VIIRS versus AMSR-2 SST Retrievals: The Effect of Aerosols

Richard Lindsley and Frank Wentz

Remote Sensing Systems

MODIS/VIIRS Science Team Meeting

2016-06-08

Introduction

- Sea Surface Temperature (SST) is retrieved from IR/MW T_B

- IR SST retrieval is sensitive to aerosols

- Aerosols do not affect MW SST retrieval

- AMSR-2 (microwave) SST retrievals are compared against VIIRS

- Aerosol optical thickness (AOT) from MODIS additionally used

Datasets: AMSR-2

- RSS retrieves multiple parameters from AMSR-2 T_B values
  - SST (subskin)
  - Wind speed
  - Water vapor

- https://podaac.jpl.nasa.gov/dataset/AMSR2-REMSS-L2P-v7.2

- GDS L2P files converted to L3U, gridded onto 0.2-degree grid

- 2012-07-02 to present

Datasets: VIIRS

- NOAA ACSPO product
- https://podaac.jpl.nasa.gov/dataset/VIIRS_NPP-OSPO-L3U-v2.4
- SST (skin), cloud-masked, best quality
- GDS L3U files regridded to 0.2-degree grid
- 2015-05-19 to present

Datasets: MODIS
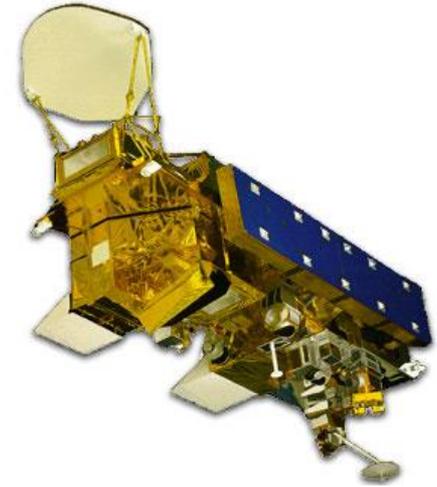
- MODIS on Aqua (2002 – present) and Terra (1999 – present)
- http://modis-atmos.gsfc.nasa.gov/MOD08_D3/index.html
- Aerosol optical thickness (AOT) at 0.55 µm
- Level 3 daily gridded product, 1-degree grid
- HDF-EOS2 files converted to netCDF

Analysis

- Collocate VIIRS, AMSR-2, MODIS data
  - VIIRS and AMSR-2:
    - Host platforms have similar orbits (1:30pm local time of ascending node)
    - 6-hour time offset (most matchups are within 100 min)
  - Only data indicated at highest quality used (`quality_level == 5`)
  - AOT retrieved from both MODIS, averaged across a few neighboring days
  - 2015-05-19 to 2016-04-14
- Any possible diurnal warming is excluded
  - Reject all collocations during the day (near 1:30 pm local solar time) with AMSR-2 wind speeds < 6 m/s

Results: VIIRS – AMSR-2 SST (all)
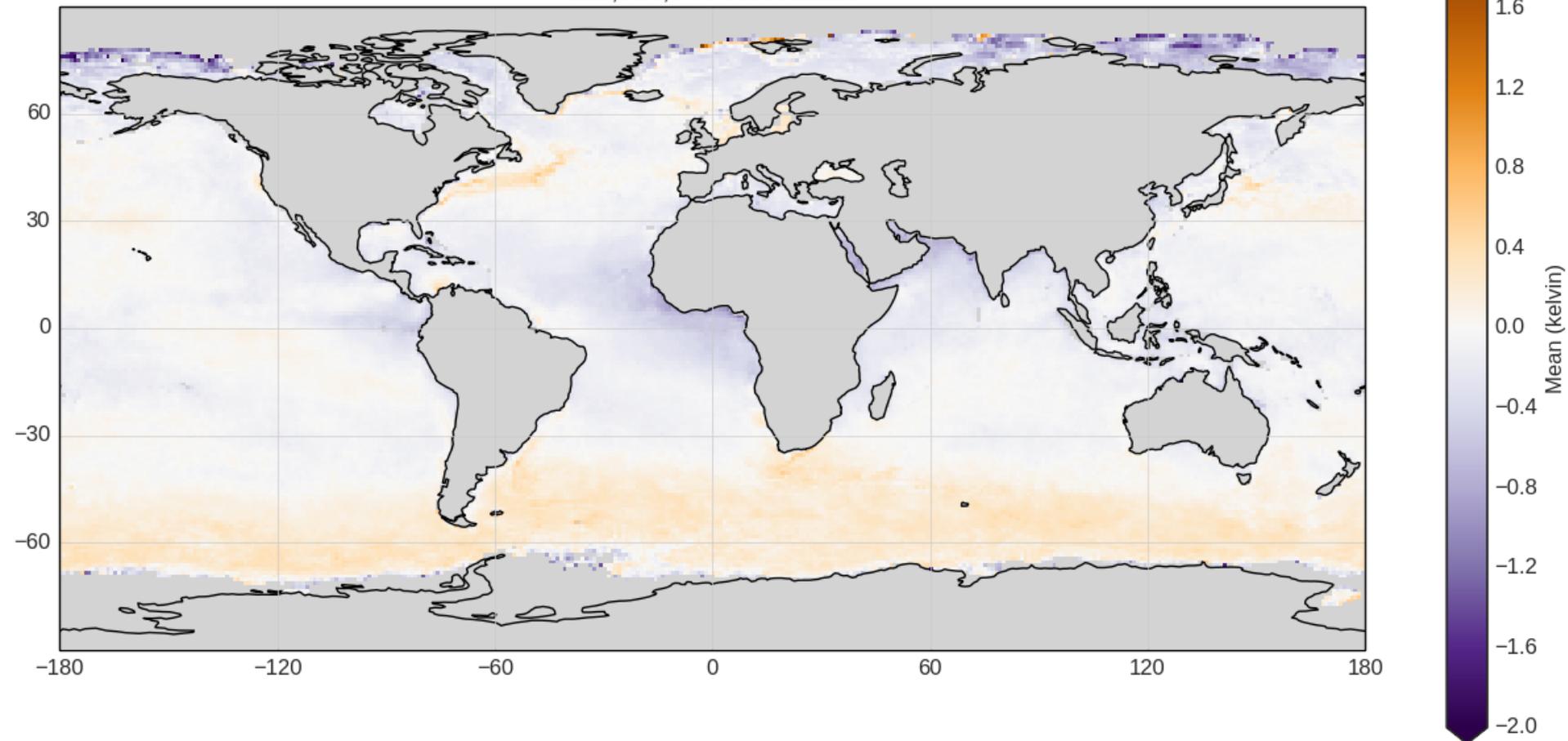
151,784,044 collocations

Results: VIIRS – AMSR-2 SST (all)

