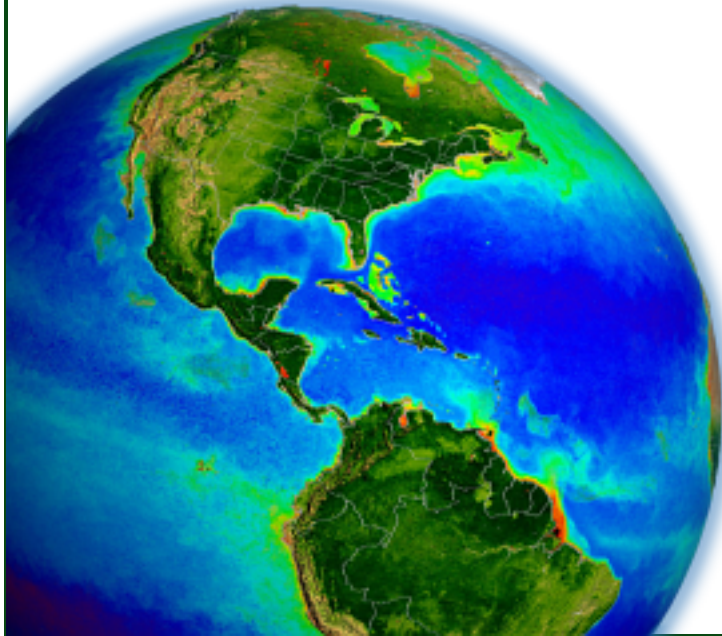# Updates to the On-Orbit Calibration of SNPP and NOAA-20 VIIRS for Ocean Color Applications

Gene Eplee, Gerhard Meister, Fred Patt, Kevin Turpie, Sean Bailey, and Bryan Franz

NASA Ocean Biology Processing Group

MODIS/VIIRS Calibration Workshop
November 18, 2019

On-Orbit Calibration Updates

- Using solar-derived f-factors to calibrate lunar observations:
  - Fits to the calibrated lunar time series have smaller uncertainties than computed differences between the solar and lunar time series.

- Using prelaunch RSRs in deriving the lunar irradiances predicted by the ROLO model:
  - Removes uncertainties in how mRSRs impact ROLO predictions.

- Using long-period exponentials as basis vectors for radiometric fitting to the lunar time series for bands M1-M11:
  - Simultaneous linear fits of lunar time series by exponentials and libration angles minimize any impact of libration on the radiometric fits.
  - Lunar gains are the exponential component of the fits.
  - Lunar gains applied to solar-derived F-factors for bands M1-M4, M8, M9

- Deriving modulated RSR gains from TOA ocean, lunar, and solar reference spectra:
  - Band-averaged radiances computed for reference spectra and mRSRs distributed over the mission.
  - Gains derived from exponential fits to radiances, starting at first light.
  - mRSR gains are ratios of ocean and lunar or solar gains.
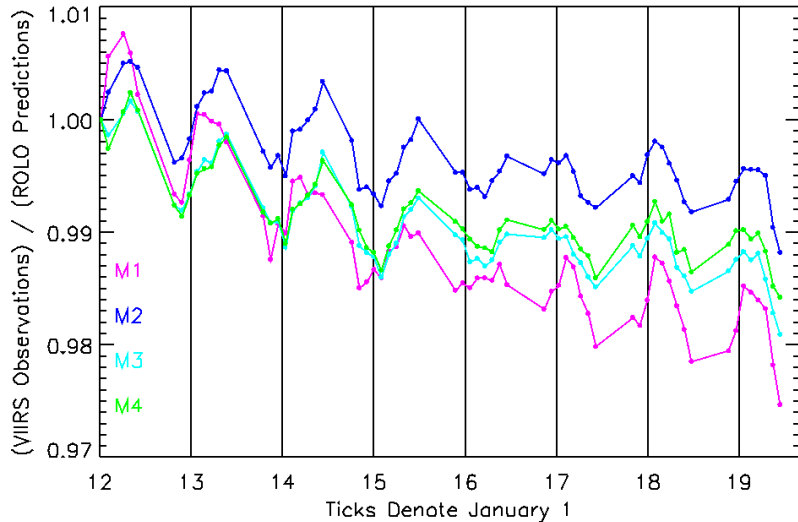
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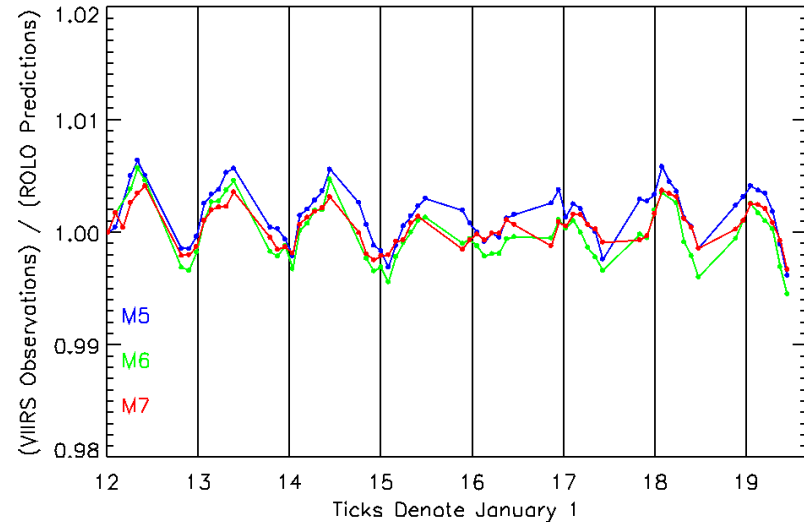# Response Trending
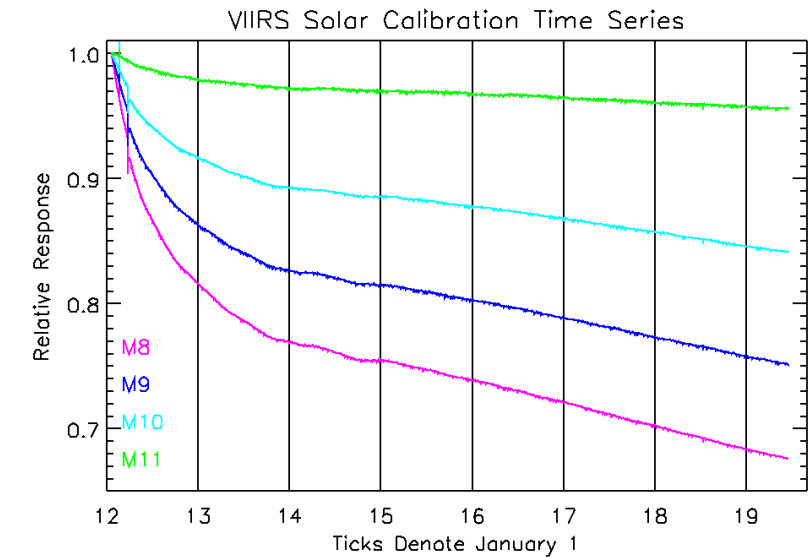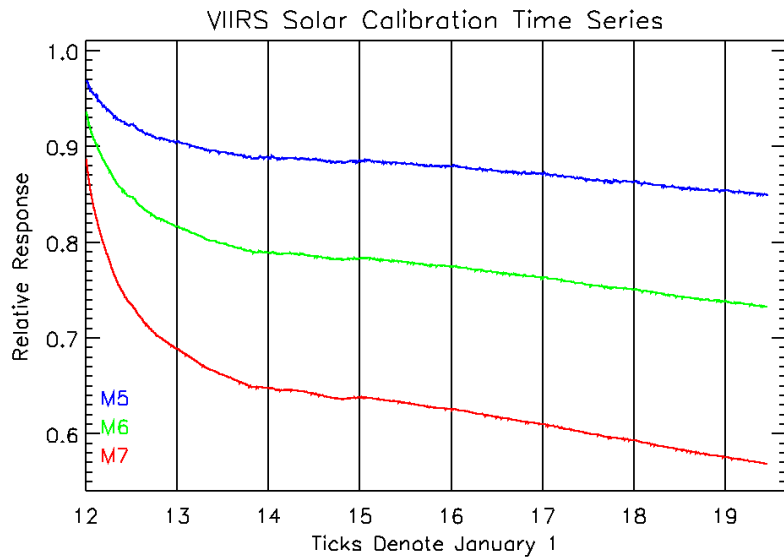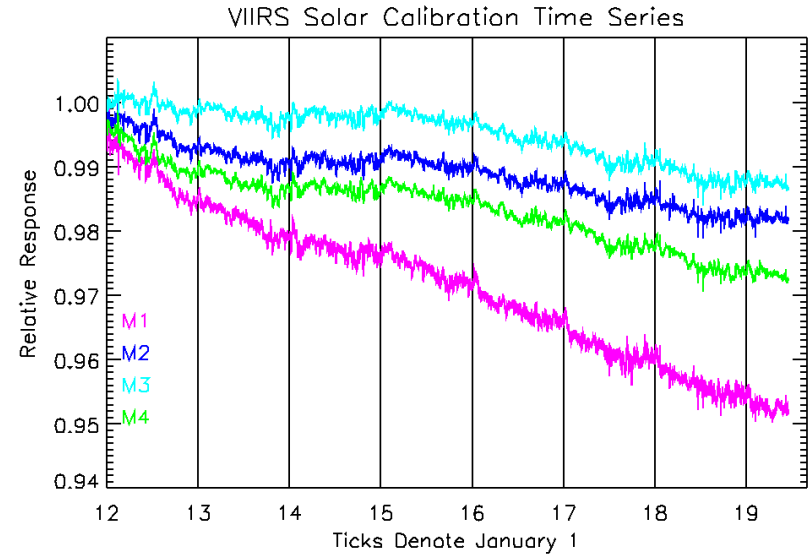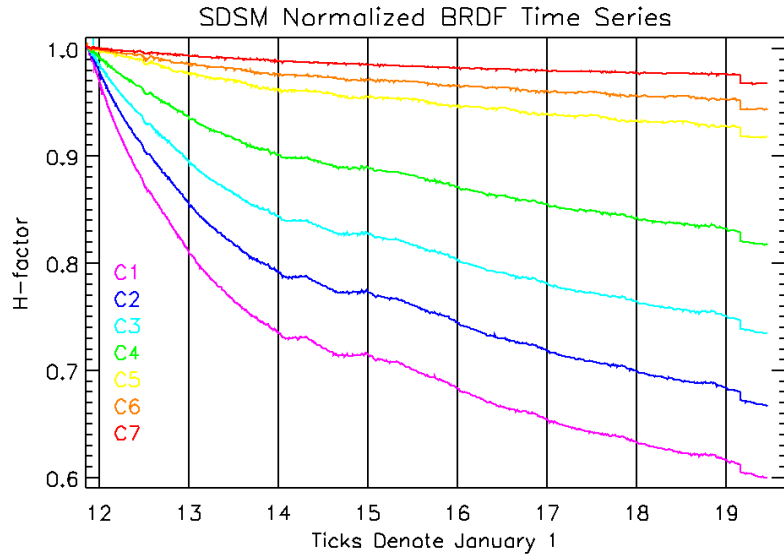
Solar F-factors

