



Extended Coronal Imaging with GOES-R Solar UltraViolet Imager

Sivakumara K. Tadikonda, SSAI
Lanham, MD 20706
Daniel B. Seaton, CIRES, Univ.
Colorado, and NCEI
Boulder, CO 80305

Gustave J. Comeyne, NOAA
Greenbelt, MD 20771
Alexander Krimchansky, NASA
Greenbelt, MD 20771
Monica Todirita, NOAA
Greenbelt MD 20771

Abstract

Solar corona in **17.1nm** and **19.5nm** wavelengths up to three solar radii from Sun center was observed by the **Solar UltraViolet Imager (SUVI)** on the Geostationary Operational Environmental Satellite (GOES) – 16 and GOES-17. The nominally Sun-pointed SUVI was off-pointed to the left and to the right of the Sun center at a regular cadence and a composite **Extended Coronal Imaging (ECI)** frame was created. The imaging area in the composite is about three times the nominal image area in the East-West direction (about $5^{\circ}R_{\text{sun}}$ versus $1.6^{\circ}R_{\text{sun}}$ for nominal images). The campaign was conducted in February (4 hours), June (72 hours), and August-September of 2018 (5 weeks). Limited solar CME activity during the 5-week campaign was observed in both the SUVI and LASCO C2 imagers. Some of the observations during this campaign include structures up to a few solar radii off the solar limb, and interesting coronal activity – both on and off the solar disk. They are presented here.

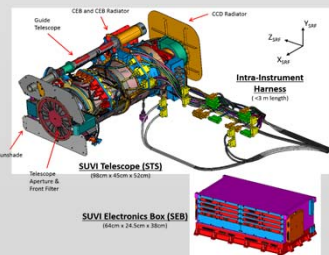
Objectives

- Investigate the presence of solar EUV corona to a few solar radii
- Evaluate 17.1 nm and 19.5 nm for long term observations
- Explore CME detection capability

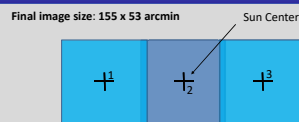
The Spacecraft



The Solar UltraViolet Imager (SUVI)

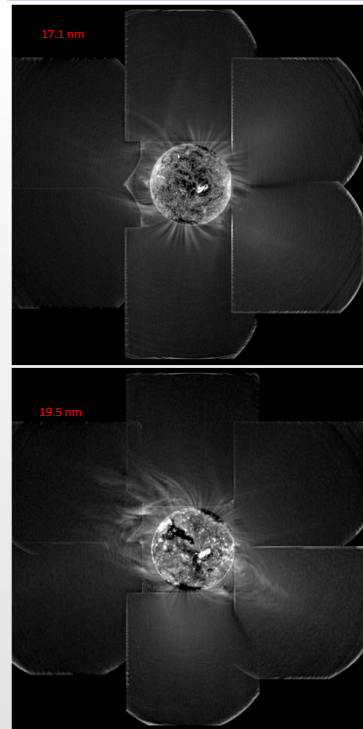


The ECI Frame



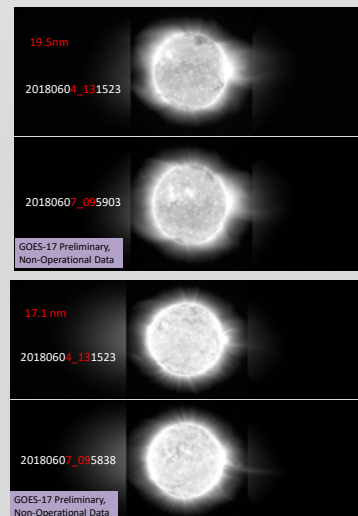
- Covers 4.5x Solar radii in E-W
- 17.1nm and 19.5nm (June 2018 campaign)
 - ECI frame Cadence: 5 min 48 secs
- 17.1nm, 19.5nm, and 30.4 nm (August 2018 campaign)
 - ECI frame Cadence: 6 min 32 secs
 - 10 secs exposure – center
 - 20 secs exposure – off-points
 - 2x2 on-chip binning onboard