151,784,044 collocations
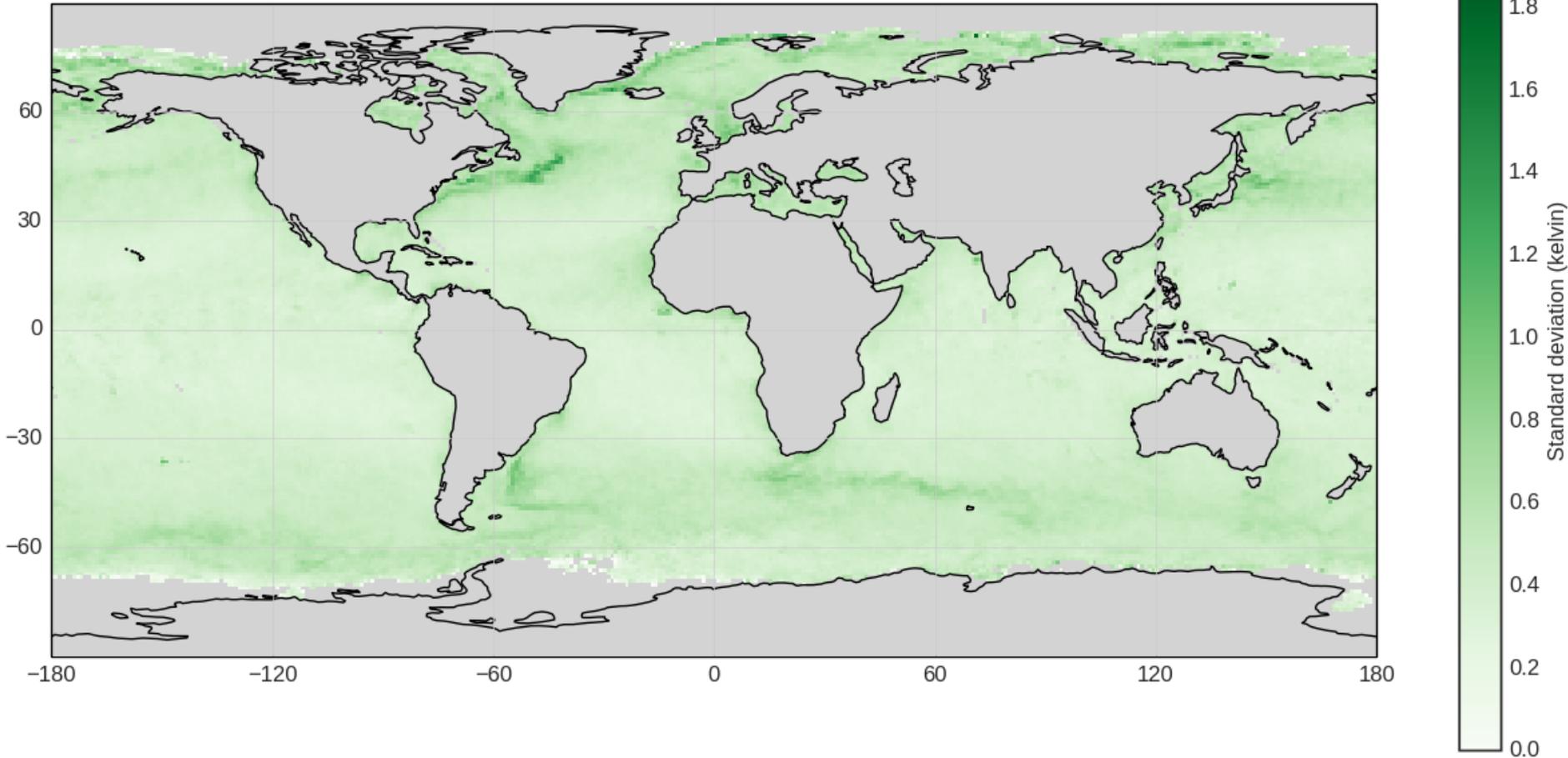
Results: VIIRS – AMSR-2 SST (Jan 2016; day)

5,667,354 collocations
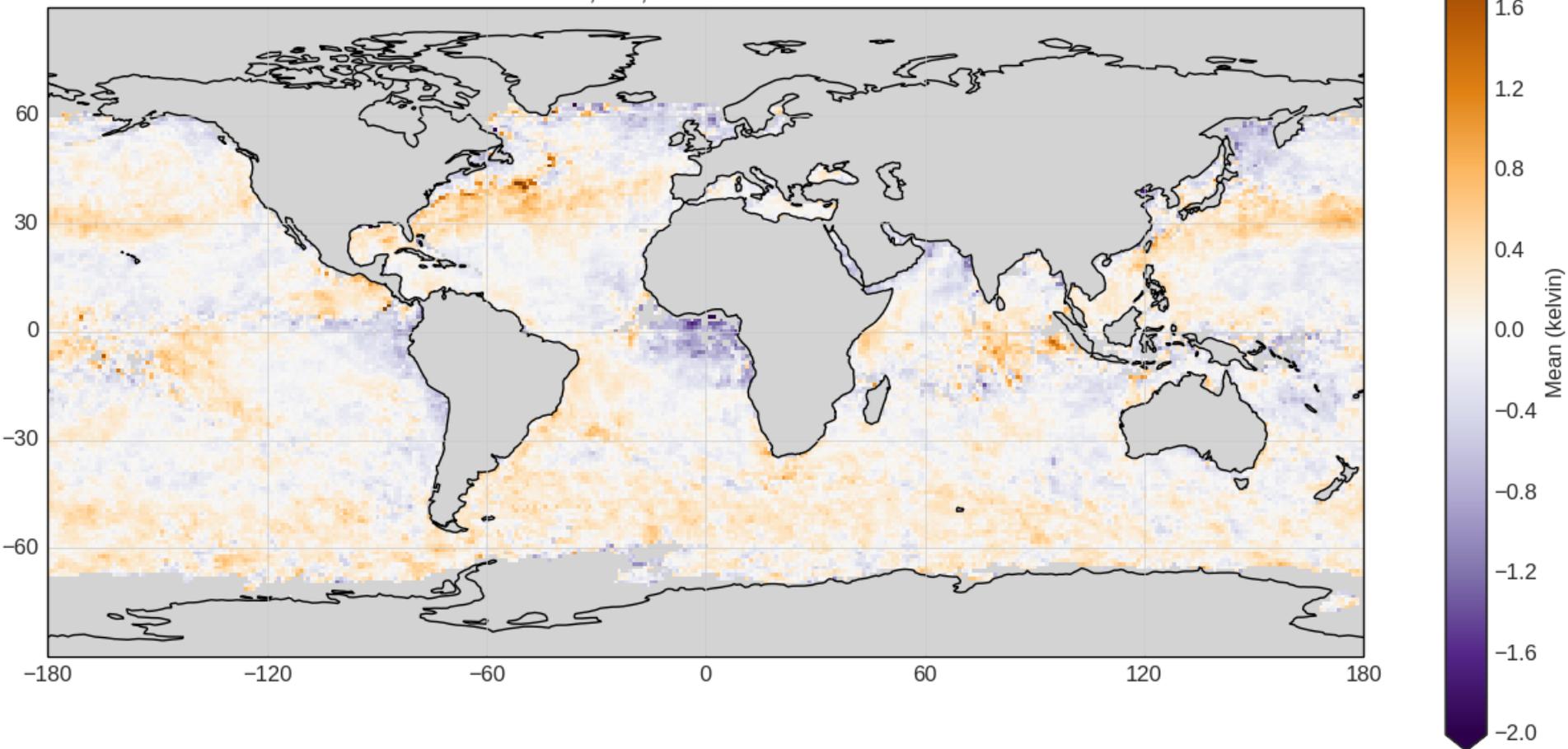
Results: VIIRS – AMSR-2 SST (Jan 2016; night)