SNPP Lunar
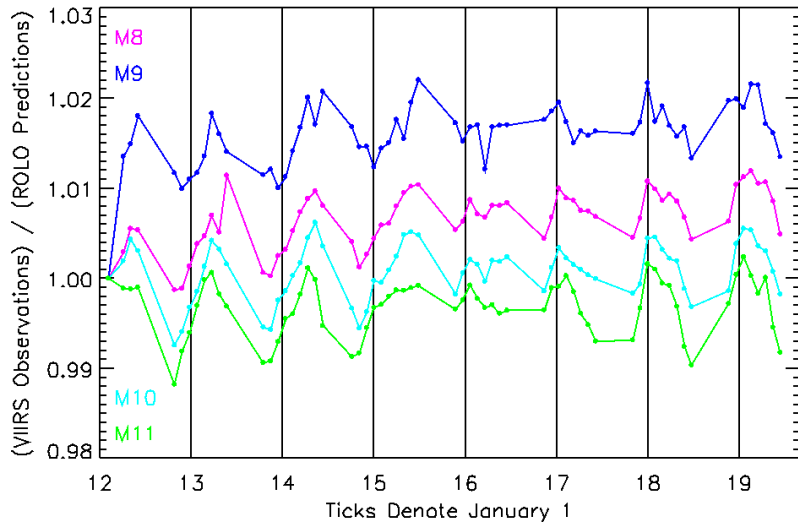# Response Trending:
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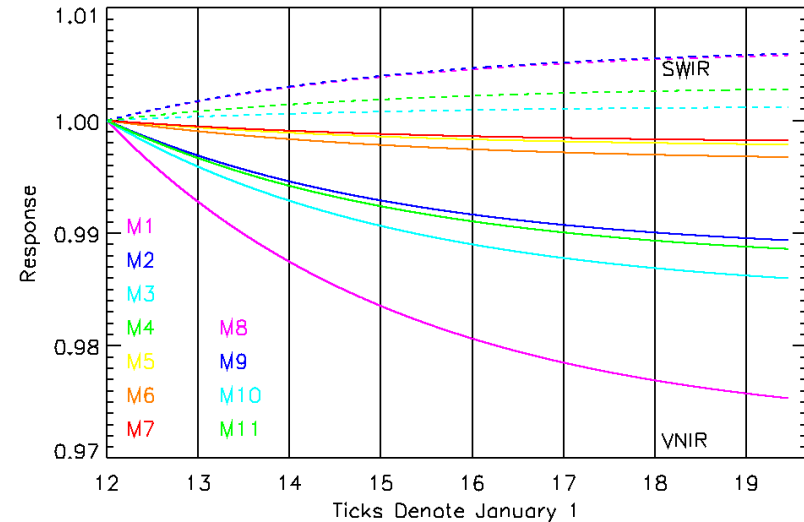
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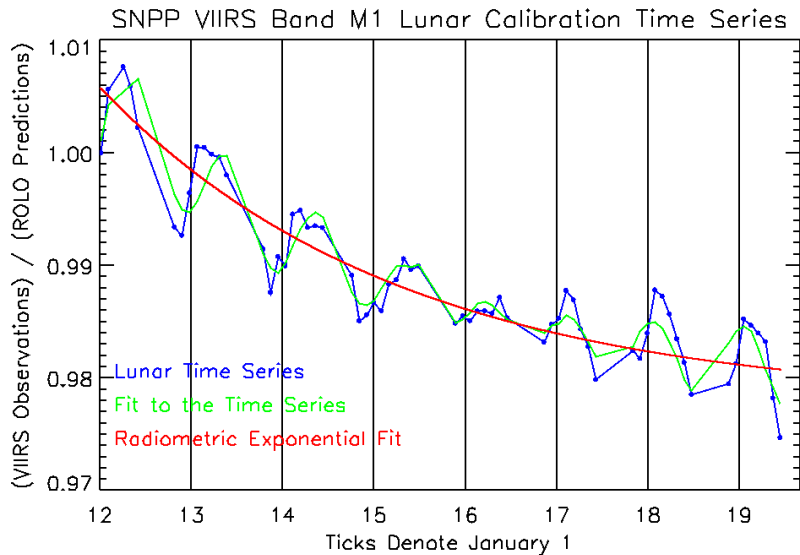
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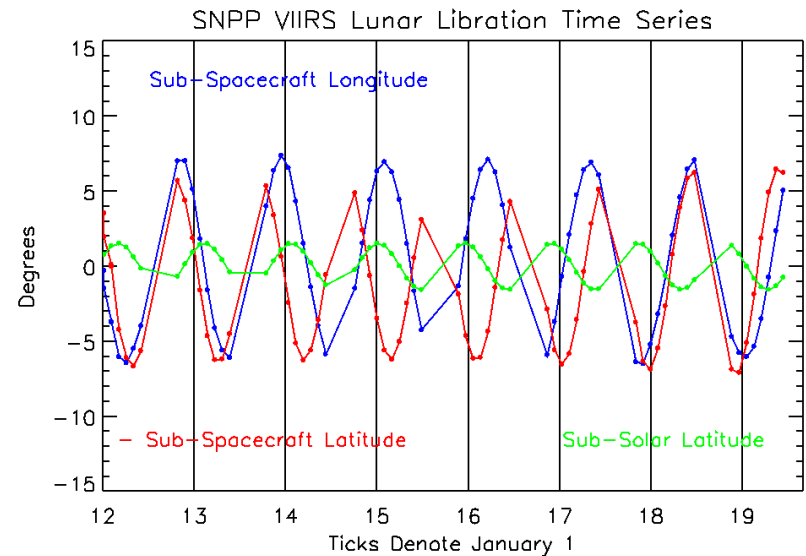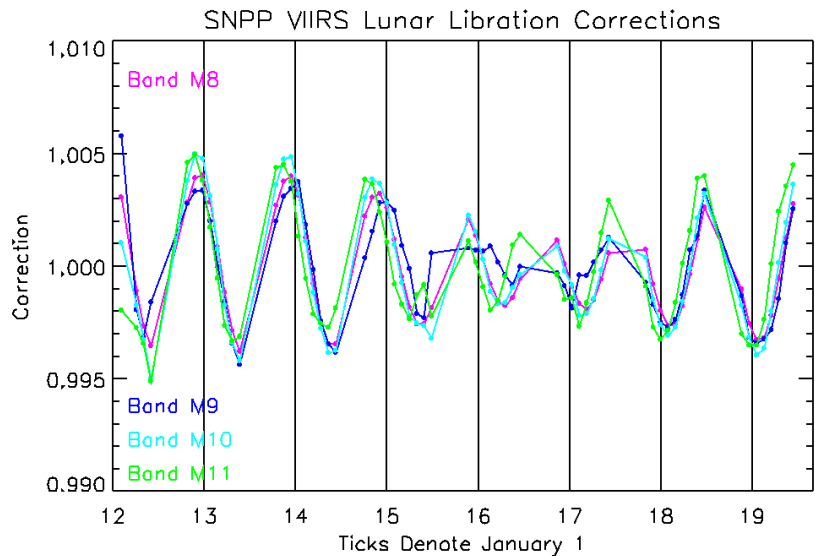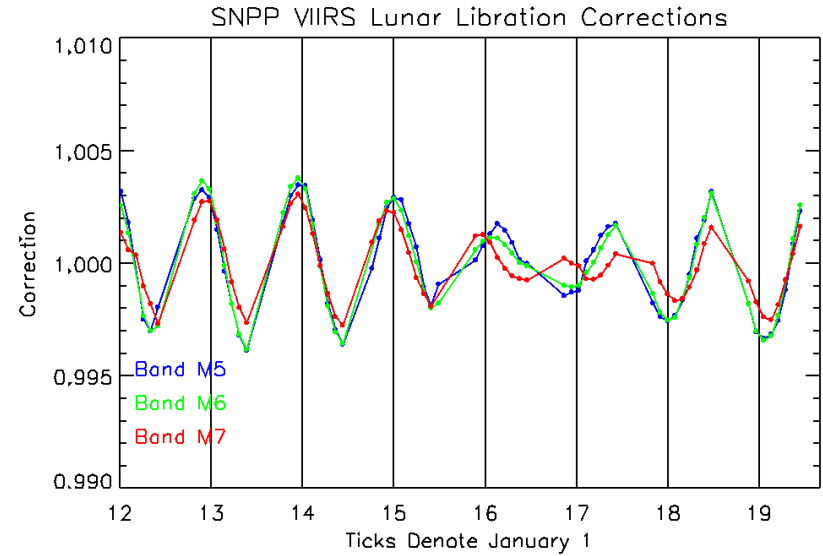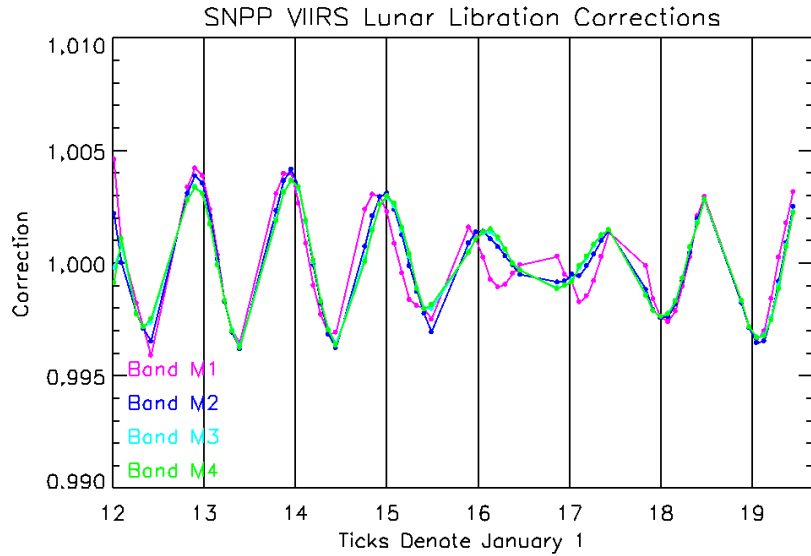
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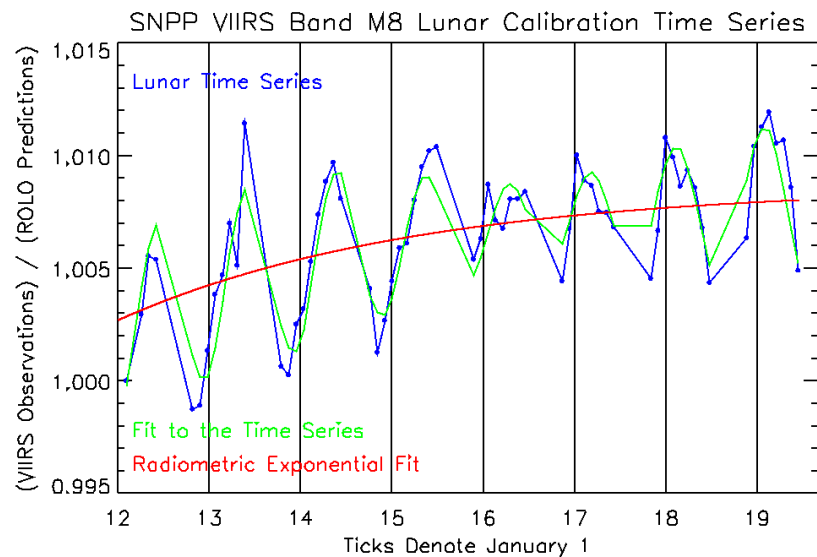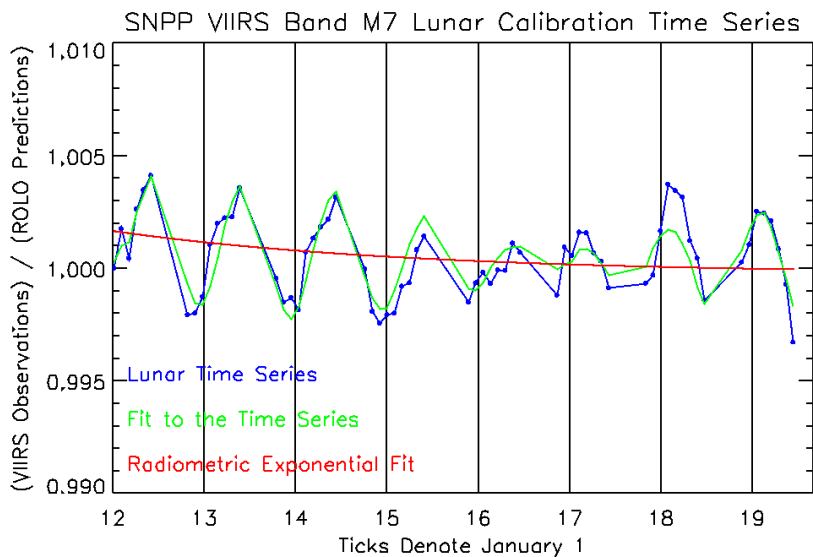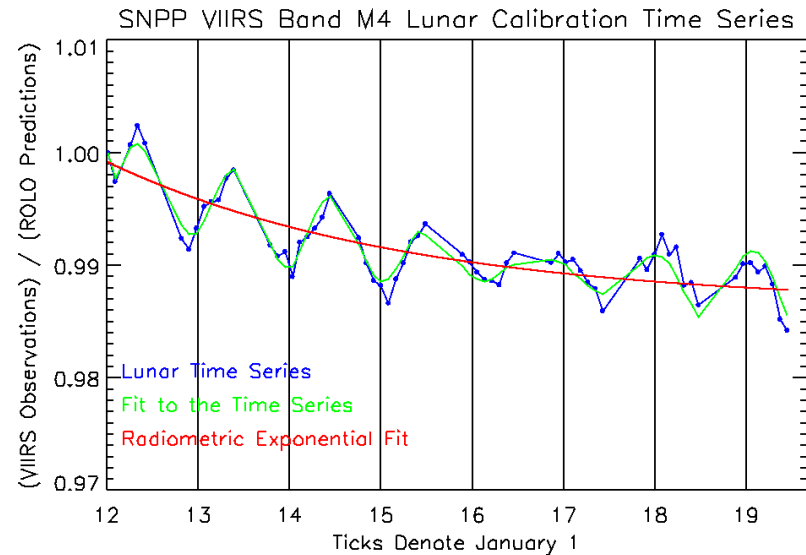
SNPP Modulated RSR
Gain Trending

