

# Cloud Reprocessing of the Solar UltraViolet Imager (SUVI) Data from GOES-16 and -17

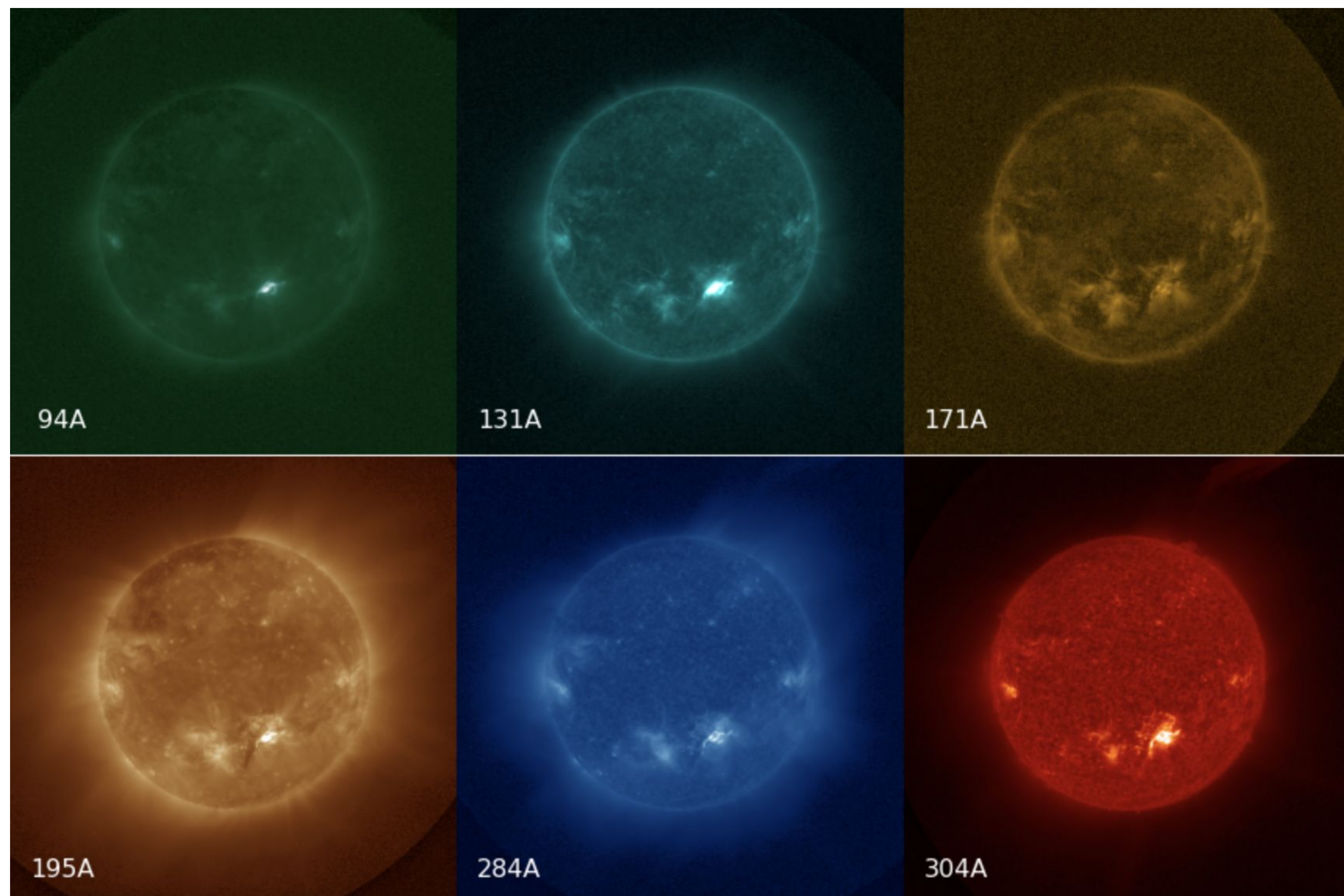


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## ABSTRACT

The Solar UltraViolet Imagers (SUVIs) are four identical instruments on-board the GOES-R series of satellites which continuously monitor solar activity in extreme ultraviolet (EUV) wavelengths. The duration of operations of the four SUVI instruments provide overlapping images of the Sun from these instruments over the course of multiple solar cycles. In order to provide the best data to space weather forecasters and scientists, we have developed an in-house pipeline to reprocess the data in order to correct errors, fill gaps, and add support for advanced metadata features missing from the original real-time data from the four GOES platforms, including both the operational GOES-16 and -17 and future GOES-18 and GOES-U. Here we discuss our improvements to the pre-existing processing pipeline, and present the results and comparisons to previously-processed data. We also discuss our experience using the cloud for this analysis.