8,988,588 collocations
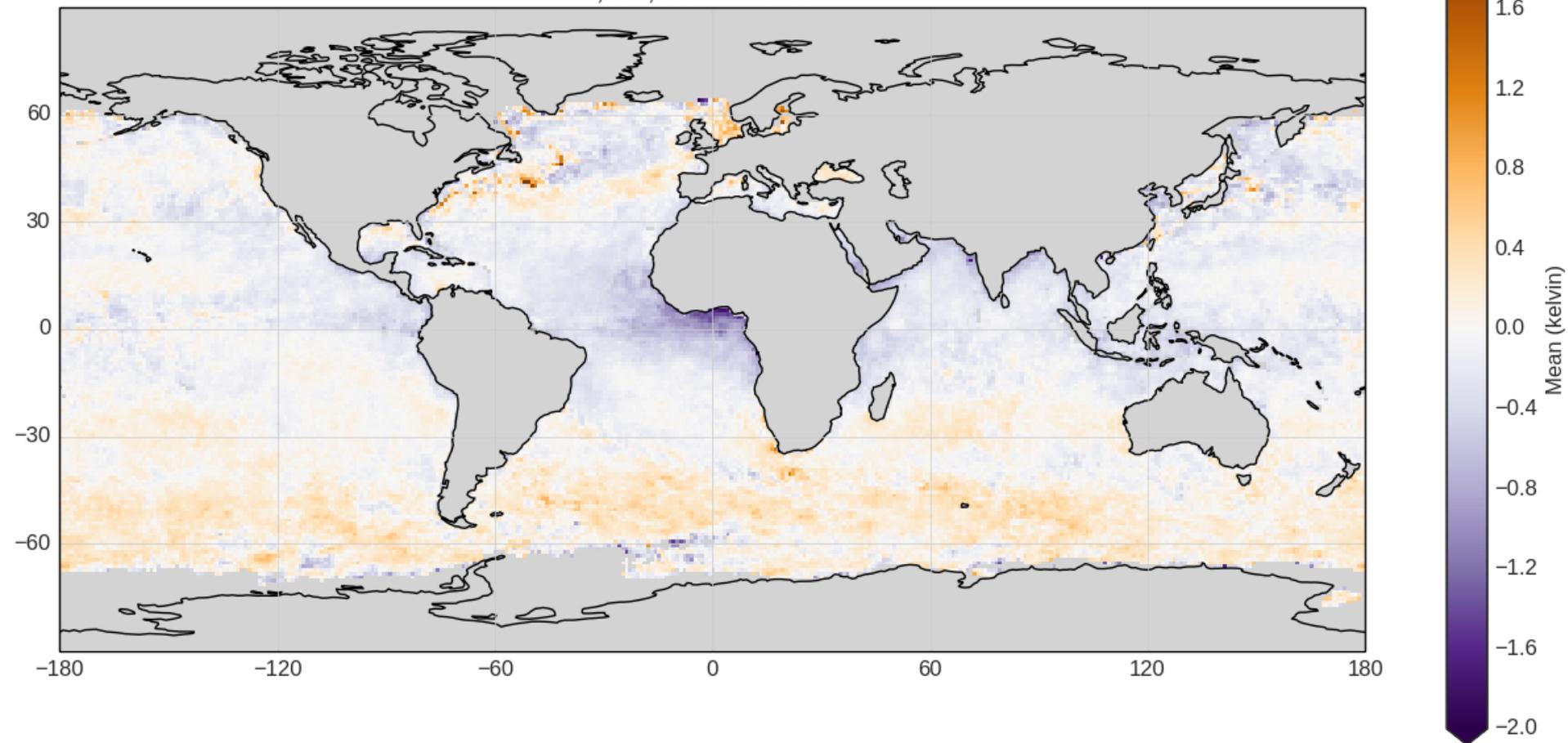
Results: SST residual and AOT

(one week each)
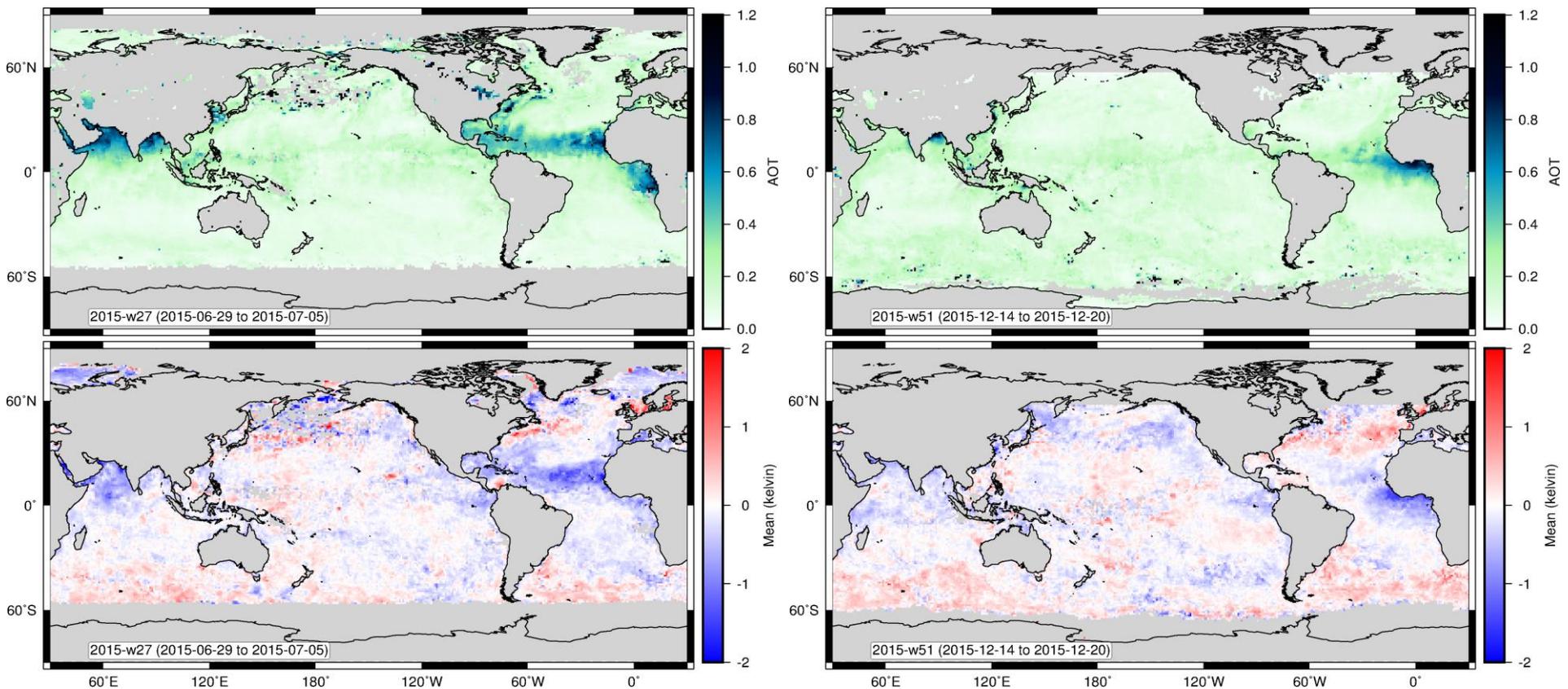
Results: SST residual versus AOT

