

Lunar Observation

On April 9th, 2025, we performed two lunar observations. The moon passed behind the earth and was in the FOR for approximately three minutes on each side of the earth. We were able to step north, as opposed to nominal stepping to the west. This data can serve as a calibration metric as well as highlighting TEMPO's capabilities.

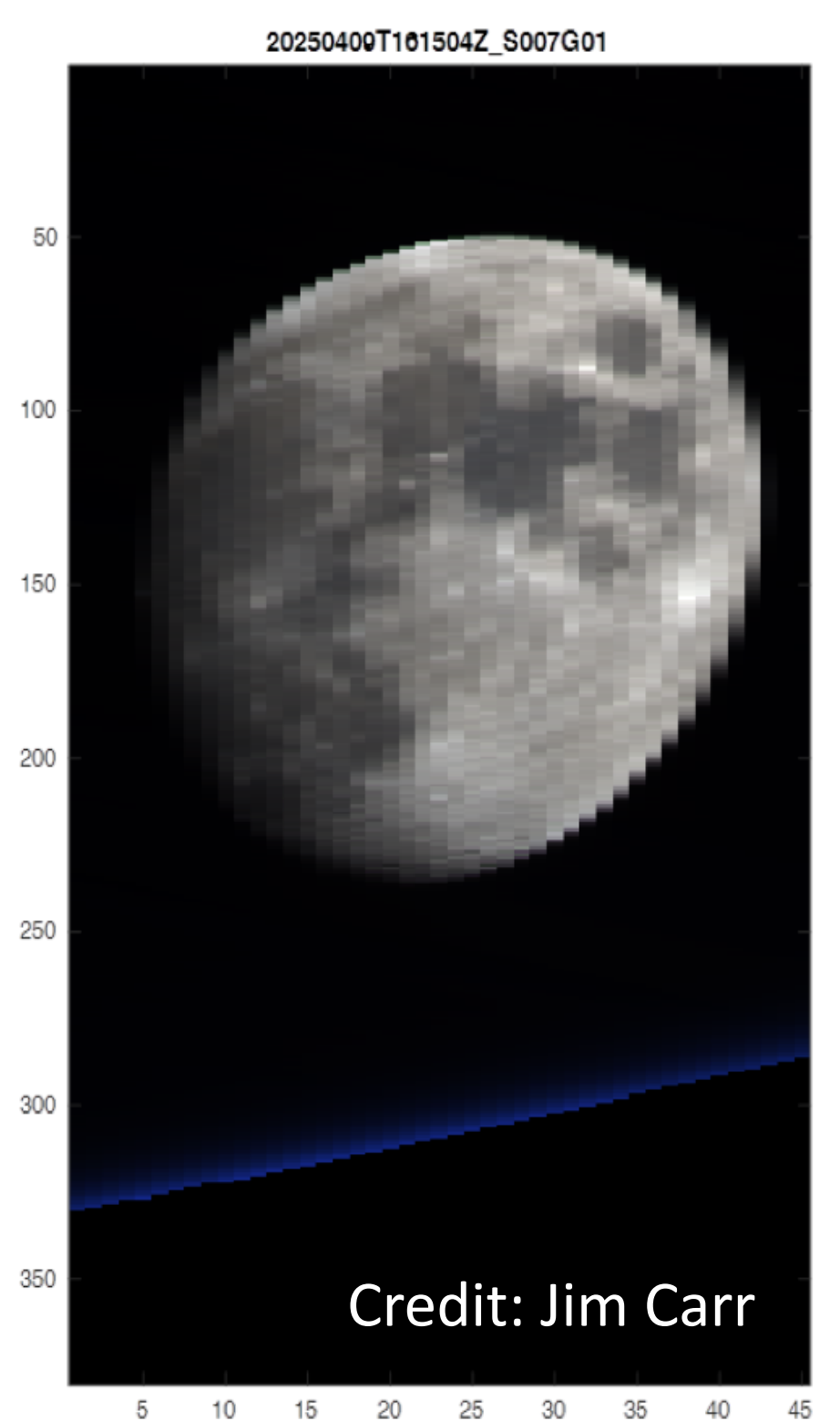


Figure 1: Image constructed from RGB images in L1 granule (Credit: Jim Carr)

