Poster 768

# GRATDAT: A novel approach to monitoring and processing radiometric data from GOES-R ABI

David Pogorzala[1], Zhenping Li[2], Jon Fulbright[3], Matt Seybold[4]

[1]Integrity Applications Inc., [2]ASRC, [3]Columbus Technologies and Services, Inc., [4]NOAA/NESDIS/OSPO

Image credit: Japan Meteorological Agency

## Introduction

The Advanced Baseline Imager (ABI) on board the Geostationary Operational Environmental Satellite (GOES)-R Series will feature increased spatial, spectral and temporal coverage over the current N-Series Imagers. With this enhanced capability comes a vast increase in the number of radiometric parameters, and in the complexity of the data processing. A new tool, the GOES-R ABI Trending and Data Analysis Toolkit (GRATDAT), is being developed to help analysts maintain the tighter data quality standards of operational products. GRATDAT features three main components: automated monitoring of radiometric parameters to identify outliers, processing of raw data offline to intermediate stages between Level-0 (L0) and Level-1b (L1b), and interactively querying and visualizing data at various stages of processing.

GRATDAT will reside within the GOES-R Ground Segment and be used by engineers to monitor radiometric performance in near-real time. In addition GRATDAT will be used by scientists at NOAA/NESDIS/STAR to perform offline processing of raw data and deep-dive analyses into anomalies.

## Level-0 to Level-1b Data Processing

A major feature of GRATDAT is the ability to perform offline processing of raw, L0 data. The tool decompresses L0 to detector counts (L1a), and calibrates the counts to detector-level radiances (L1α). Planned development includes enabling navigation (L1β) and resampling to L1b imagery. Analyzing data processed to these intermediate stages can provide critical insight into anomalous behaviors seen in the operational data stream.

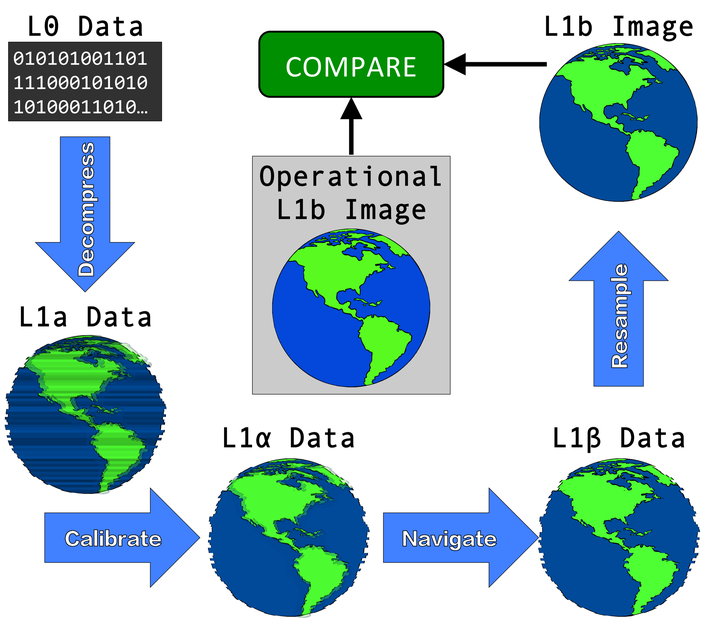


Figure 1: Pictorial example of the L0 -> L1b processing chain. GRATDAT processes data using the same algorithms employed in the operational Ground Segment, but allows users to modify algorithm parameters and variables. This allows scientists to compare and contrast results with outputs from the operational product stream.

## Data Analysis and Visualization

GRATDAT contains a sophisticated Data Analysis Toolkit (DAT) that allows users to analyze ABI data in L1a, L1α, L1β or L1b formats. Interactive functionality includes brightness/contrast scaling, x- or y-axis profile plots, RGB composites, Fourier spectrum analysis, histogram and cumulative histogram analysis, conversion of radiance to top-of-atmosphere reflectance or brightness temperature, image-to-image differences, and Data Quality Flag visualization.