(Dec 2015; mid-Atlantic)
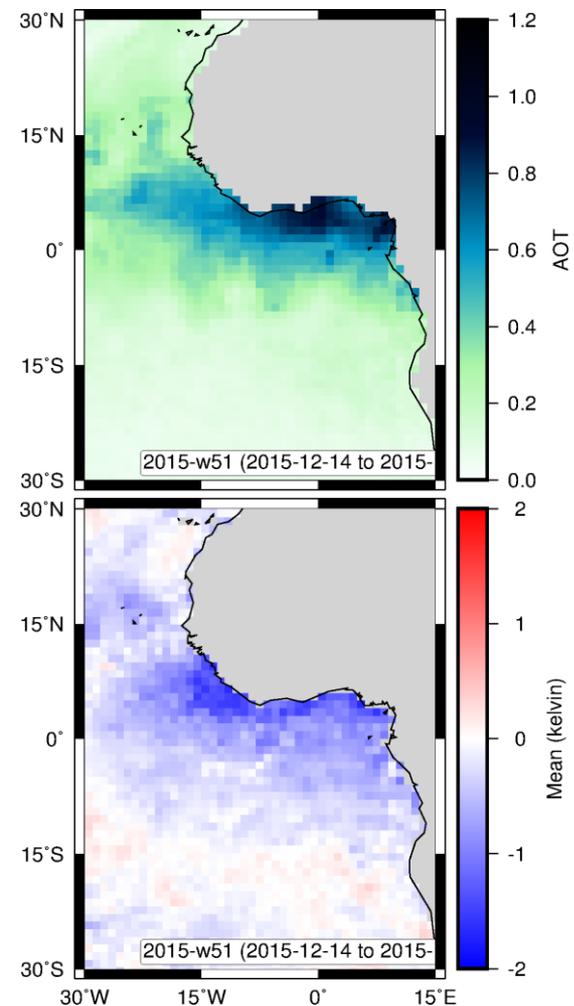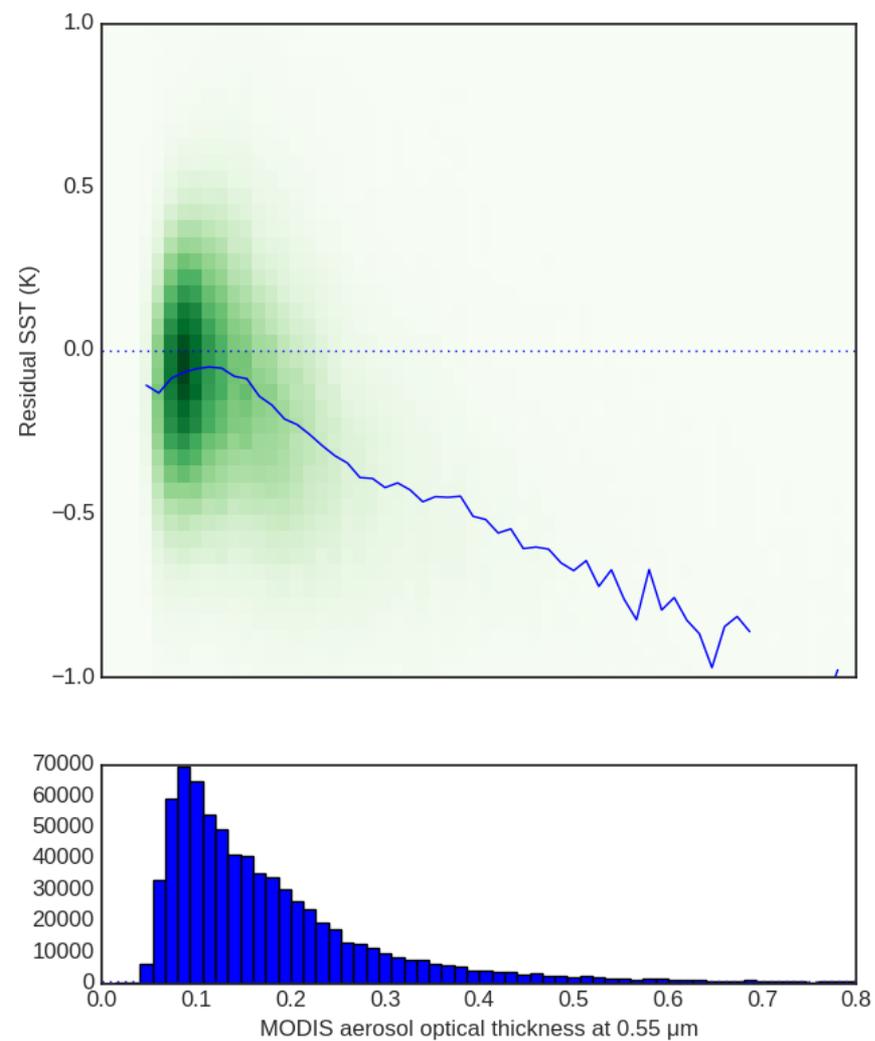
Conclusion

- Aerosol optical thickness at 0.55 μm (retrieved by MODIS) correlates with many of the SST differences between AMSR-2 and VIIRS

- However, aerosols alone do not account for all SST differences

- VIIRS SST retrieval is affected by the presence of aerosols

- Future work: eliminate or correct VIIRS SST retrievals with aerosol contamination

Appendix

Datasets: CMC

- Canadian Meteorological Centre combines SST from multiple sources
  - VIIRS
  - In situ (buoys)
  - AMSR-2
  - AVHRR
- https://podaac.jpl.nasa.gov/dataset/CMC0.2deg-CMC-L4-GLOB-v2.0
- Daily GDS L4 files on 0.2-degree grid
- 1991-09-01 to present

Results: VIIRS – CMC SST (all)