Modulated RSRs
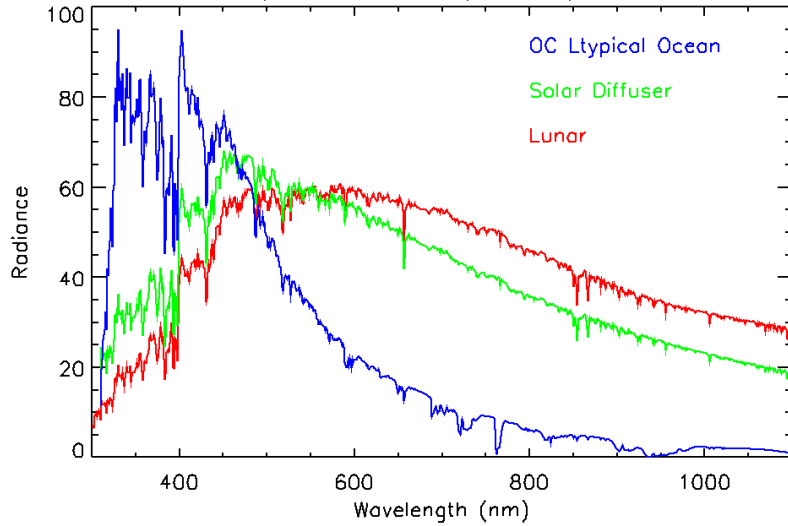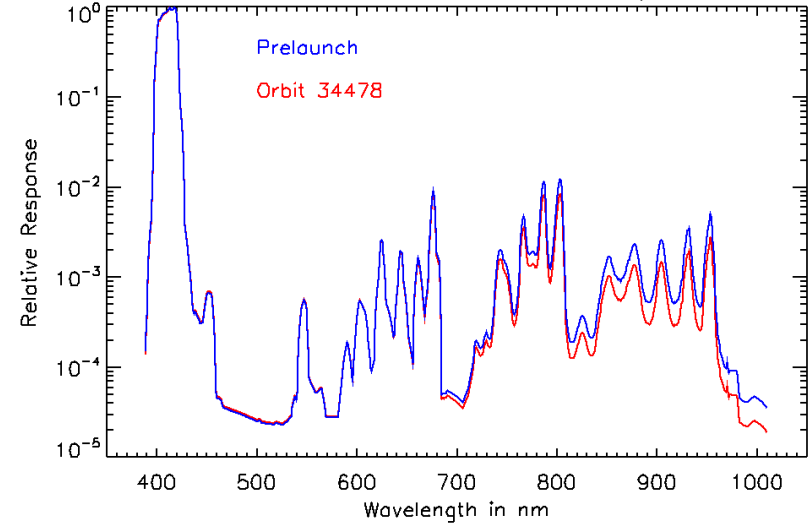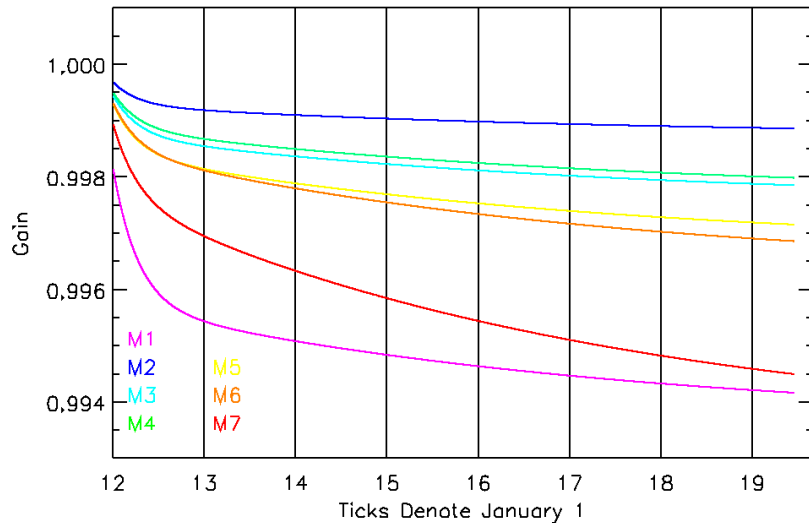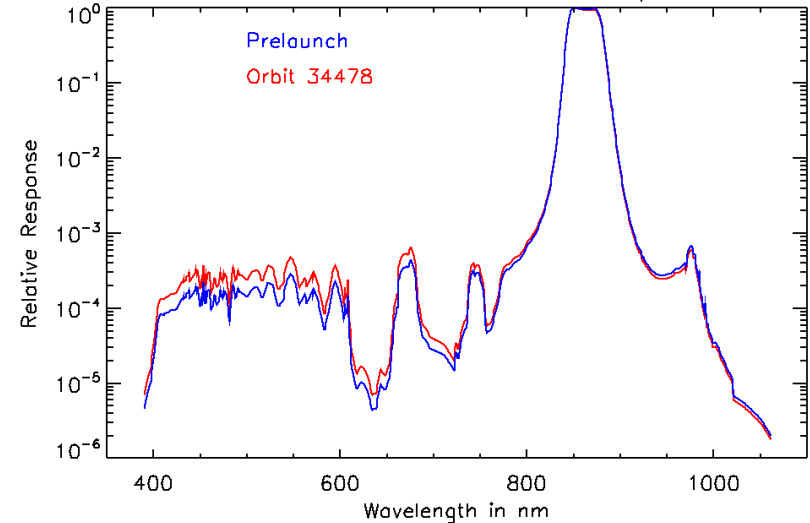
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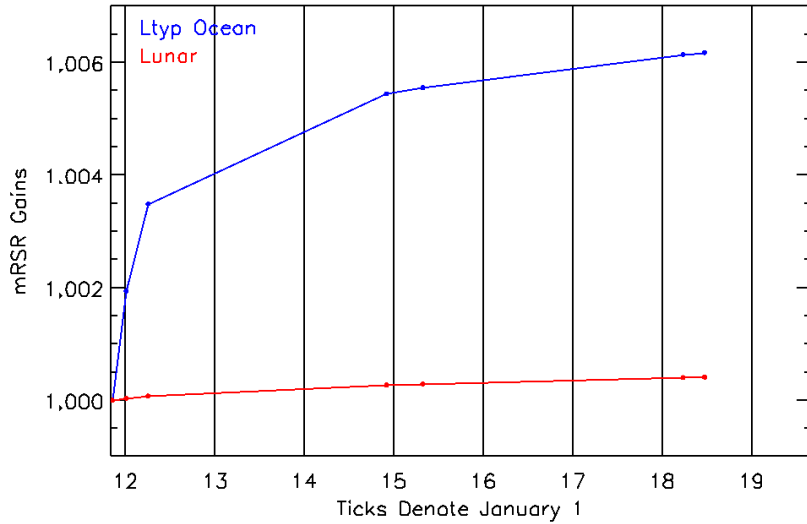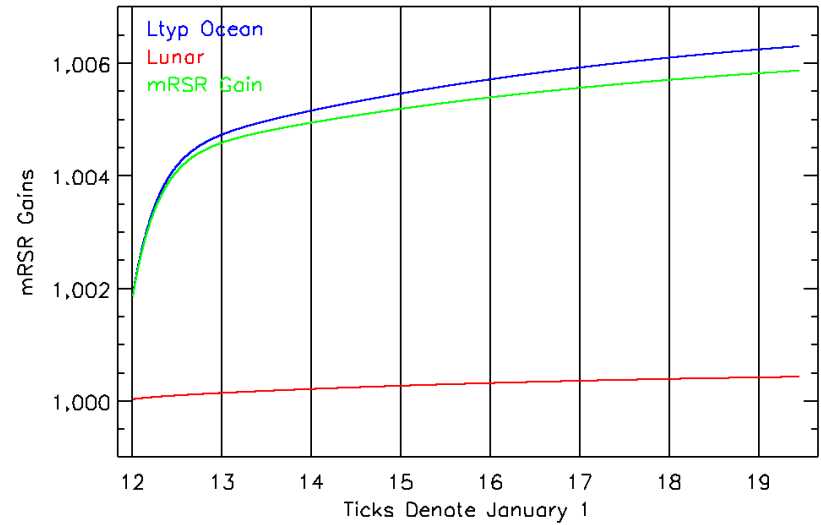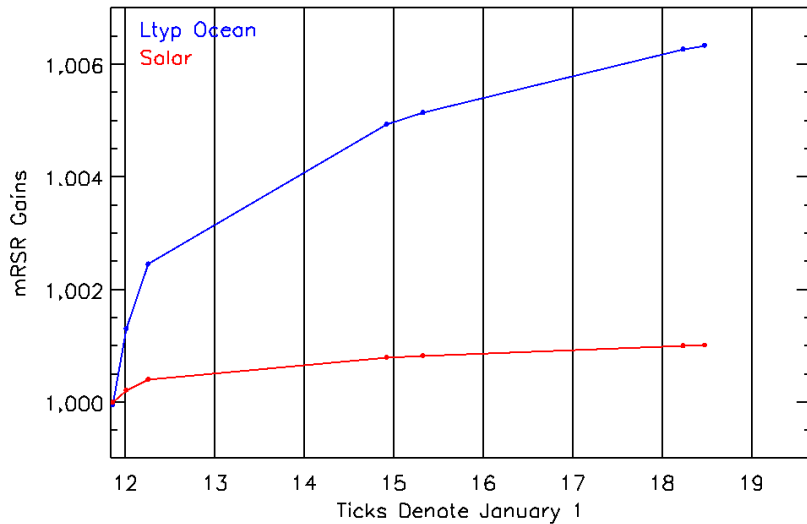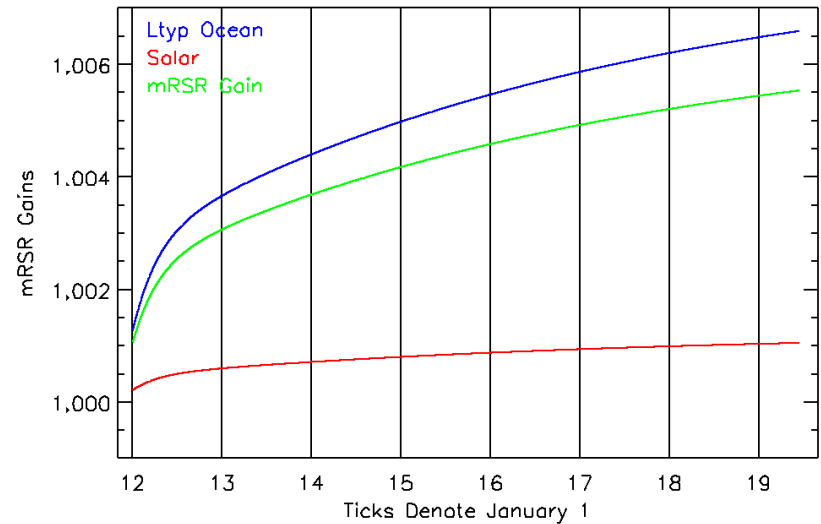
SNPP Final F-factors:
Lunar and mRSR Adjustments to Solar F-factors