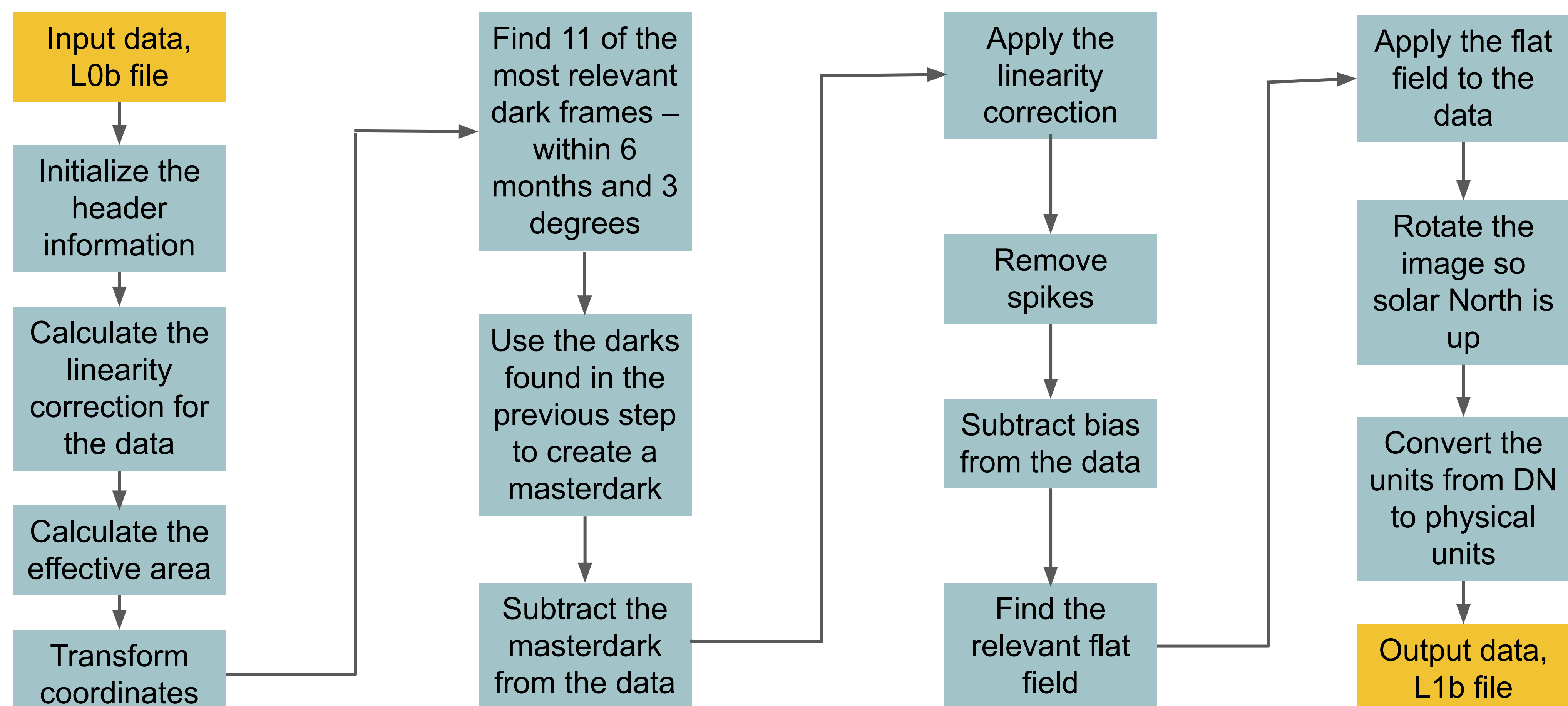
## WHAT IS SUVI?