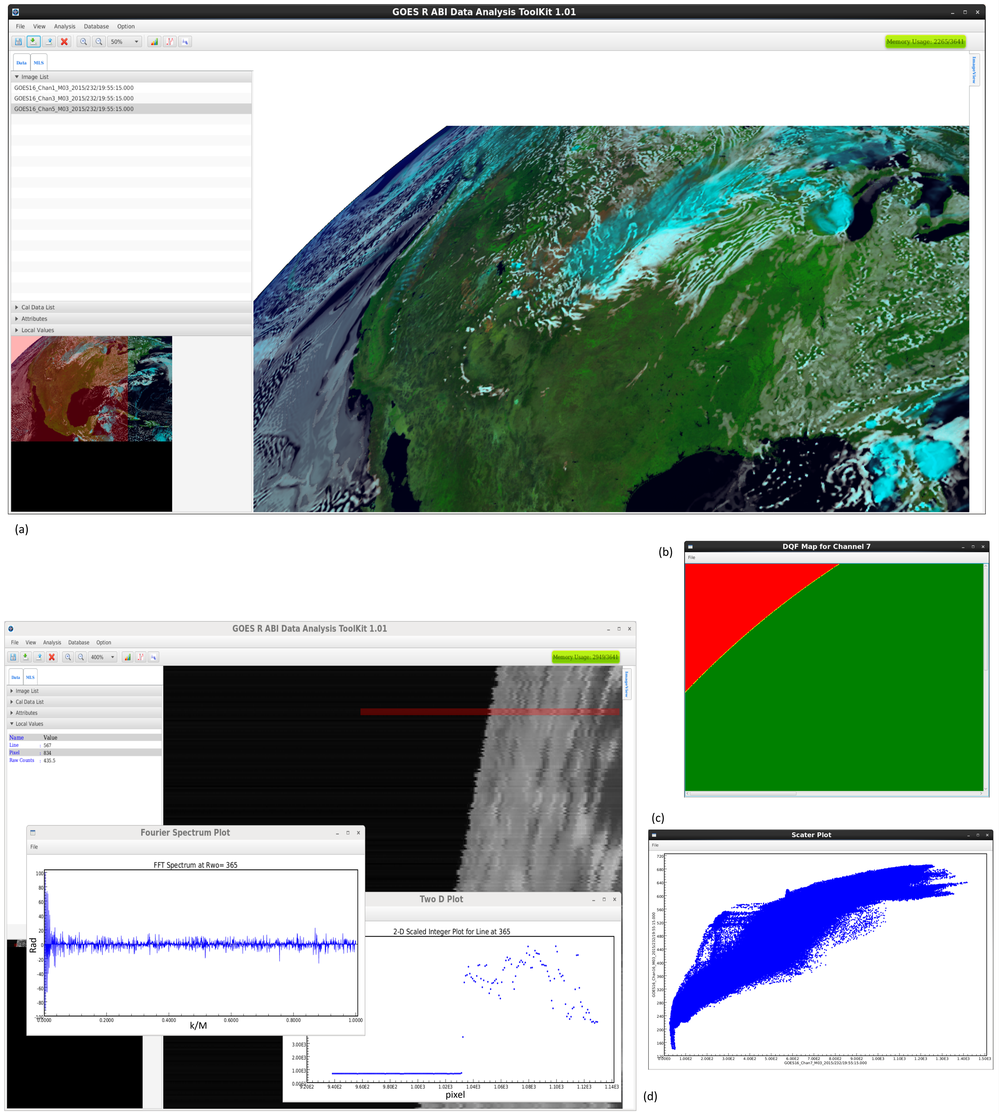


Figure 2: clockwise from top: (a) The DAT displaying an RGB composite of an L1b image, (b) visualization of Data Quality Flags, (c) 2-D scatter plot of radiances for channels 7 and 16, (d) interactive analysis of a swath of L1a data.

## Radiometric Performance Trending

Since many radiometric parameters exhibit a diurnal behavior, anomalous values are best detected using non-static thresholds. The novel technique employed by GRATDAT, the Adaptive Trending and Limit-Monitoring Algorithm (ATLMA), accomplishes this by expressing parameters as a Fourier expansion. This expansion is computed nightly by an iterative, least-square fitting of data from the previous 48-72 hours. Any new data point arriving in near-real-time that lies more than a user-defined number of standard deviations away from the predicted value is flagged as an outlier for further investigation.

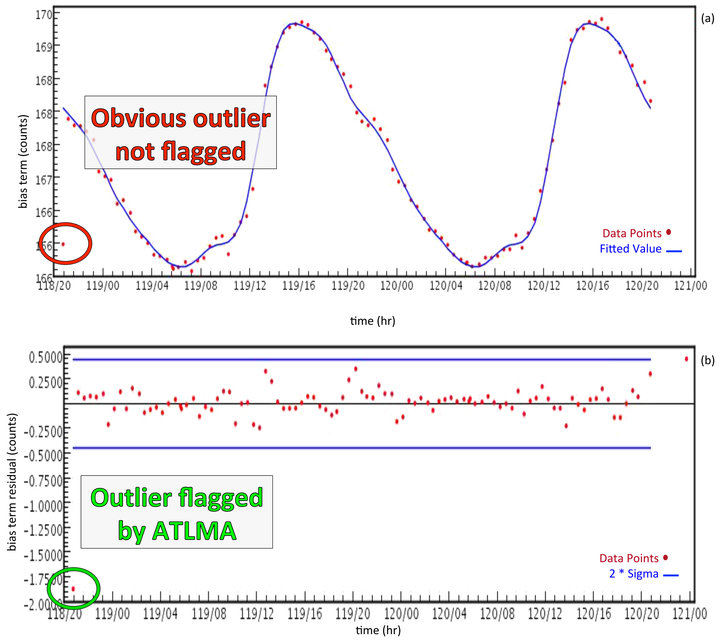


Figure 3: (a) Time series plot of GOES-13 Channel 4 biases (red) and values predicted by ATLMA (blue). (b) Residual between the data points and their predicted values. In both plots an outlier data point can be seen, though only by using an adaptive threshold is it is automatically flagged as an outlier.

## Summary

- GRATDAT will be a key asset for the teams at NESDIS/OSPO and NESDIS/STAR responsible for maintaining ABI L1b product quality.
- Offline data processing allows scientists to optimize the L1b products by modifying variables.
- Automated monitoring of thousands of radiometric parameters will help engineers identify and address potential anomalies in the data before the downstream products are impacted.

## References

Li, Z., et al., 2015. Adaptive Trending and Limit Monitoring Algorithm for GOES-R ABI Radiometric Parameters, *GSICS Quarterly Newsletter*, DOI: 10.7289/V5XK8CHN