Introduction

TEMPO special observations are defined as any observations that deviate from the nominal hourly scan pattern, which includes optimized scans over the field of regard (FOR) in the morning and evening, with hourly scans in the middle of the day covering the full FOR. Special observations are used to scan a specified area at a higher temporal resolution and are useful when conditions are changing quickly. Special observations must be approved by the science team and requested at least **two weeks in advance** by completing the form on the Early Adopters website.

https://weather.ndc.nasa.gov/tempo/green_paper.html

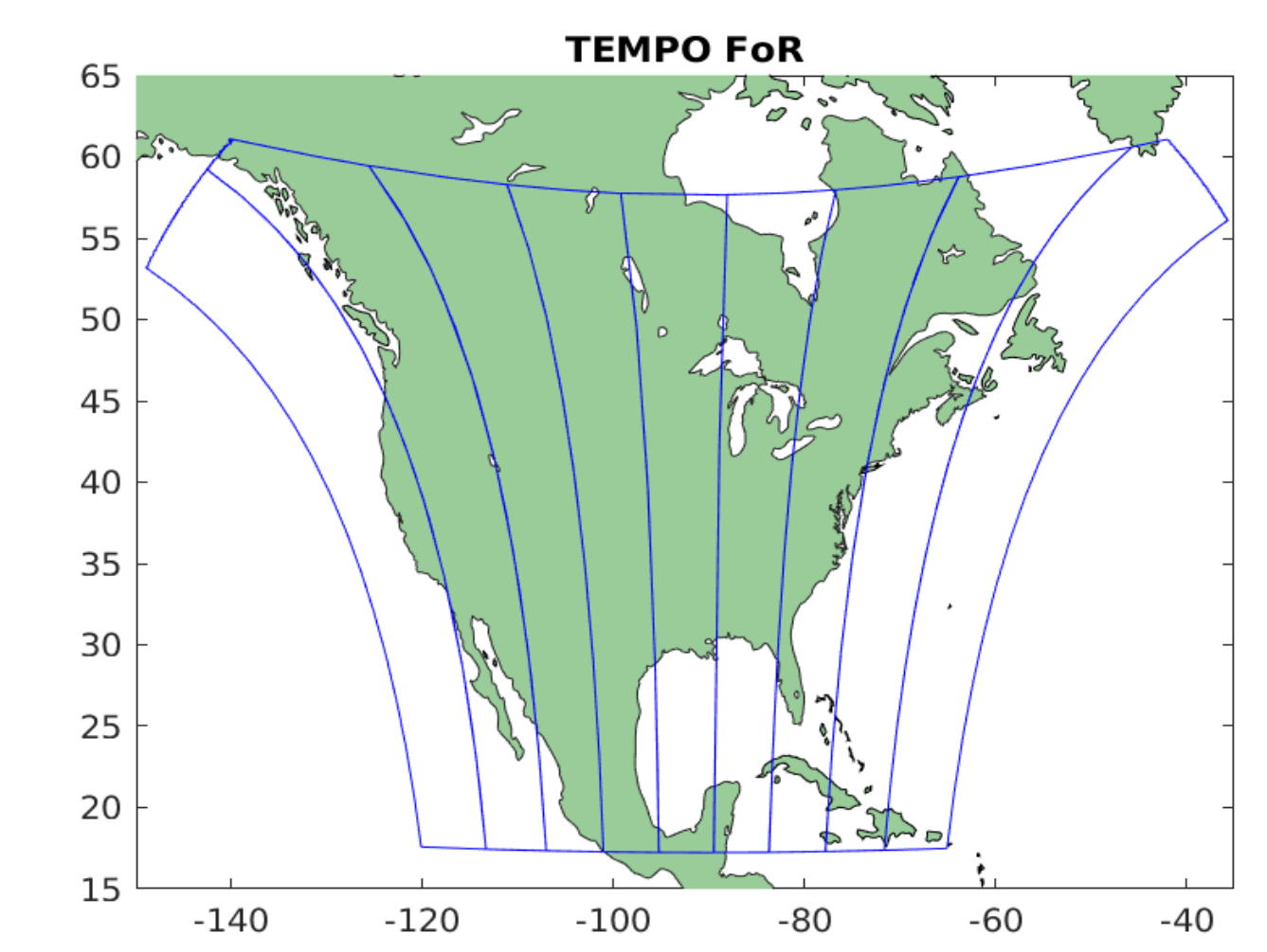


Figure 2: TEMPO Field of Regard (FOR)

Railroad Valley

We performed special observations over the Railroad Valley, Nevada satellite calibration site in early June 2025. These observations were 20 minute scans, with a fixed mirror x-position (East/West), and stepping in the y direction (North/South). The mirror position over the same location can vary due to jitter, so we selected 3 mirror x-positions to increase the probability of hitting the target location at the appropriate time.