151,784,044 collocations
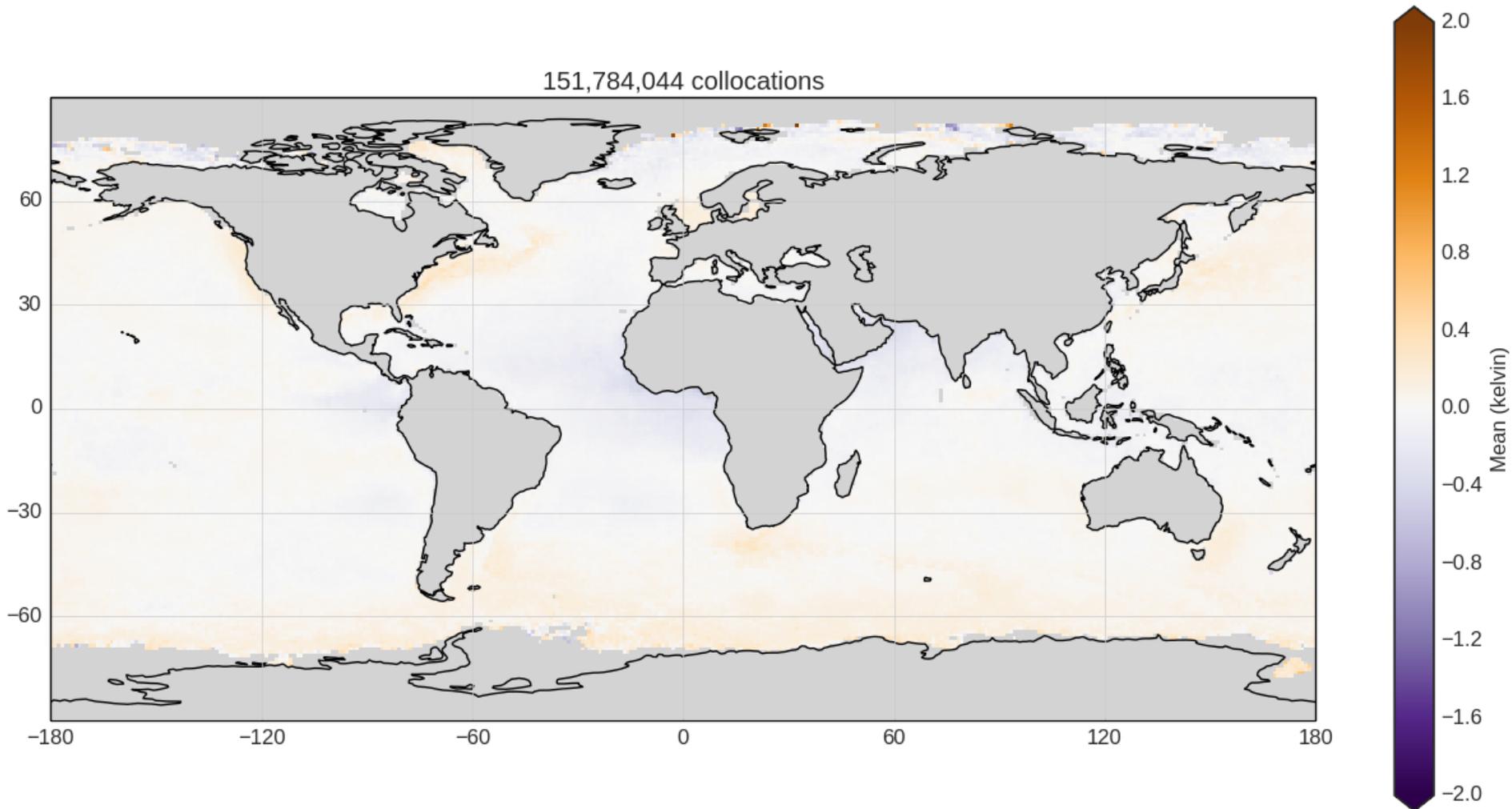
Results: AMSR-2 – CMC SST (all)


151,784,044 collocations

Results: VIIRS – CMC SST (all)