SNPP Final F-Factors
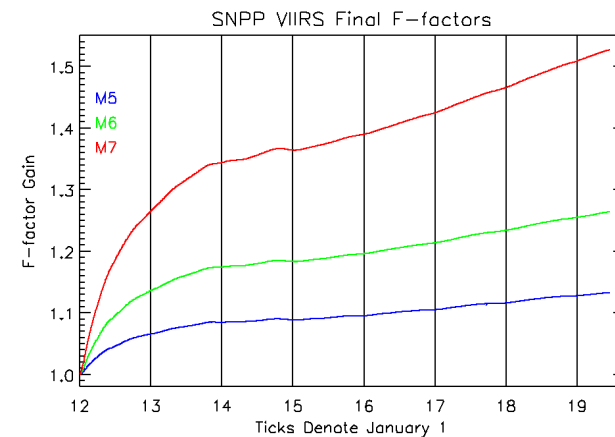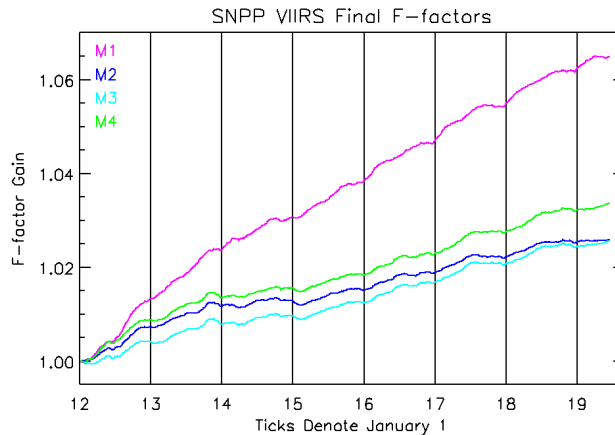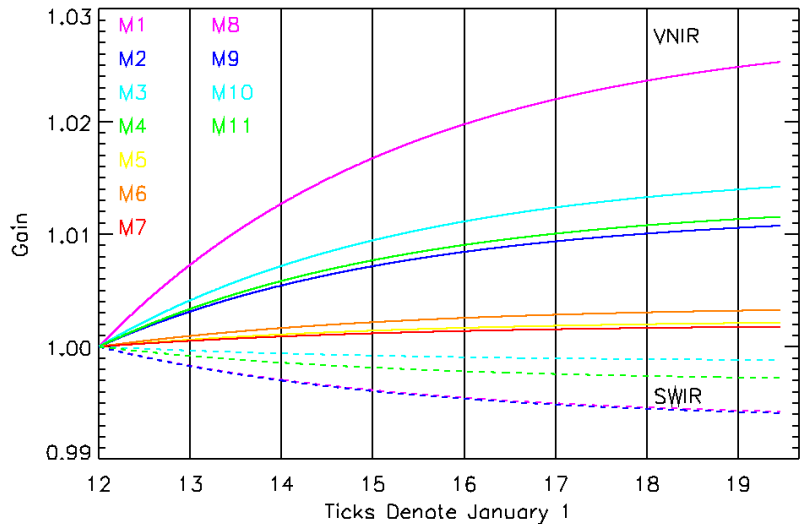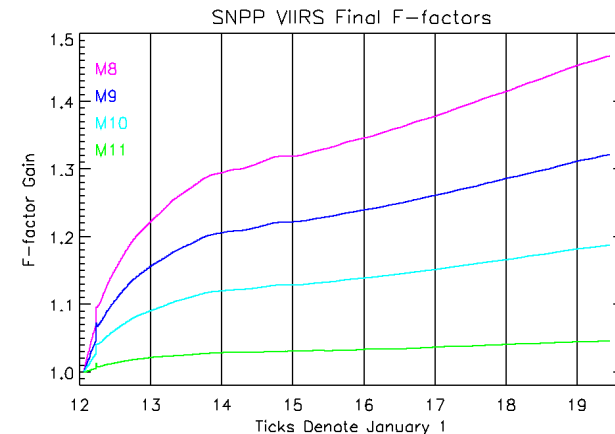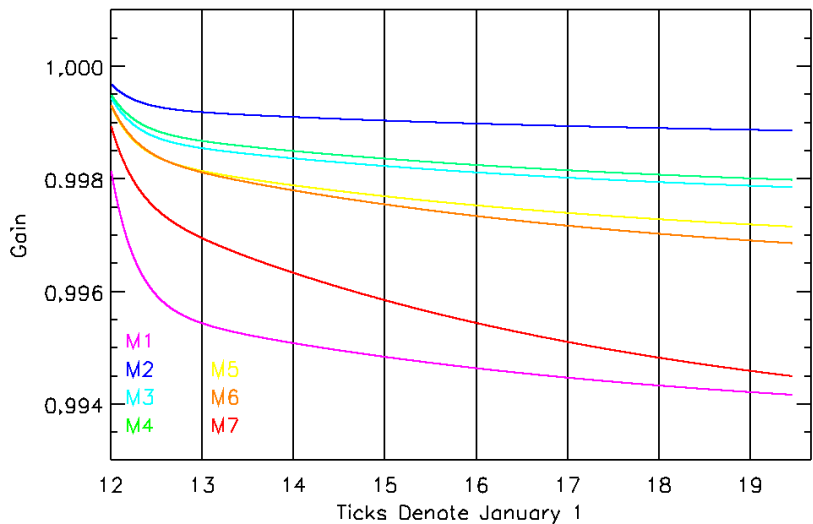
SNPP Final F-factors:
Validation through Ocean Color Anomaly Analysis