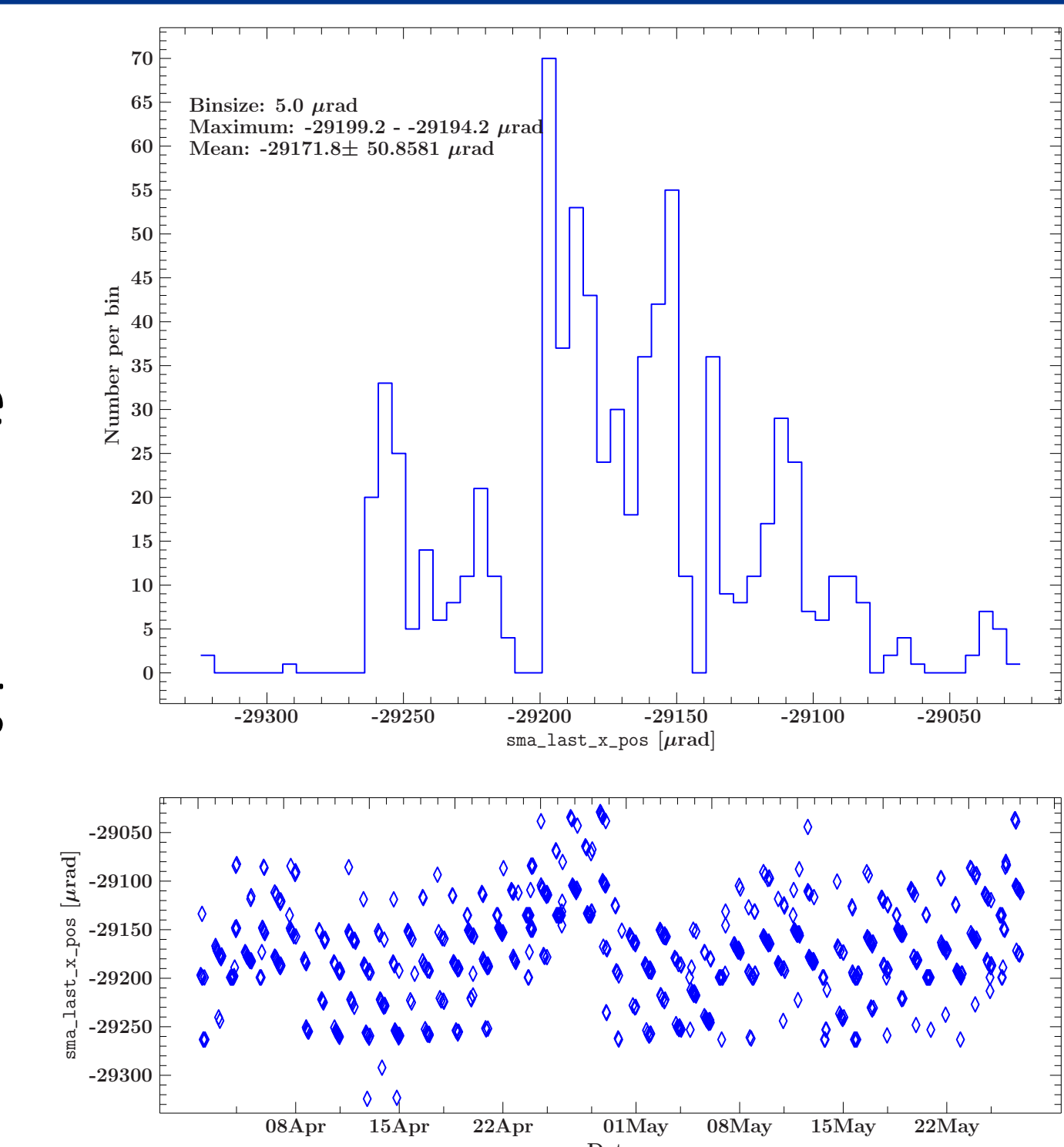


Figure 3: Used recent TEMPO observations to show the requested latitude and longitude mapped onto the East/West mirror position, in microradians.