Results: AMSR-2 – CMC SST (all)
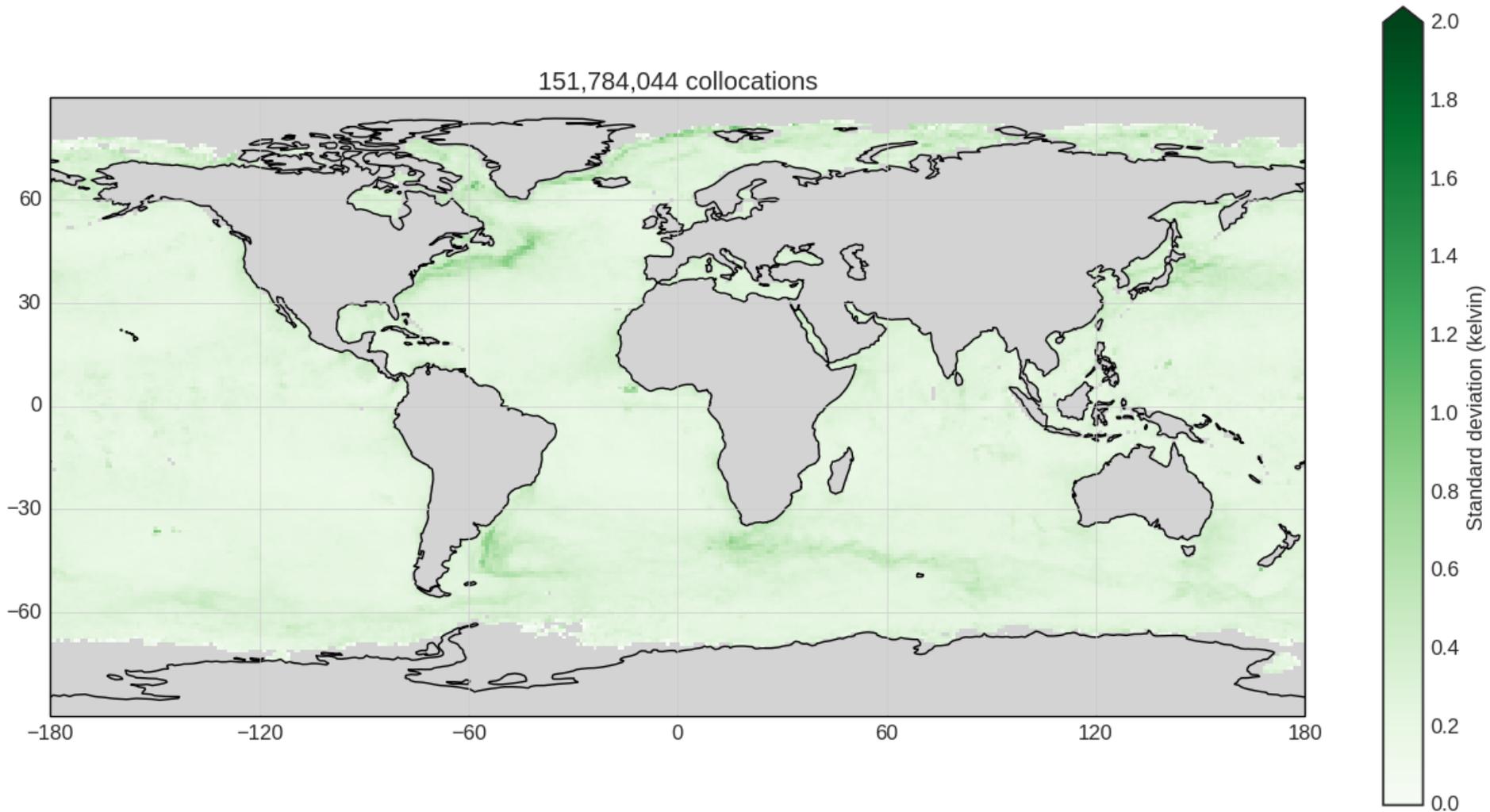
151,784,044 collocations
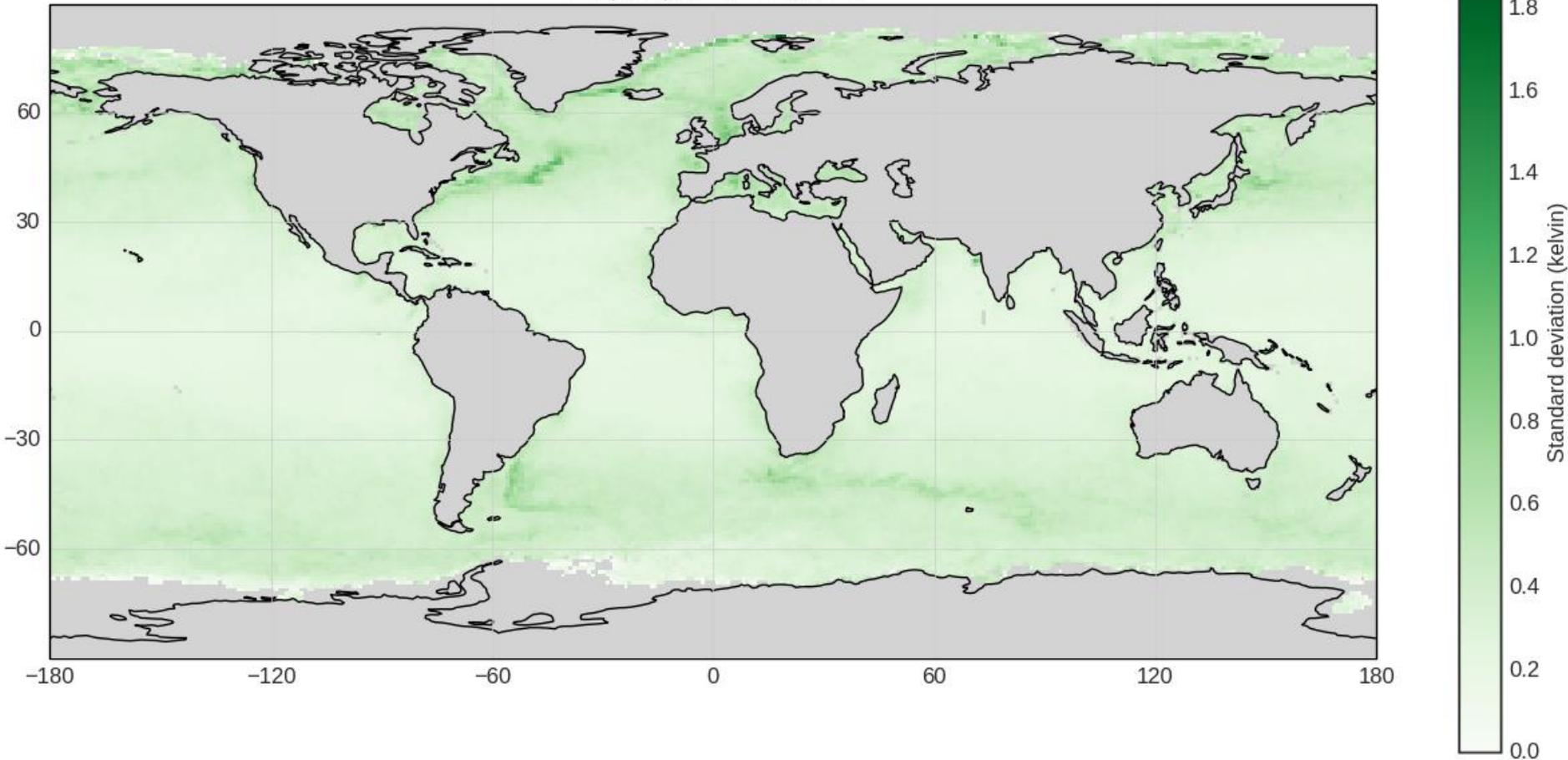
Results: joint histograms (all)
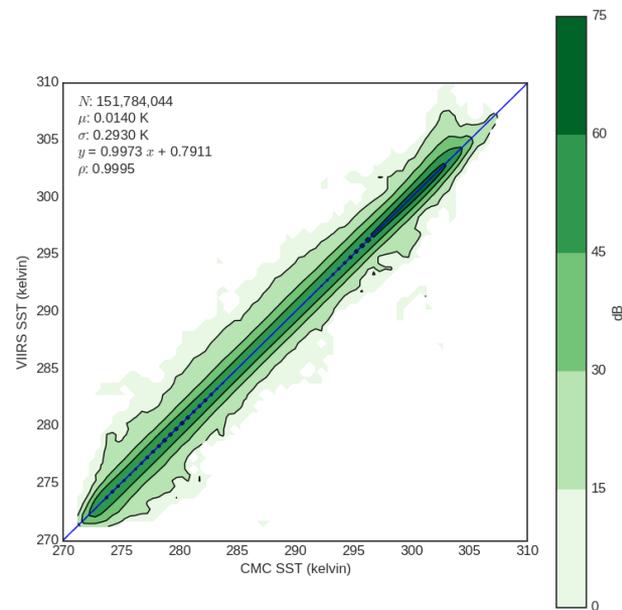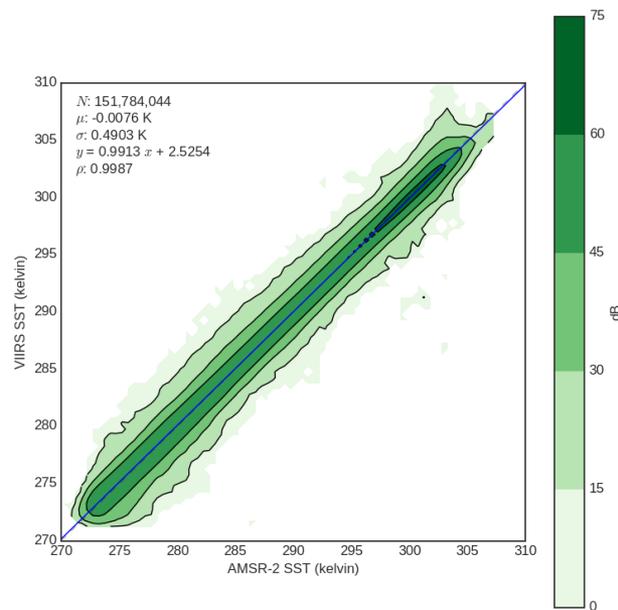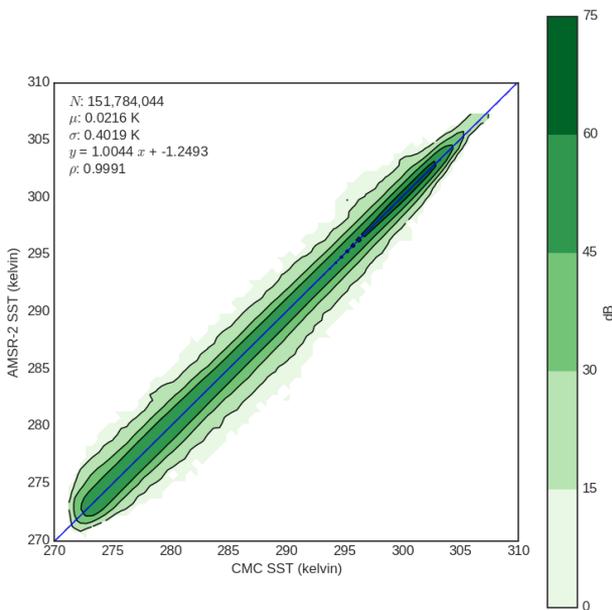