Remote Sensing Reflectance Anomalies
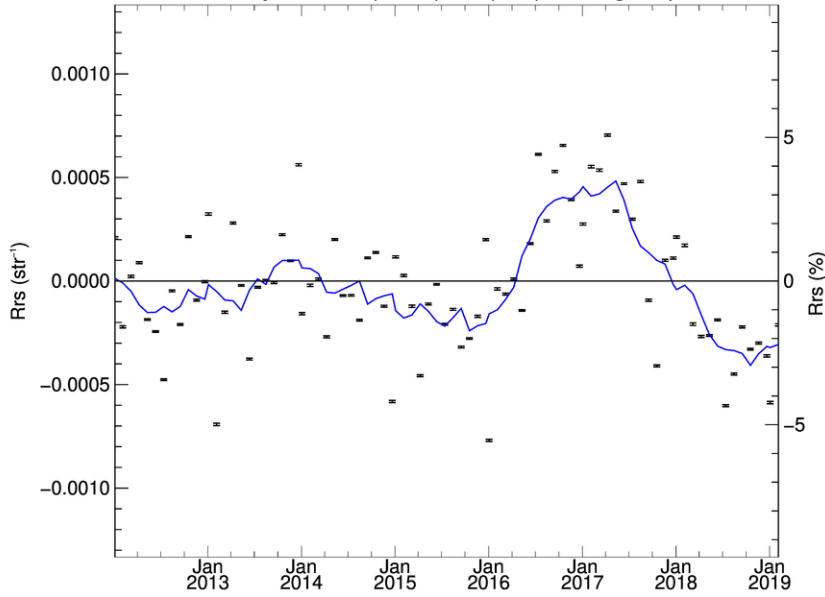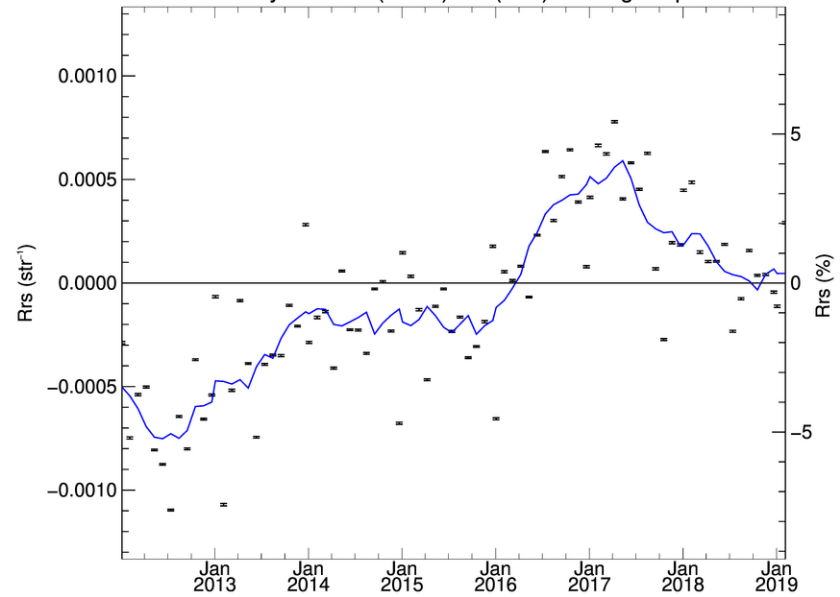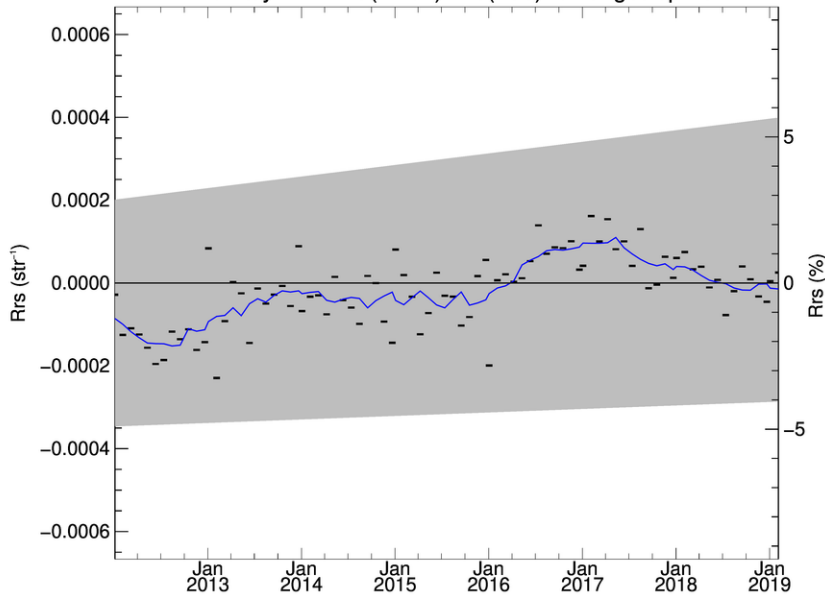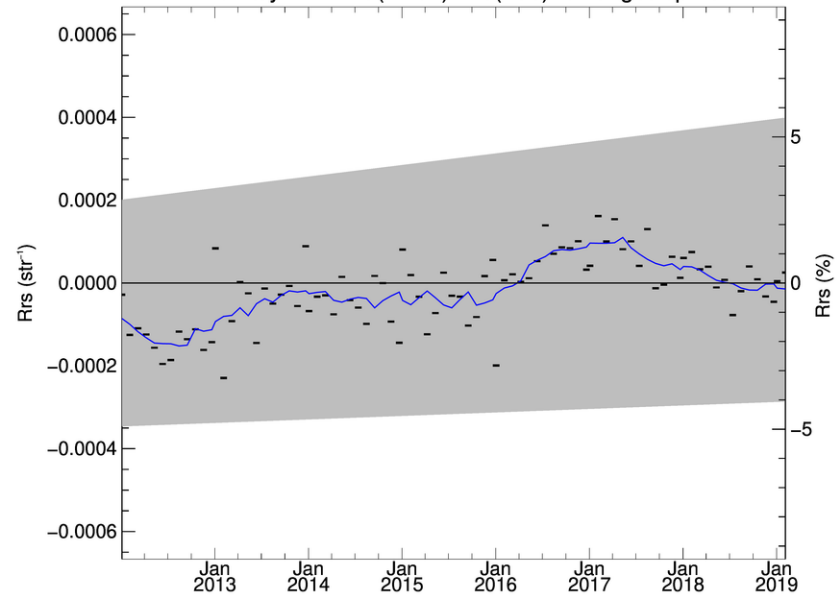
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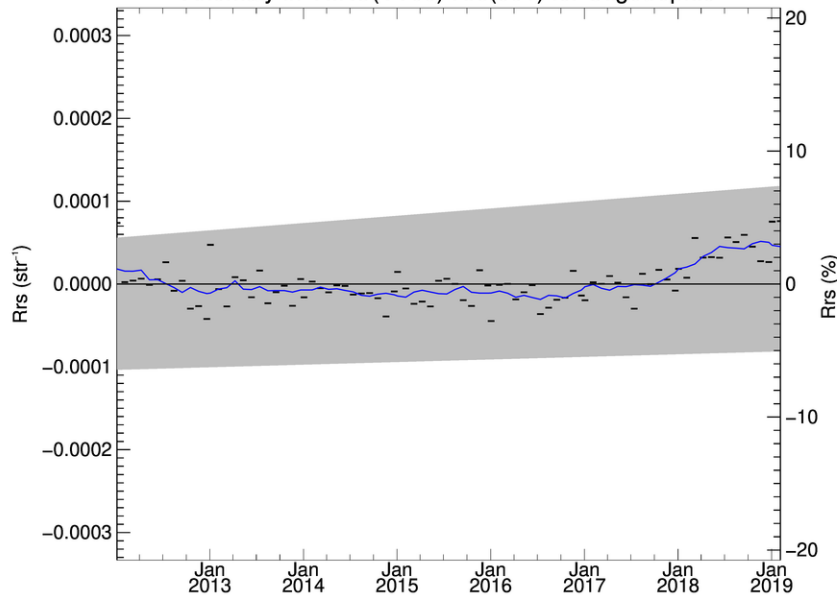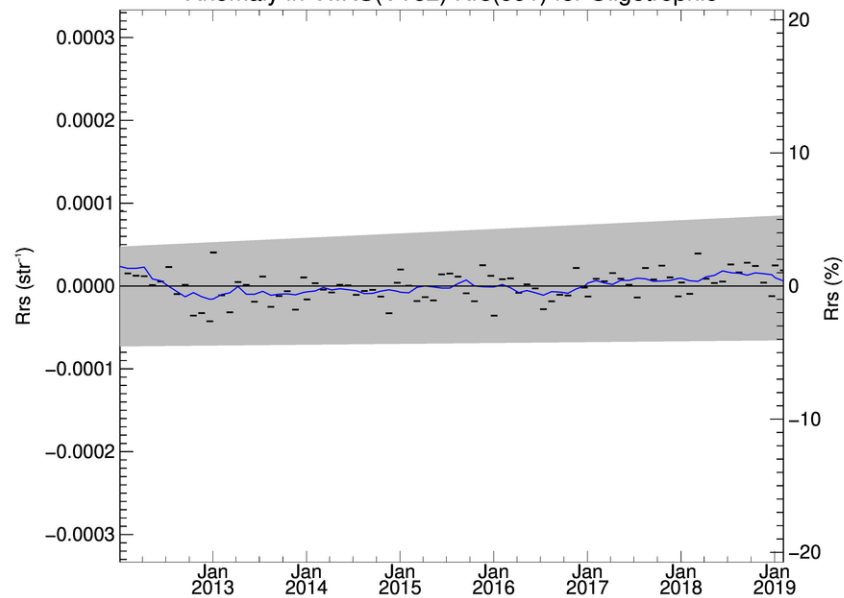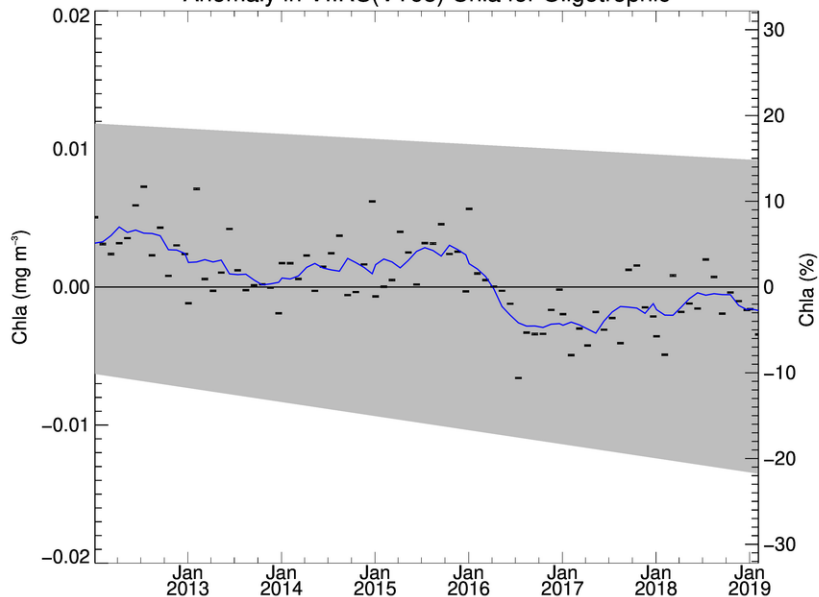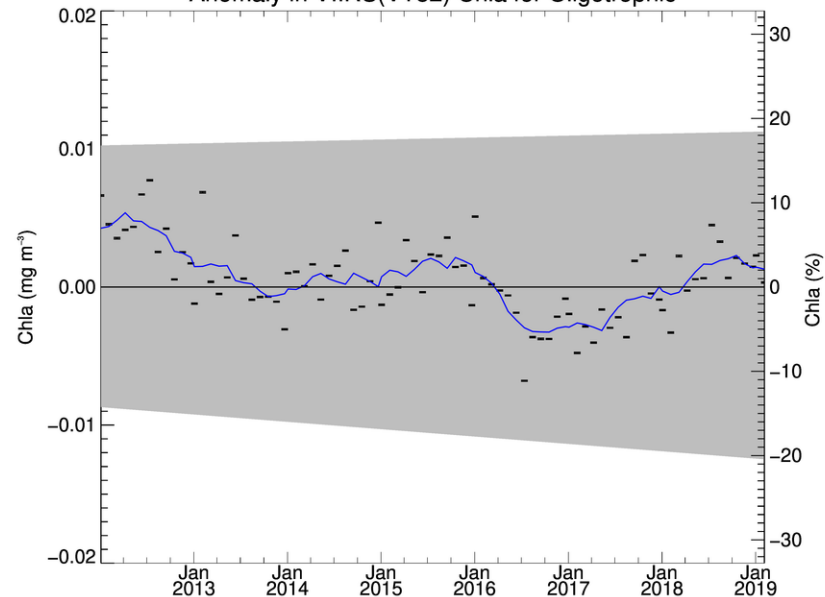
JPSS1 Solar
Response Trending

Solar F-factors
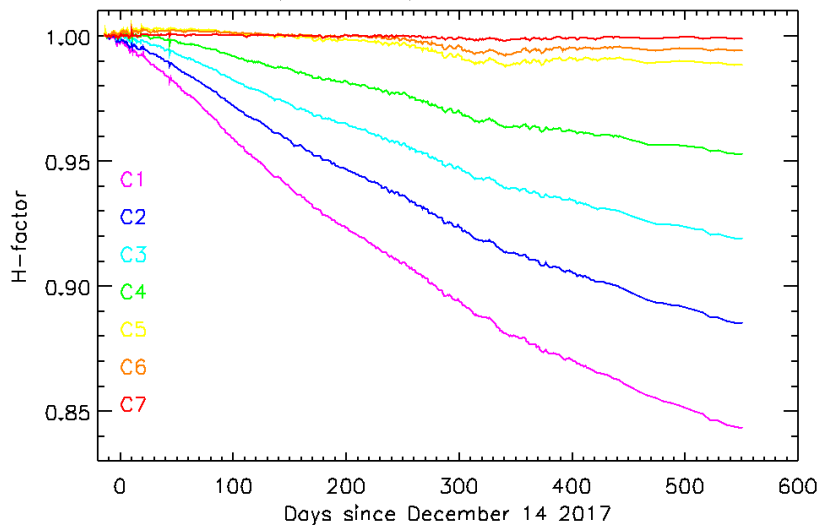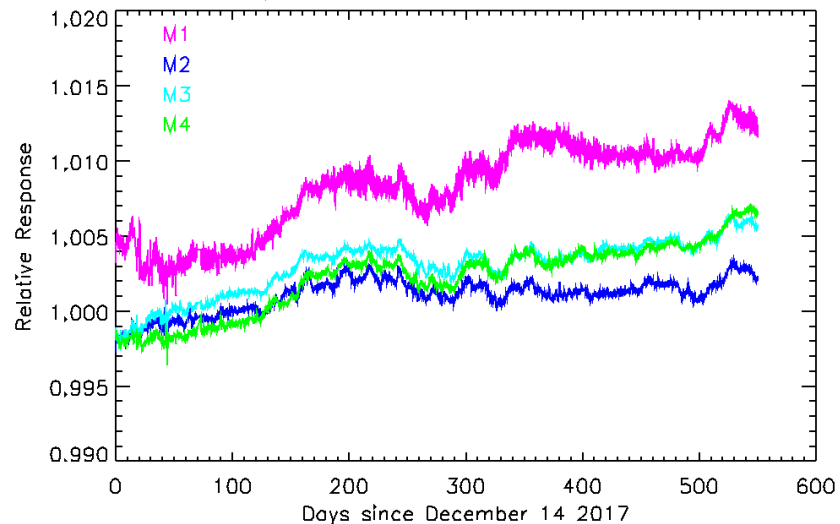
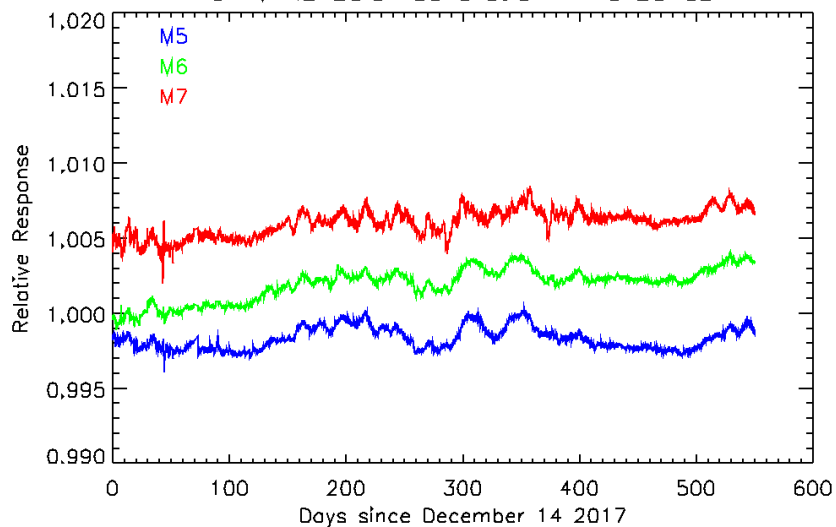# JPSS1 Lunar
Response Trending:
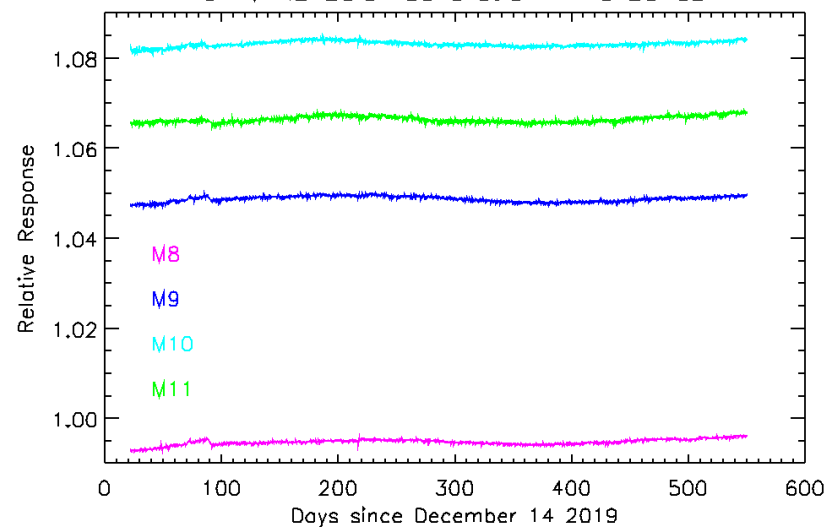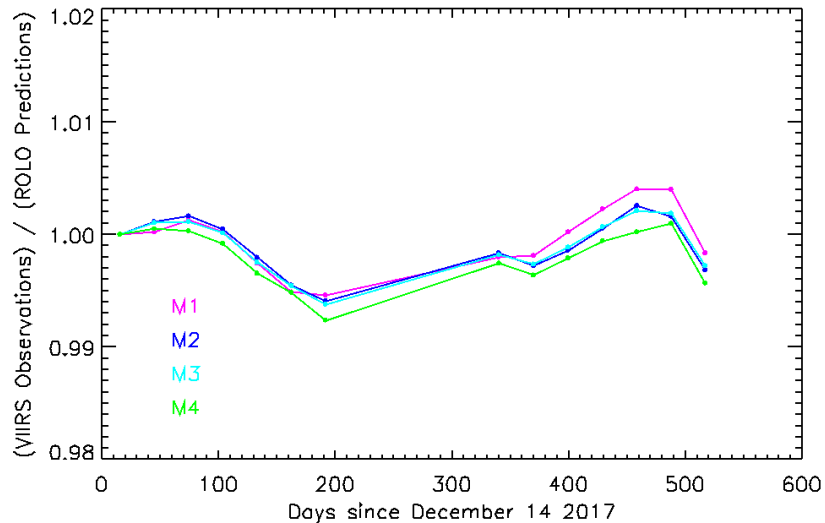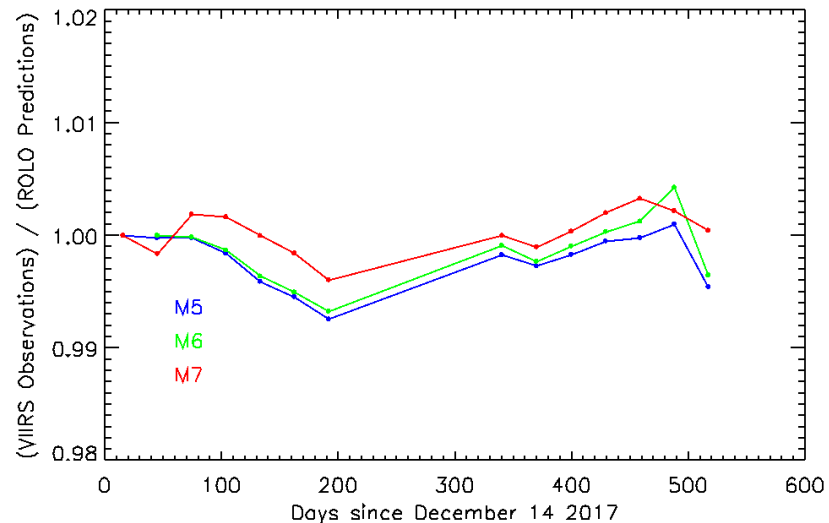# No Solar F-factors Applied
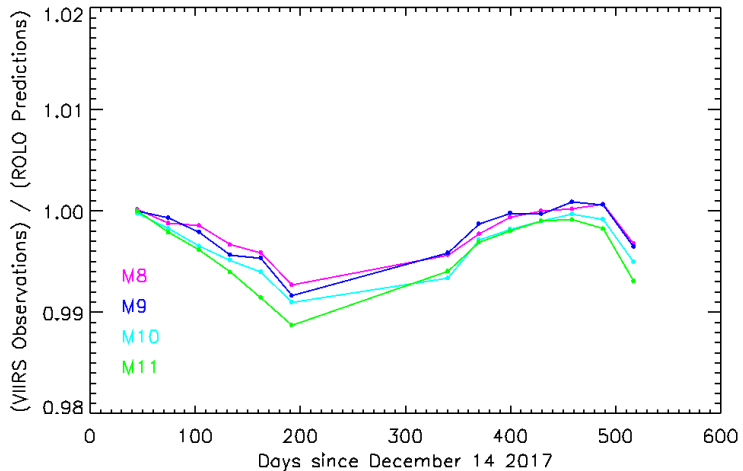
Lunar Time Series