10-Minute Special Observations

The most common type of special operations is 10-minute scans, which scan a small portion of the FOR. Typically, we alternate 10-minute scans with hourly scans; one nominal scan that covers the full FOR in an hour followed by six 10-minute scans over the specified area. 10-minute scans provide higher resolution data of the specified area, and are used when conditions are changing quickly.

Previously conducted 10-minute scans:

- January 2025: LA wildfires
- March 2025: Alabama controlled burns
- April 2025: Georgia controlled burns
- June 2025: lightning NO_x
- July-August 2025: Colorado Frontal Range

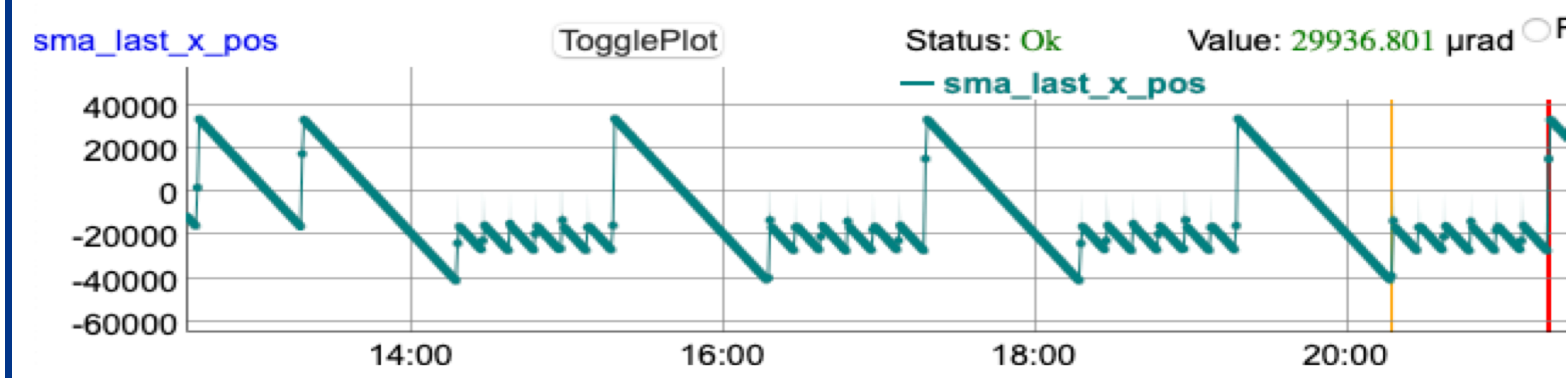


Figure 4: Plot of the x-axis, East/West position of the scan mechanism assembly from Colorado scans; six 10-minute scans alternating with nominal hourly scans

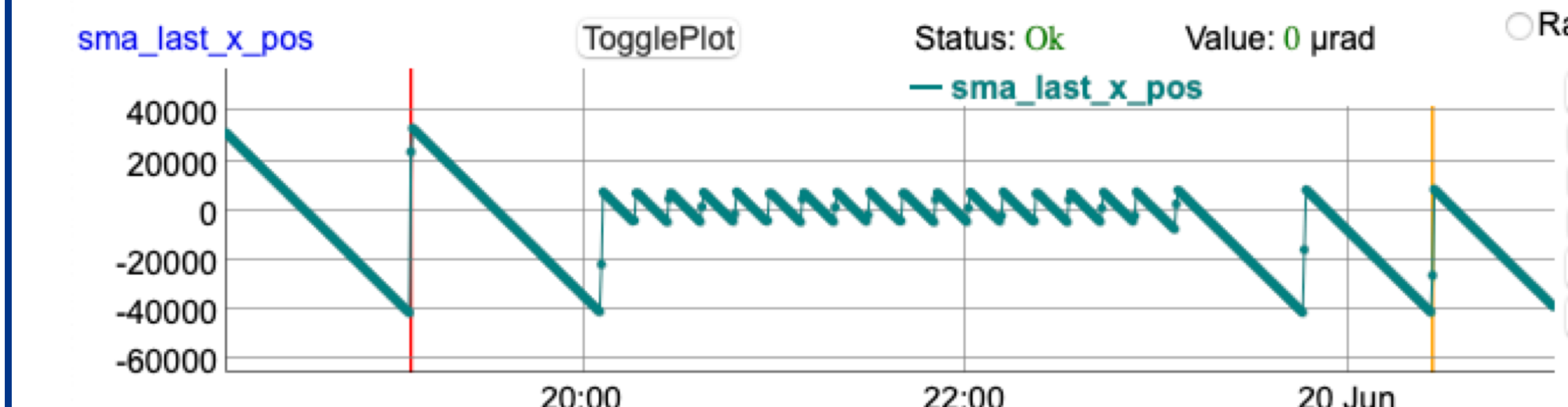


Figure 5: Plot of the x-axis, East/West position of the scan mechanism assembly from lightning NO_x; three hours straight of 10-minute scans

