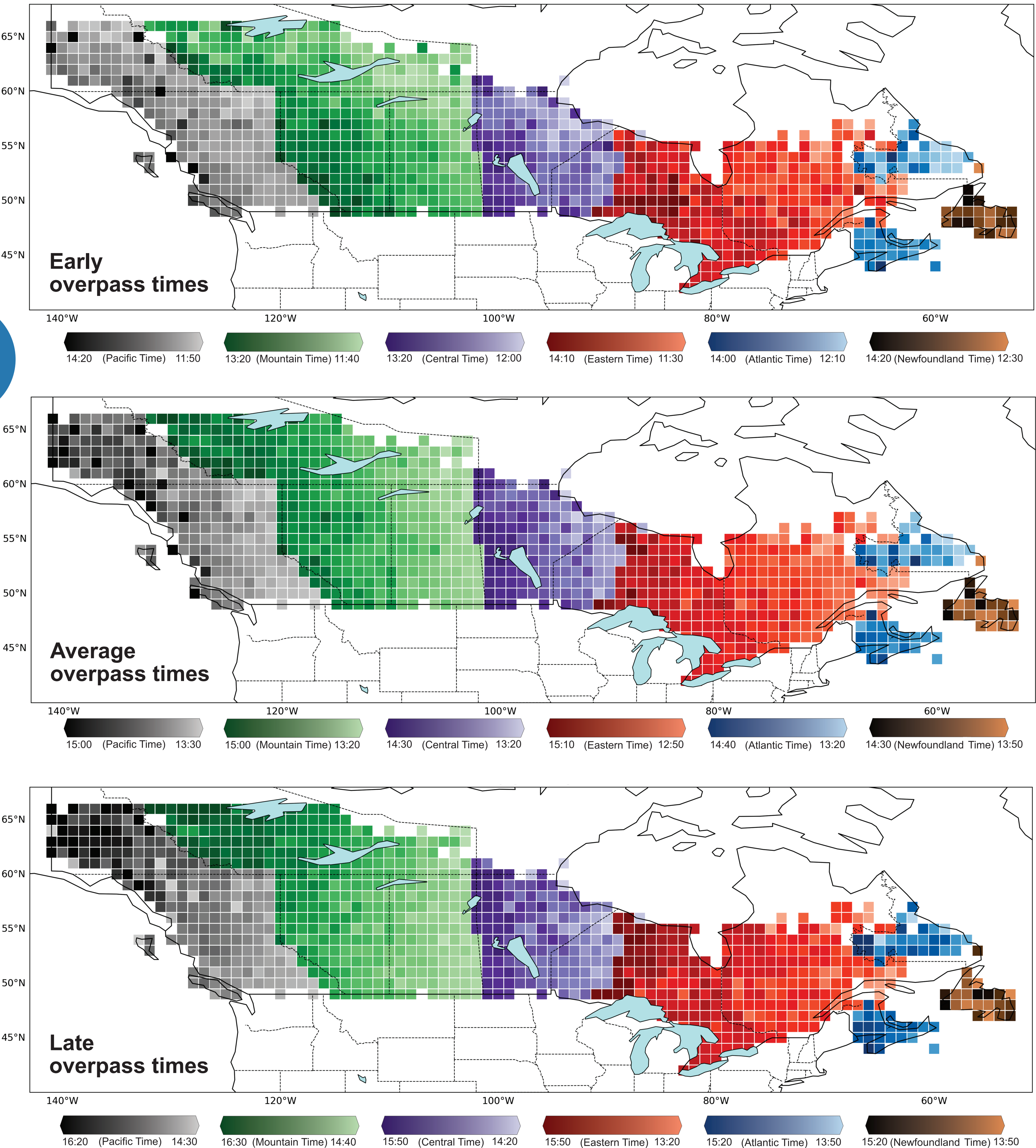


Figure 1. Maps of early (5th percentile), average (mean), and late (95th percentile) VIIRS overpass times. All times are in local daylight saving time. Each colour corresponds to a time zone (each gradient indicates the time range); the darker the colour, the later the time. Uncoloured areas of Canada had insufficient data to calculate statistics.

Aussi disponible en français sous le titre : Quand recevra-t-on les nouvelles données névralgiques de l'instrument VIIRS?
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