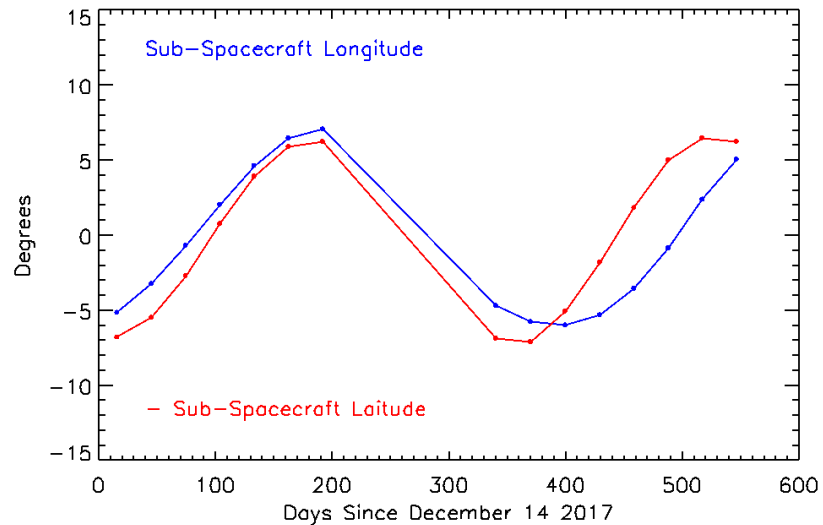

J1 VIIRS Lunar Calibration Time Series

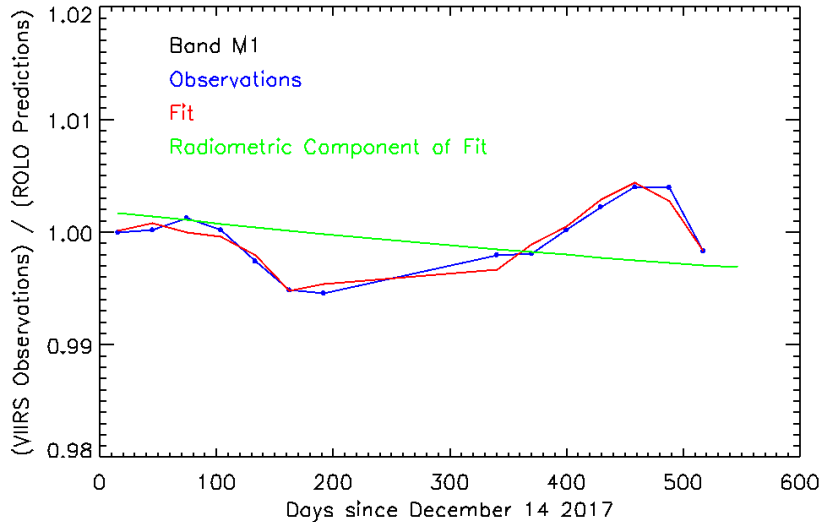J1 VIIRS Lunar Calibration Time Series

J1 VIIRS Lunar Calibration Time Series
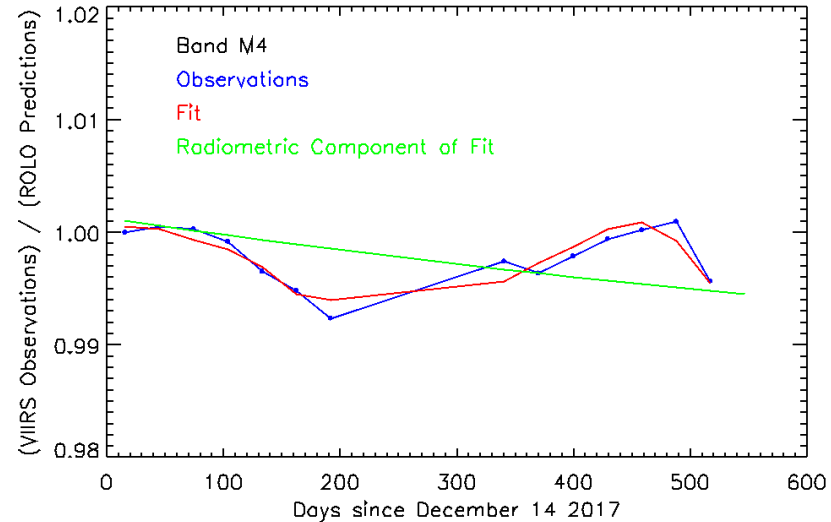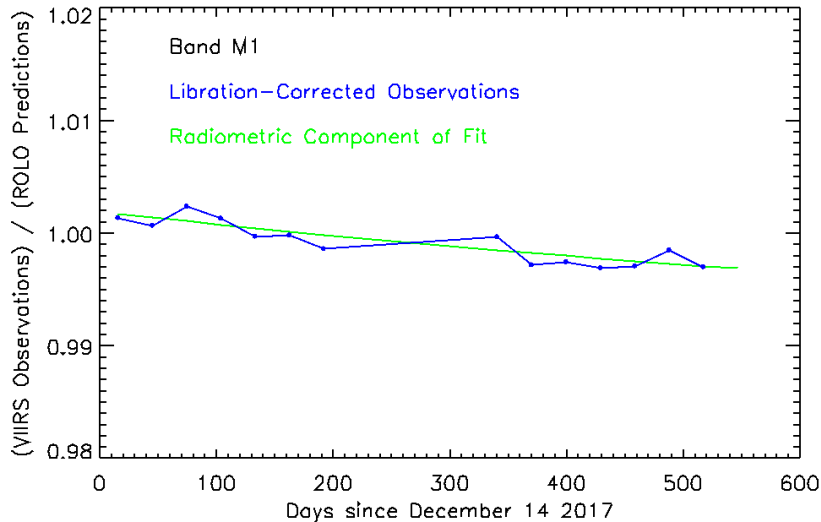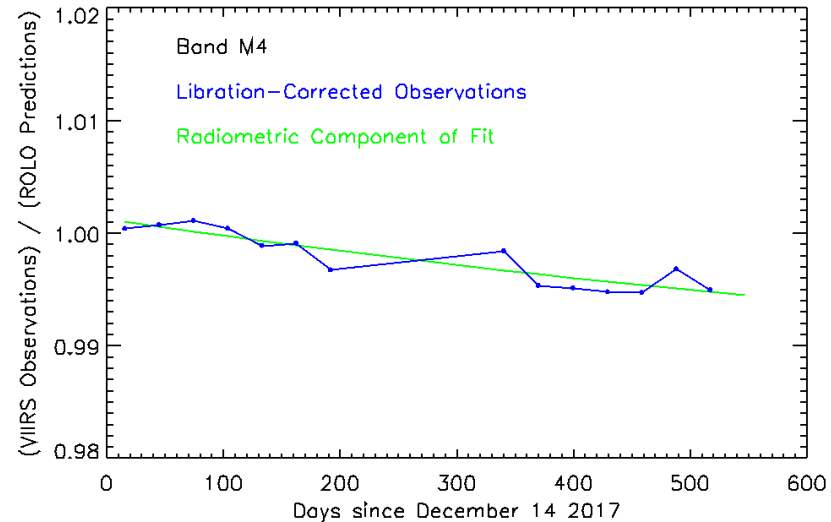
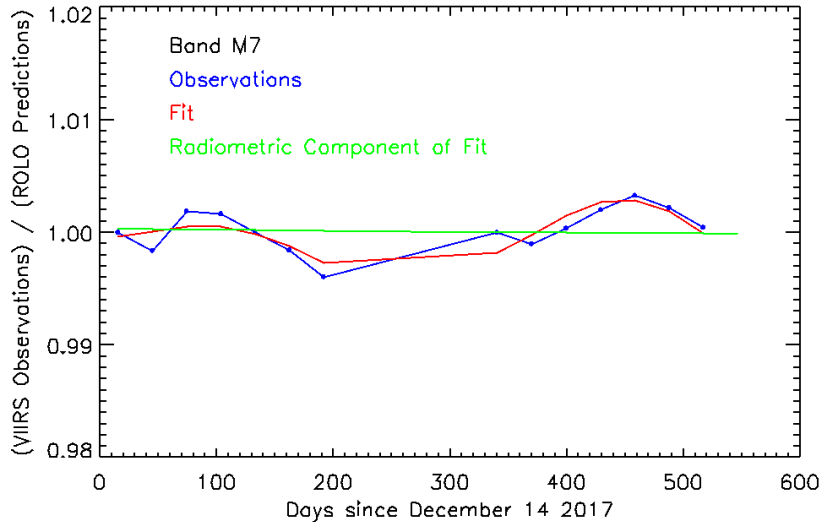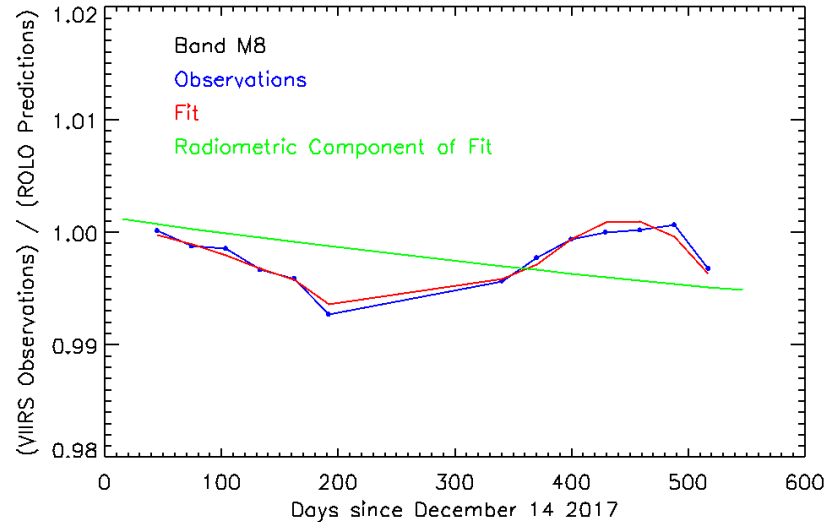JPSS1 VIIRS Lunar Libraation Time Series