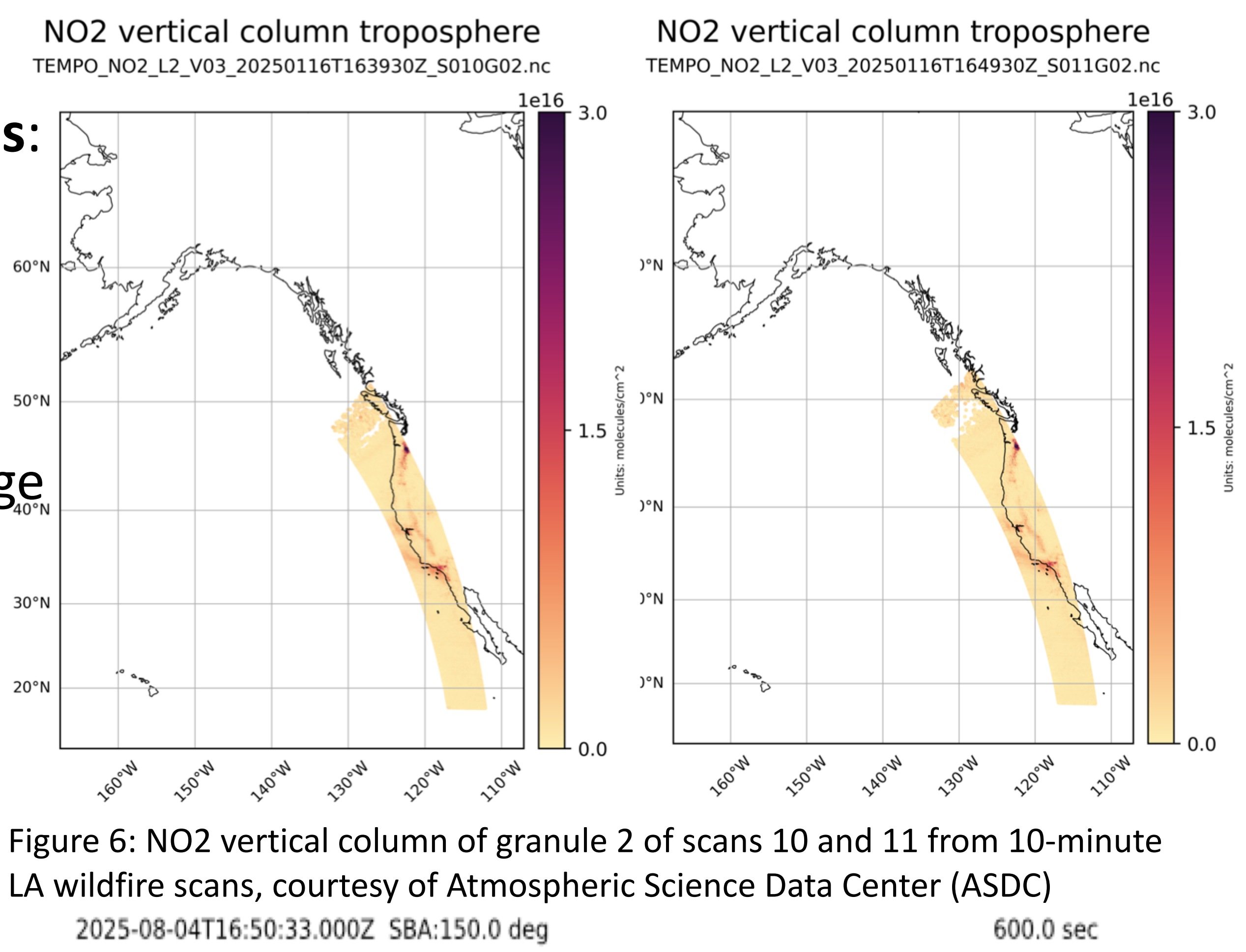


Figure 6: NO2 vertical column of granule 2 of scans 10 and 11 from 10-minute LA wildfire scans, courtesy of Atmospheric Science Data Center (ASDC)