Results: residual SST vs water vapor (all)
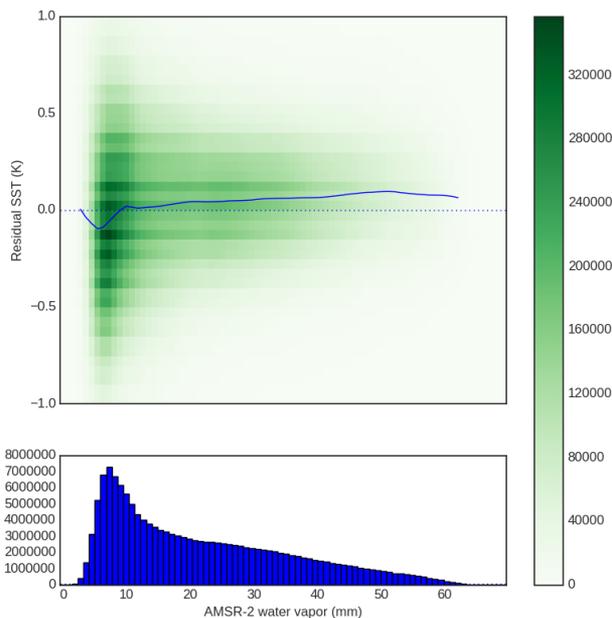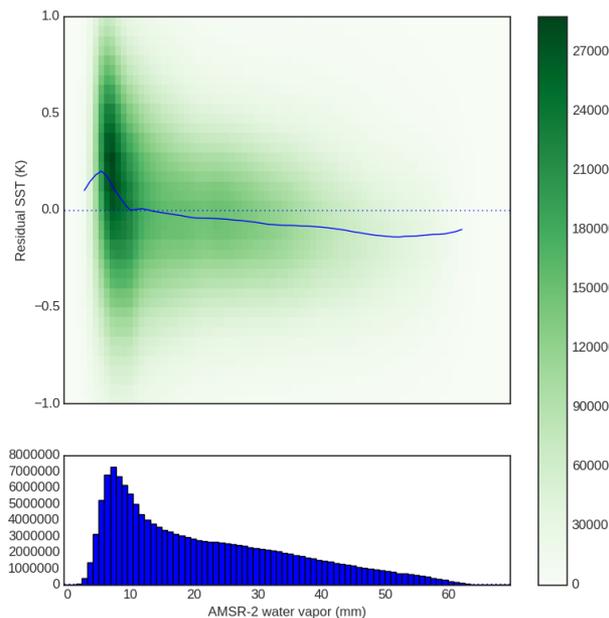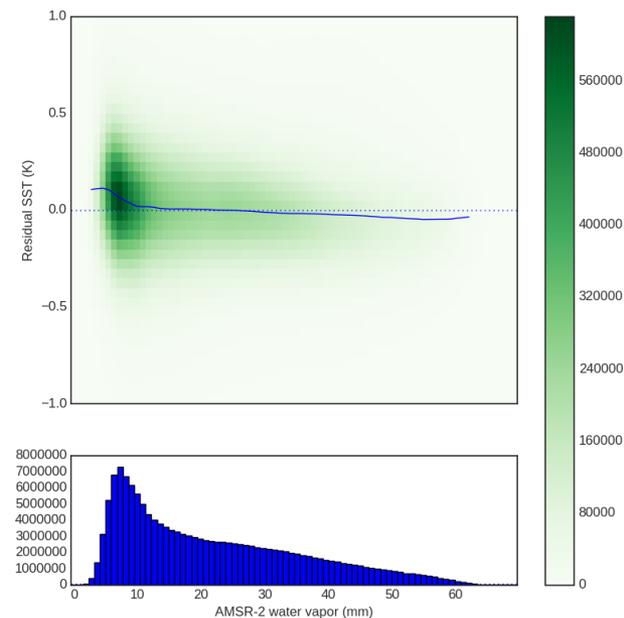
# Results: residual SST vs wind speed (all; night)
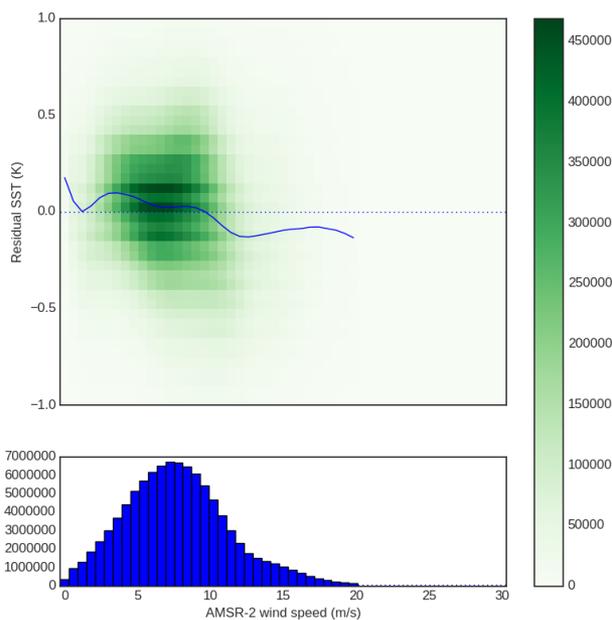