## MOTIVATION

Early in the GOES-R mission lifetime, problems with the real-time processing algorithm limited the scientific value of the SUVI L1b data products. An early prototype processing code developed at NCEI permitted us to reprocess a few specific events of great space weather importance, but was not robust enough to reprocess that large amount of data in the entire L1b archive to scientific quality. In 2021 we began developing a complete, end-to-end reprocessing data pipeline that can generate scientific-quality products from the Level-0 raw data, and can serve as a platform for data validation during the post-launch testing and validation process for GOES-18 and GOES-U in the future. During 2022, we will reprocess the entire SUVI back catalog of data to generate full validated products for the lifetime of the GOES-R series mission.

## THE PROCESS



## ACKNOWLEDGEMENTS

We would like to acknowledge the entire SUVI team for their help and for sharing their expertise. We would also like to thank William Rowland for his help navigating the NCIS project. For the most up-to-date information about this project, please see the in-person Rendezvous poster or feel free to email [allyssa.riley@noaa.gov](mailto:allyssa.riley@noaa.gov) with any questions!

## WORKING IN THE CLOUD

We had the opportunity to test out working in the cloud using Amazon Web Services as part of the NCEI Cloud Infrastructure Sandbox (NCIS), which is a stewardship and calibration/validation (cal/val) initiative at NESDIS. This stewardship project is to provide improved data to data users, including improving data quality via reprocessing and improving data availability. This SUVI L0-to-L1b reprocessing project was a good candidate for NCIS because when we fully validate this new pipeline, we will be reprocessing all of the SUVI data from GOES-16 and -17, about 28 million images!

Some thoughts about working in the cloud are included here:

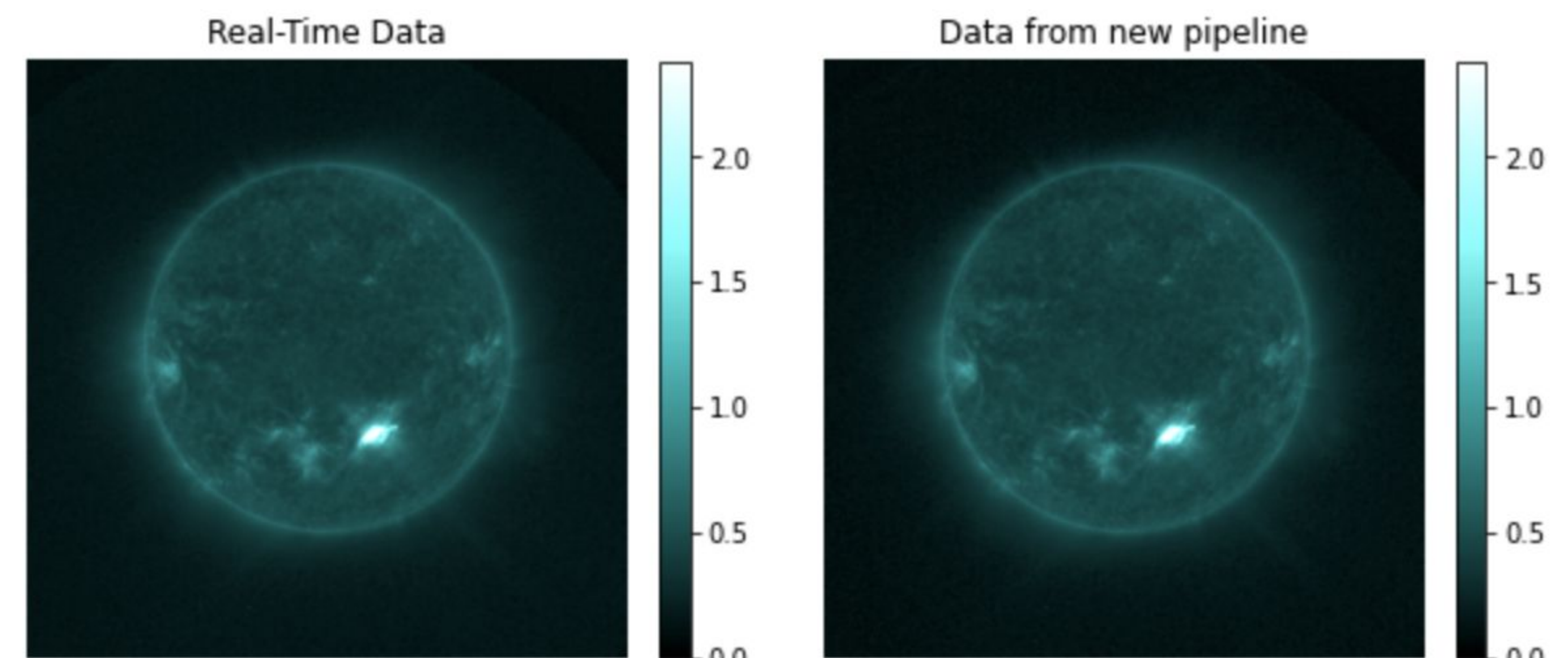
- Setup was relatively simple
- Access is as easy as logging on to the VPN and ssh-ing into the relevant server
- Moving data between the cloud and local machine is somewhat clunky (requires secure copy) but we acknowledge that this should be done sparingly
- We do not currently have the capability to view the data and debug via jupyter notebooks, but it is an available option, it just needs to be set up