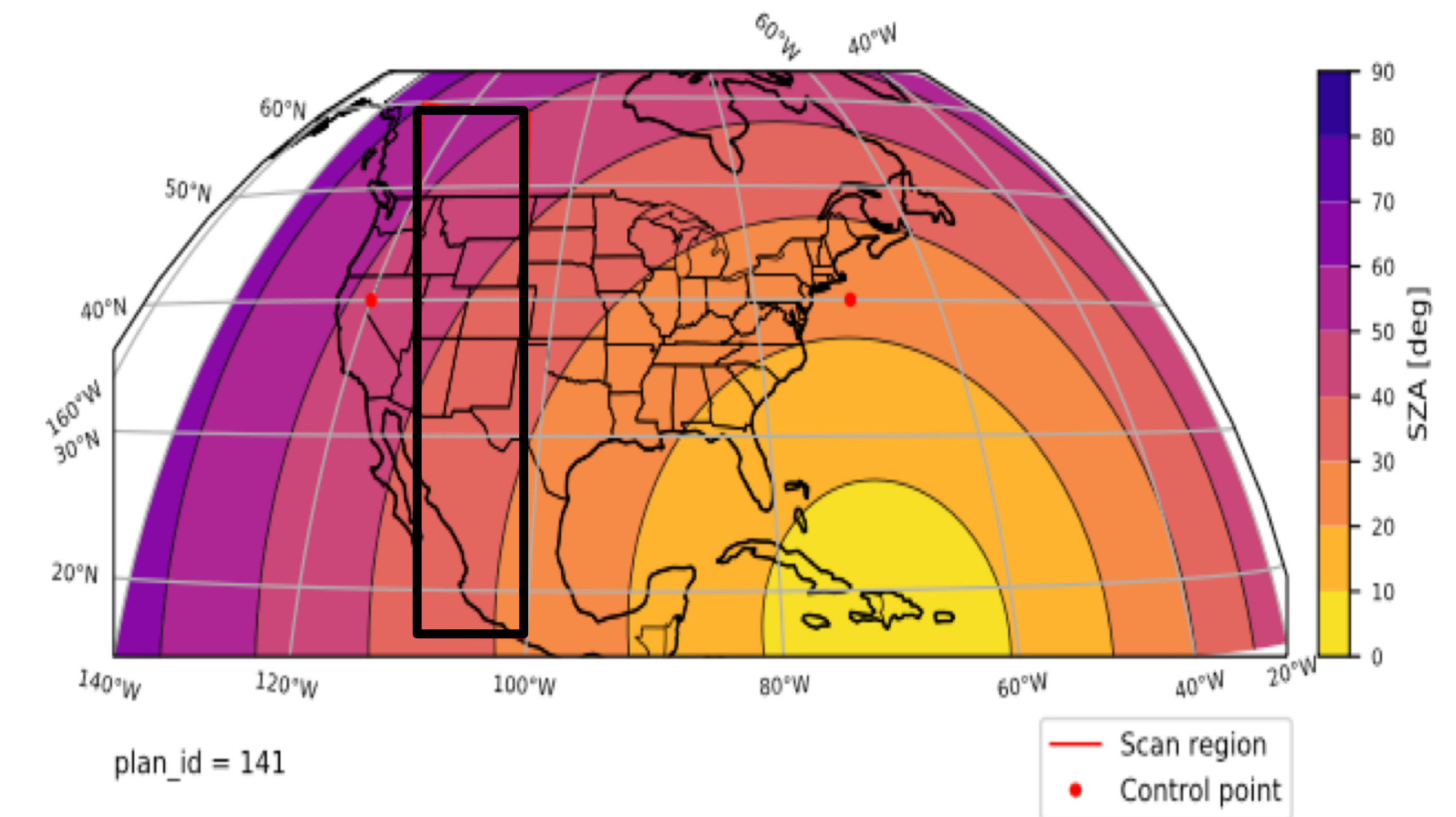


Figure 7: Plot of solar zenith angle with 10-minute Colorado scan

Green Paper

The TEMPO Green Paper (GP) contains experiments that can be conducted upon request. We have previously carried out observations described in the GP, such as prescribed burning in Fort Stewart, GA, and lightning NO_x. TEMPO is able to spend 25% of its observing time on special observations, and requests for special observation are encouraged. Requests can be submitted through the form located on the Early Adopters website and must be made at least **two weeks in advance**.