First Attempt, February 2018

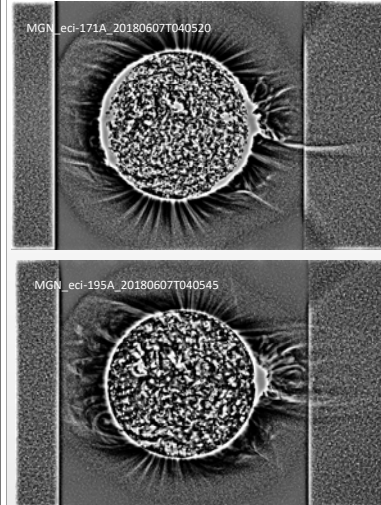


Demonstrated: EUV Corona exists to a few solar radii, even for quiet Sun

The June Campaign

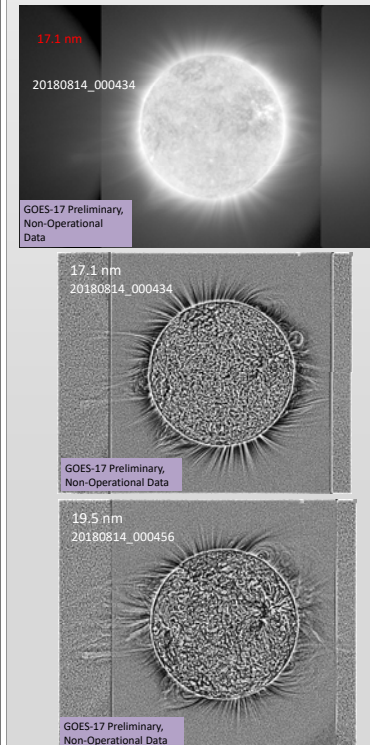


Significant activity far off the limb during the 72 hours



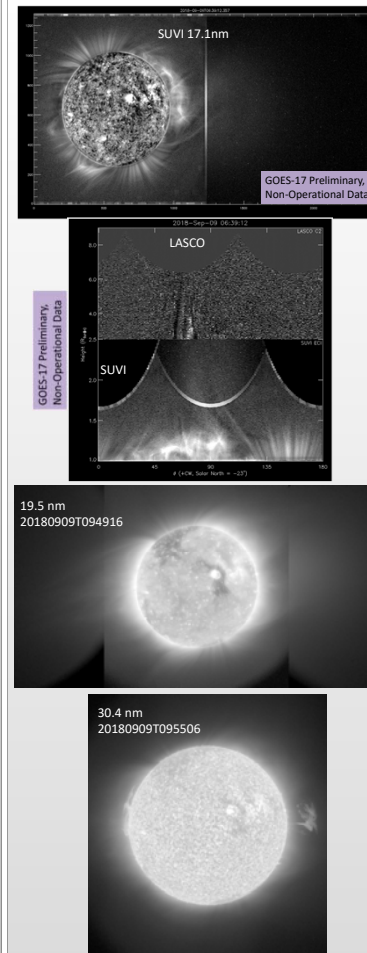
Processing highlights faint features extension outside nominal imaging area in both EUV wavelengths

Snippets from the August Campaign



A loop forming and erupting near the 0 hrs off the west limb, streaming activity off the east limb during the day, prominences in the 7 O'clock position around 1700 UT, and another loop eruption on the top right quadrant around 2300 UT are features on 08/14/2018.

CME 9/9/2018



CME activity clearly seen in 17.1nm and 30.4 nm off West limb. 19.5nm and 30.4 nm show interesting activity off the East limb as well.

Conclusion

The ECI campaign with the SUVI on the GOES-R series spacecraft demonstrated the detectability of solar EUV corona up to three solar radii, even during the quiet portion of the solar cycle. Limited CME data, where available, was trended with LASCO observations. These data could be helpful to wide-field of view EUV imagers that are being proposed. These coronal observations could help extend understanding of heating of the corona and generation of the solar wind. Further and longer campaigns will enable collection of more data and could encompass a wide range of solar activity.

References

Morgan, H., Druckmuller, M., "Multi-scale Gaussian Normalization for Solar Image Processing," Solar Physics, 2014, 289(8).
Tadikonda, S. K., Minor, R. R., Seaton, D. B., Comeyne, G. J., and Krimchansky, A., "Coronal Imaging with the Solar UltraViolet Imager," Solar Physics, 2019, 294(3).