## RESULTS AND VALIDATION

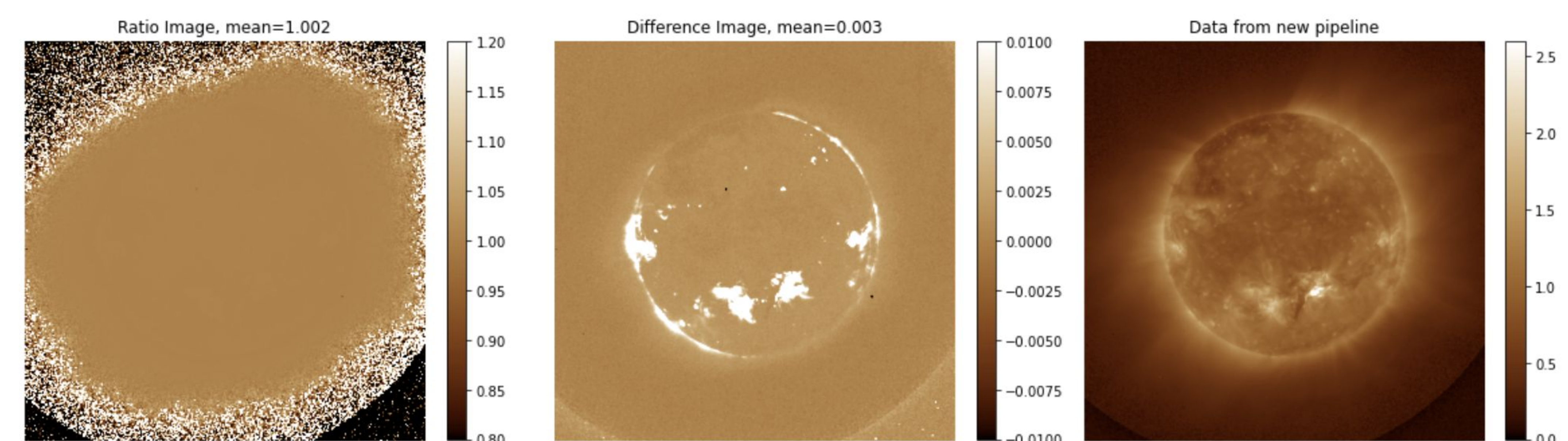
Recent improvements in the SUVI L1b reprocessing pipeline include

- Streamlined organizations for ease-of-use and later modifications
- Improved metadata
- Added data quality information
- Standardized end product file format

The figures below show a comparison of real-time and reprocessed L1b data from our pipeline



**Figure 1:** A visual comparison between the reprocessed 131 Angstrom L1b data (left) and the corresponding real-time L1b data (right) from July 6, 2021.



**Figure 2:** A 195 Angstrom ratio image (left) and a difference image (center) comparing our reprocessed data (right) to the real-time L1b observations of a solar flare that occurred on 29 Nov. 2020.

## NEXT STEPS

- Finalize and verify all metadata values
- Understand discrepancy in final data between data output from the new pipeline and data output from the Harris pipeline
- Finalize yaw flip lines in the code for GOES-17 – yaw flipping is used to manage the Advanced Baseline Imager (ABI), which has a cooling problem. Flipping the spacecraft allows the radiators to cool periodically
- Integrate with the SPADES system to be run on a regular basis
- Get pipeline running for new GOES-18 data
- At some point, we'd like to release it to be used by the general public at this website <https://www.ngdc.noaa.gov/stp/satellite/goes-r.html>