https://weather.ndc.nasa.gov/tempo/green_paper.html

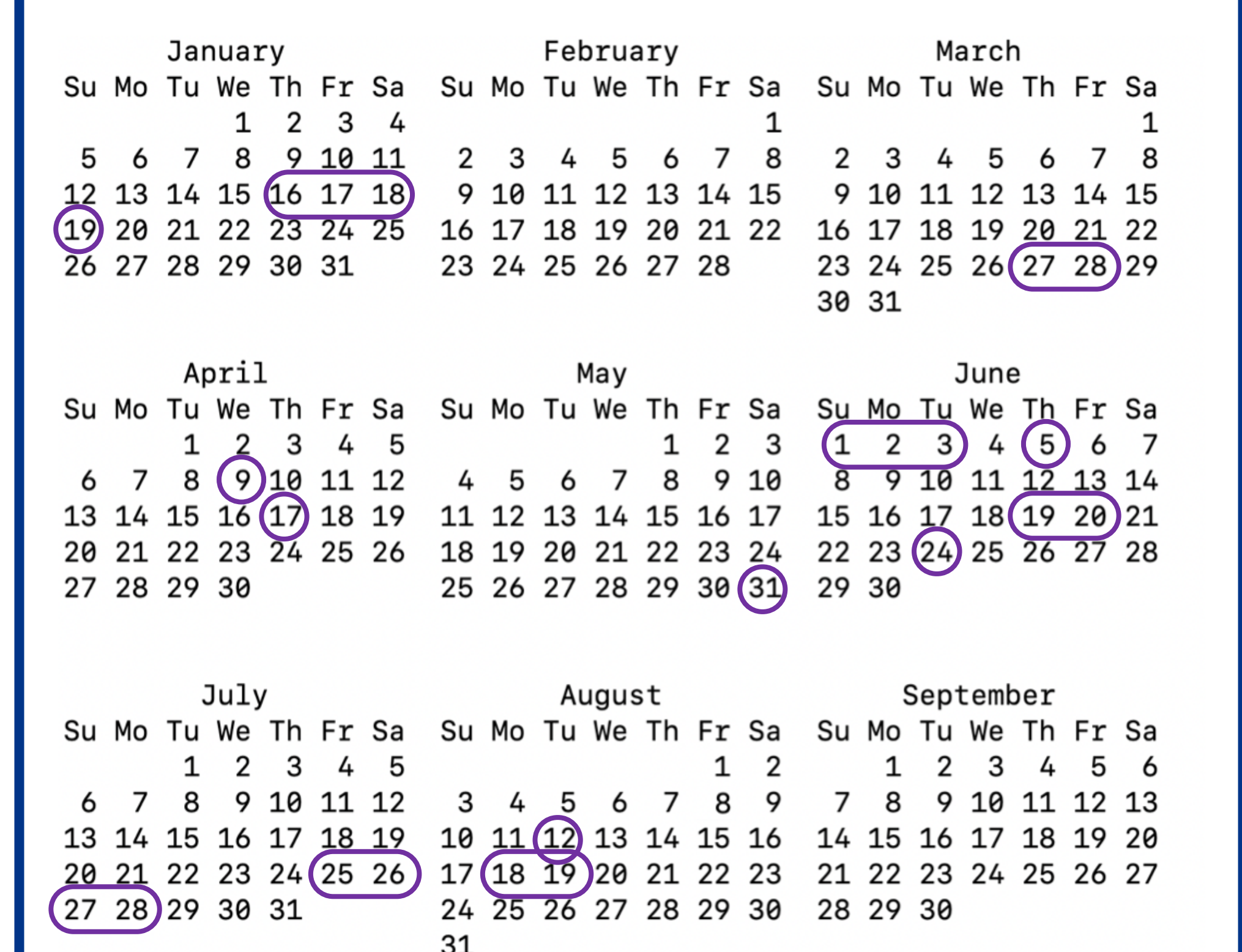


Figure 8: 2025 calendar (January-September) highlighting dates of completed special observations