Lunar Time Series Fits

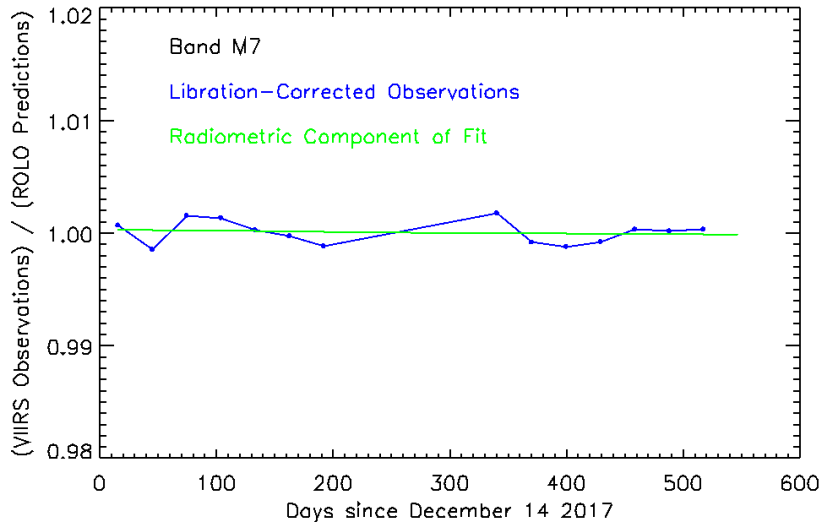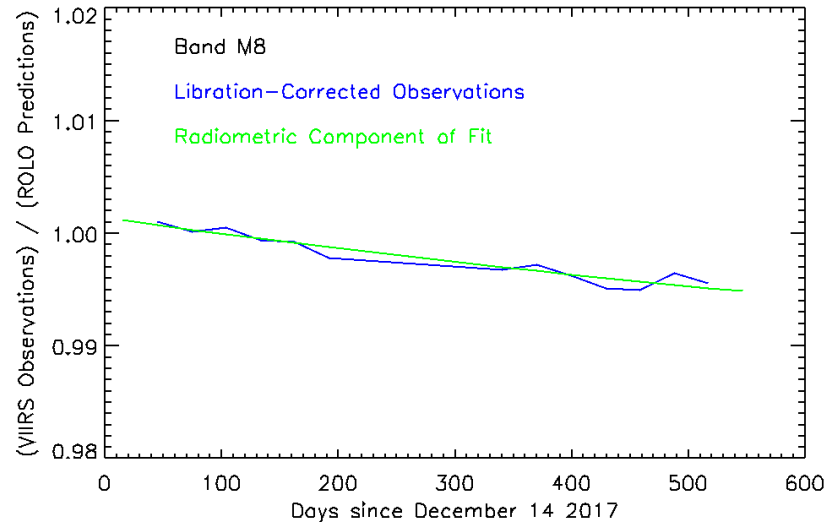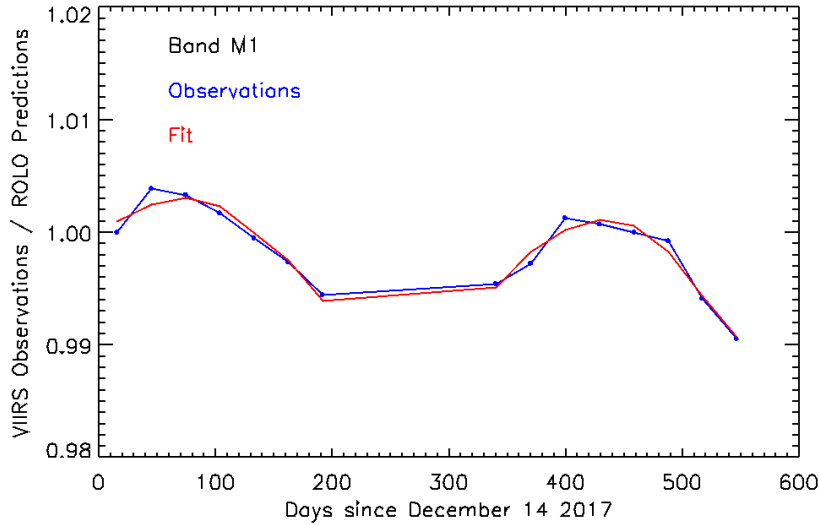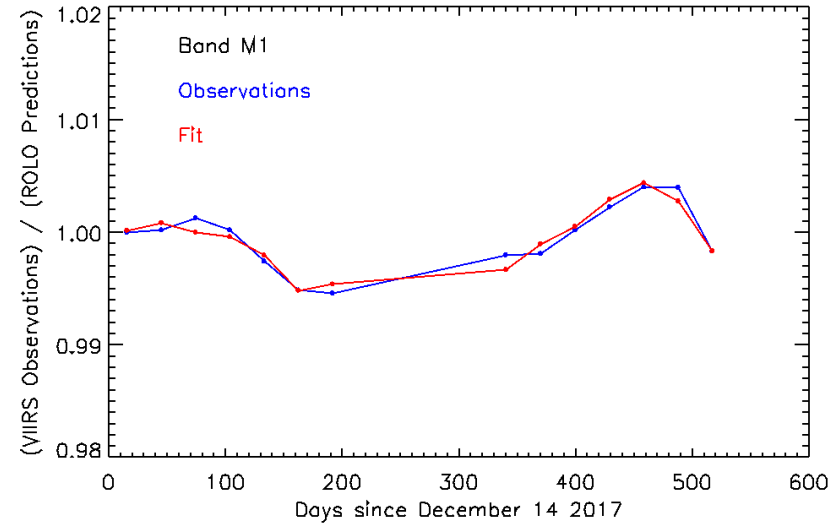# Lunar Time Series Fits

J1 VIIRS Lunar Calibration Time Series

SNPP / JPSS1
Lunar Comparisons

SNPP/JPSS1 Lunar Comparisons

SNPP/JPSS1 Lunar Comparisons

SNPP/JPSS1 Lunar Comparisons

SNPP/JPSS1 Lunar Comparisons

SNPP/JPSS1 Libration Comparisons

SNPP VIIRS Lunar Libration Corrections

JPSS1 VIIRS Lunar Libration Corrections

SNPP VIIRS Lunar Libration Corrections

JPSS1 VIIRS Lunar Libration Corrections
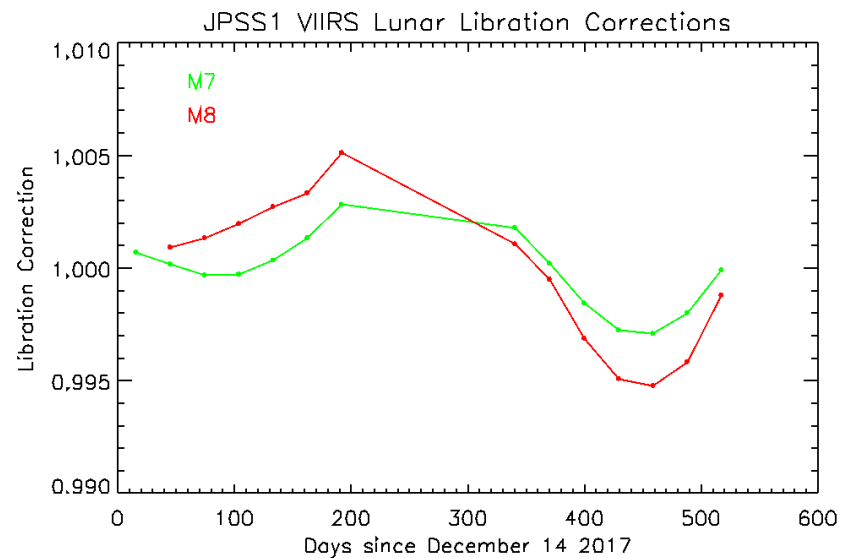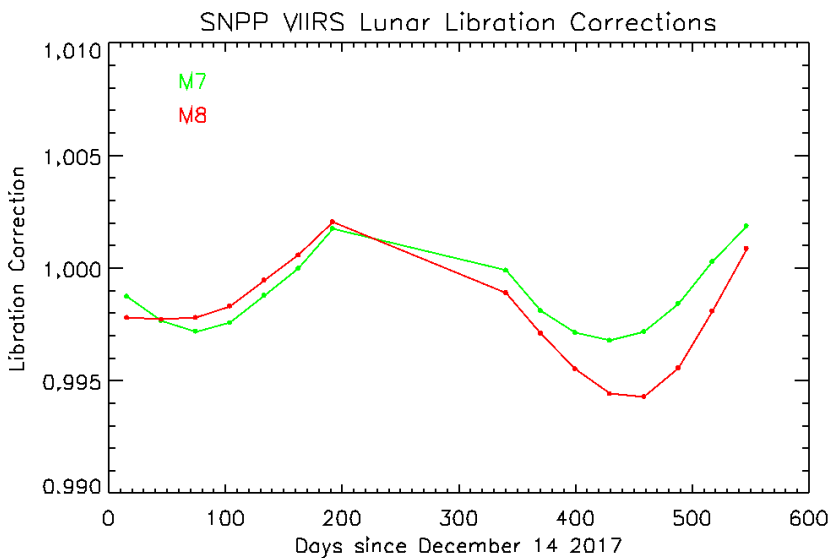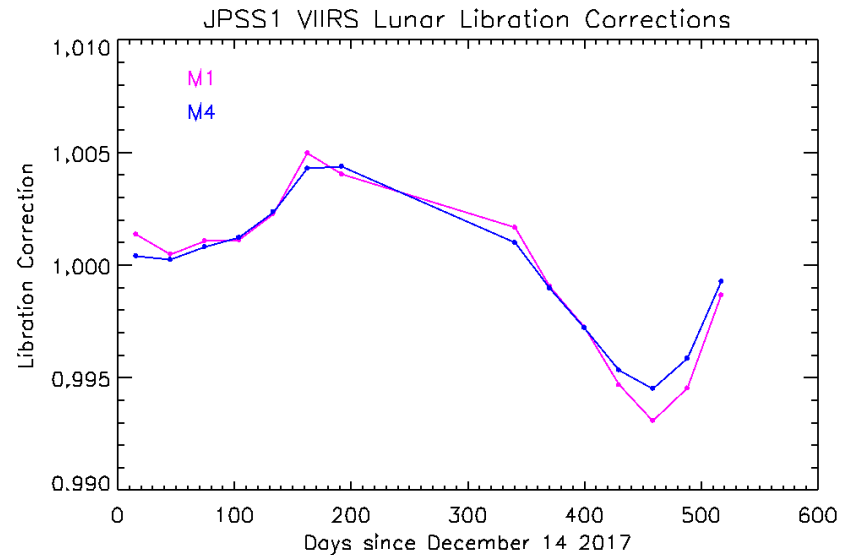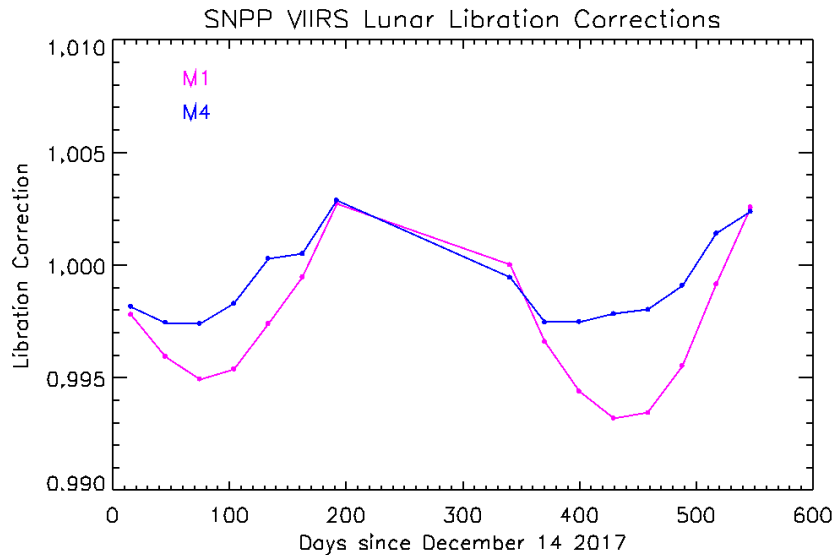
SNPP/JPSS1 Lunar Ratios
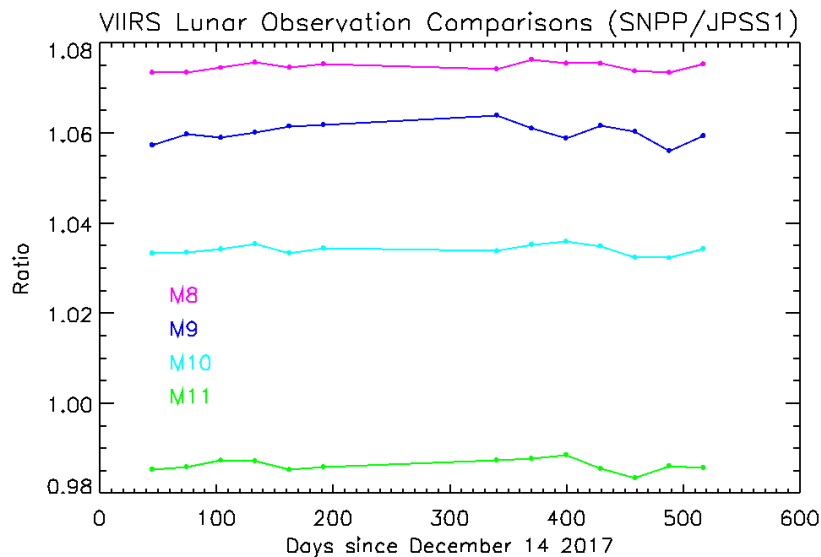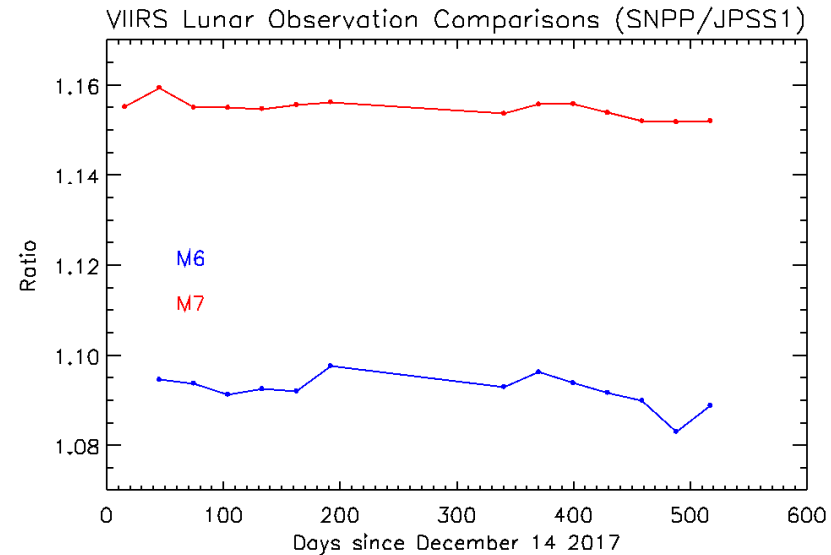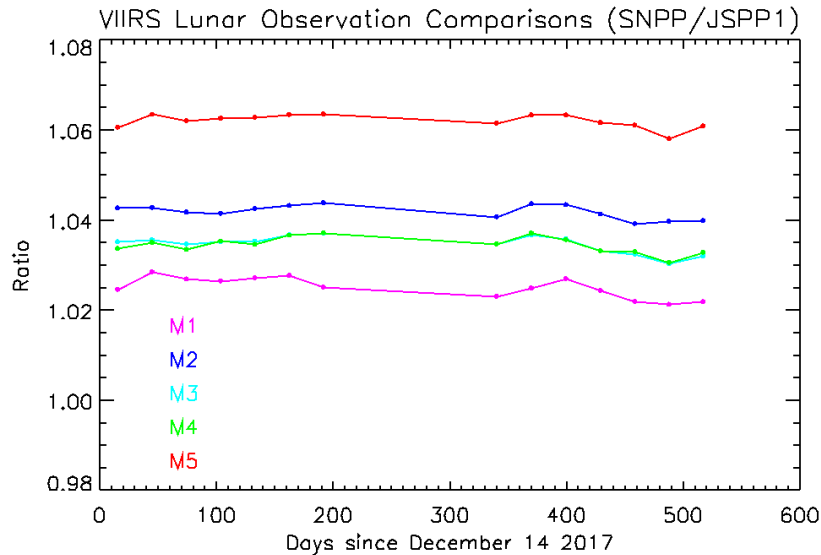
SNPP Observations w/ Time Corrections

JPSS1 Observations w/o Time Corrections

JPSS1 Lunar Observations Show
No Significant Time Drift

SNPP / JPSS1:
Ocean Color Remote Sensing Reflectance Comparisons

Remote Sensing Reflectance Comparisons

The time series are too short for an anomaly analysis.

JPSS1 R_{RS} appear more stable over time than SNPP R_{RS}.

On-Orbit Calibration Summary

- SNPP (68 lunar observations over 8 years):

  - Lunar gain adjustments to bands M1-M4, M8, M9

    - 0.6 – 2.5 % adjustments

  - mRSR gain adjustments to bands M1-M7

    - 0.1 – 0.6 % adjustments

- JPSS1 (15 lunar observations over 2 years):
  - Solar observations show possible time drifts

    - ~1% in band M1, up to 0.5% in other bands

    - Problem with screen functions
  - Lunar observations show no significant time drift

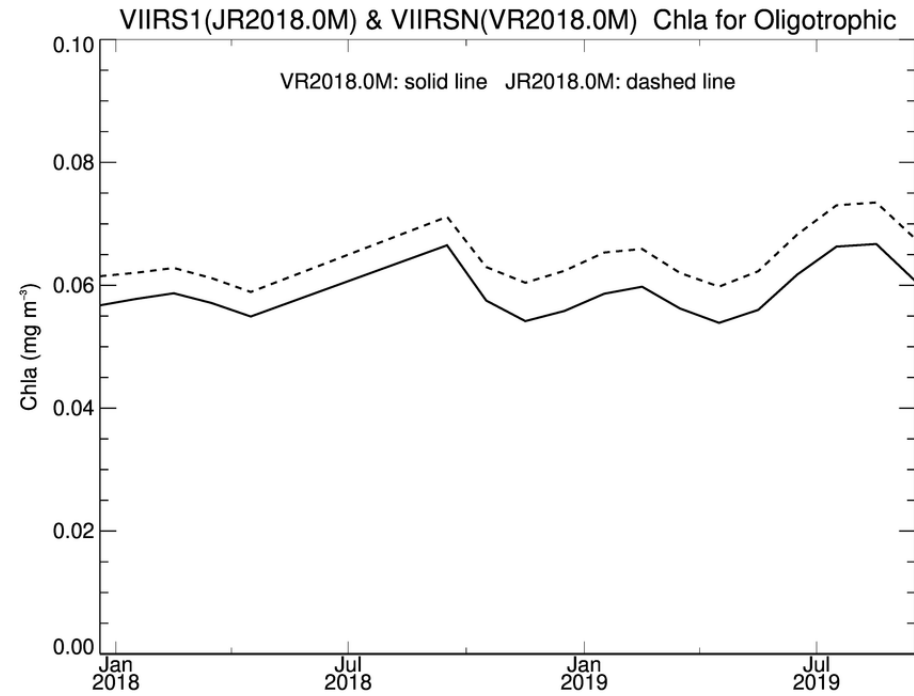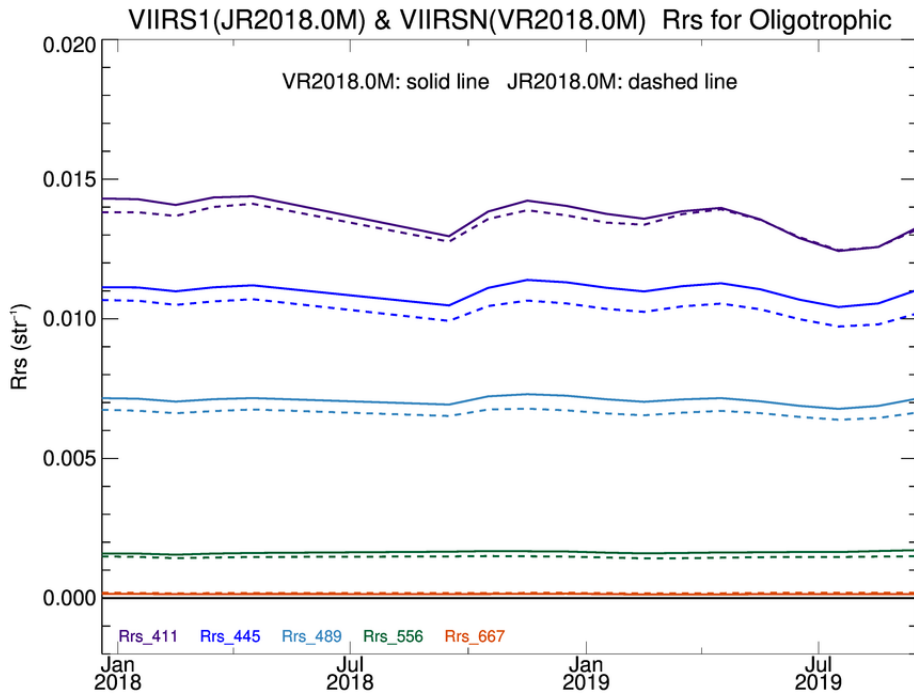   - Time drift would be comparable in size to libration effects

- SNPP / JPSS1 Lunar Observation Comparisons:

  - Libration corrections are similar

  - Observation ratios show librations cancel, show no time drift for JPSS1

- SNPP / JPSS1 Remote Sensing Reflectance Comparisons:

  - JPSS1 R_{RS} appear more stable over time than SNPP R_{RS}

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Thank You