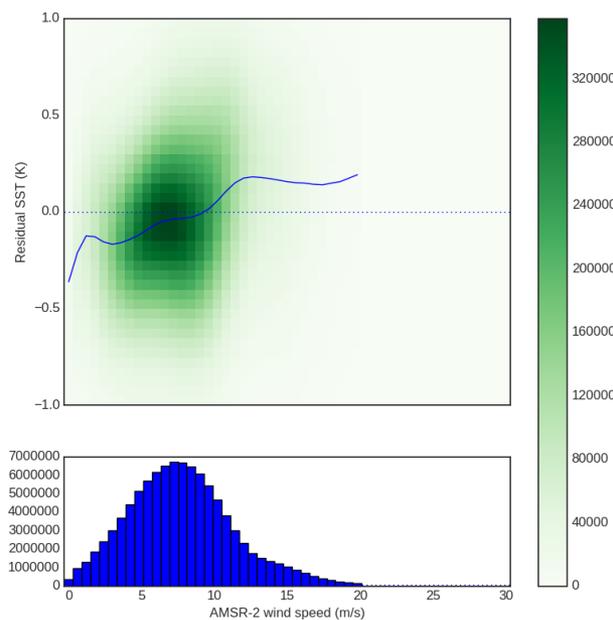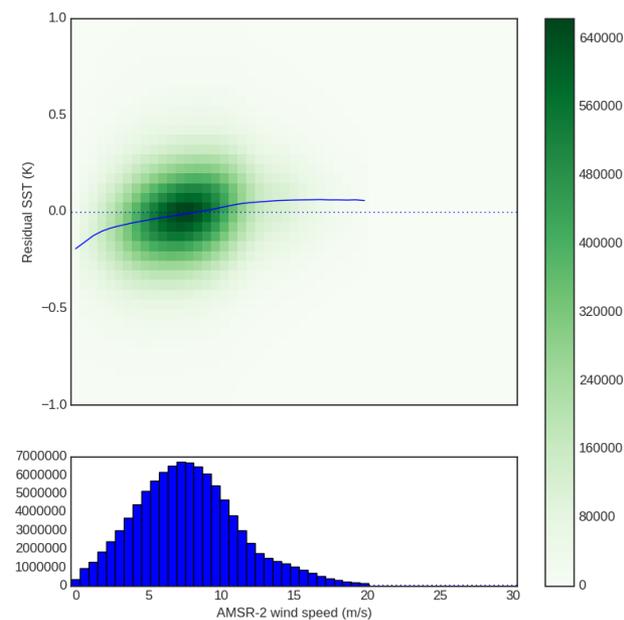
# Results: Residual SST vs AOT (Dec 2015; mid-Atlantic)
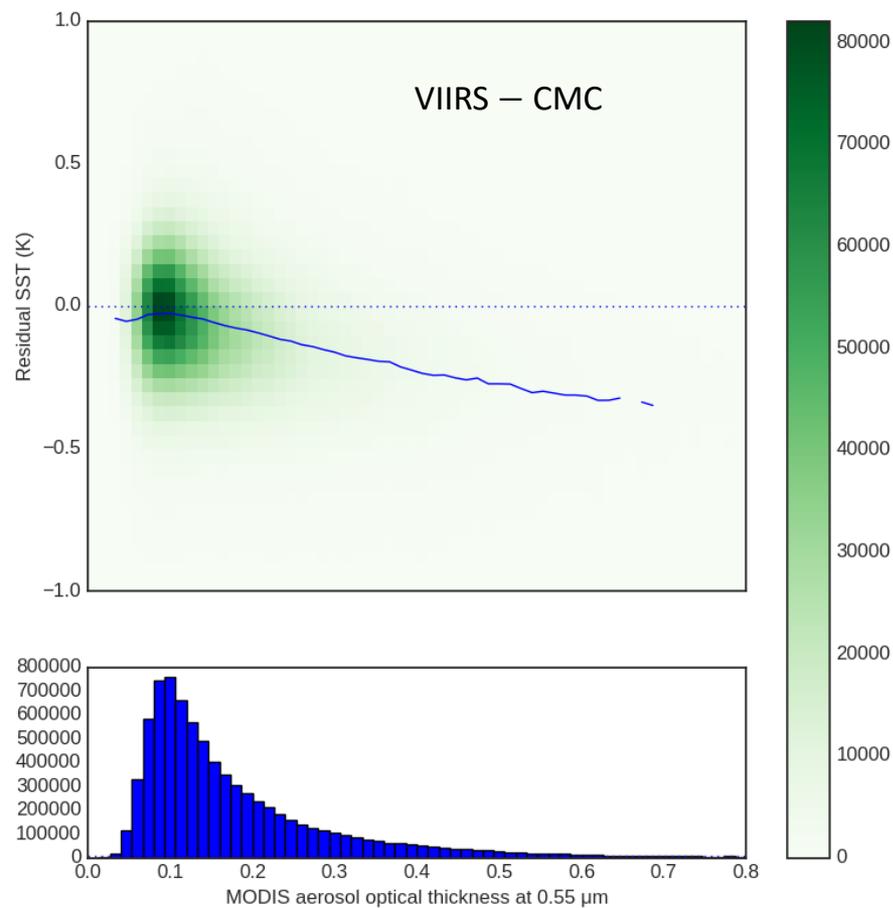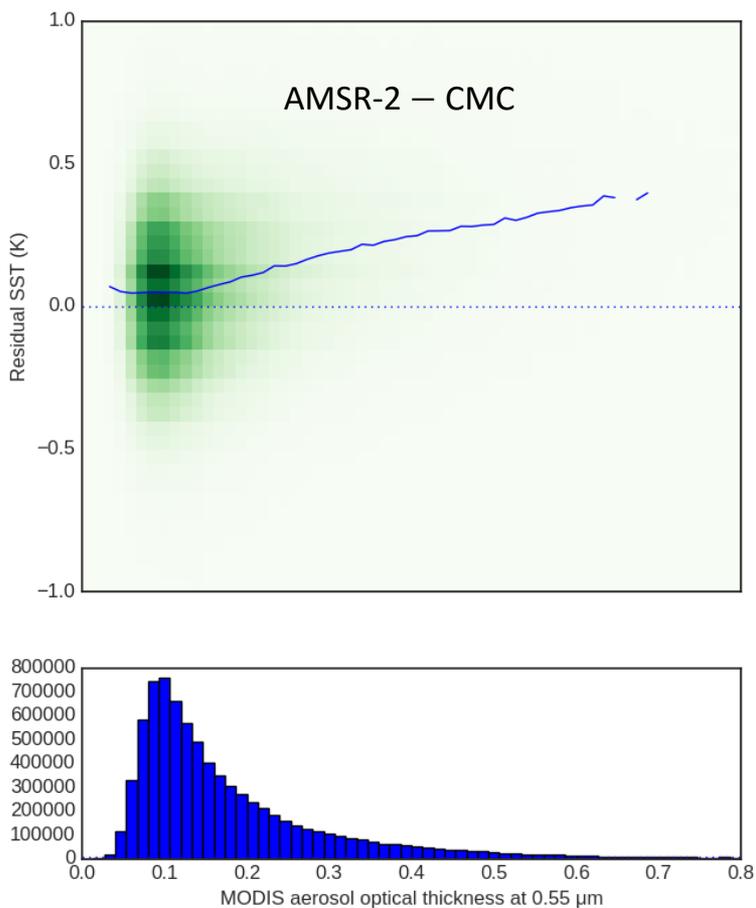
Results: VIIRS – AMSR-2 SST
(Jan 2016; day)
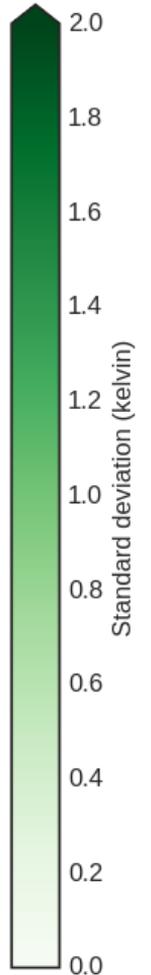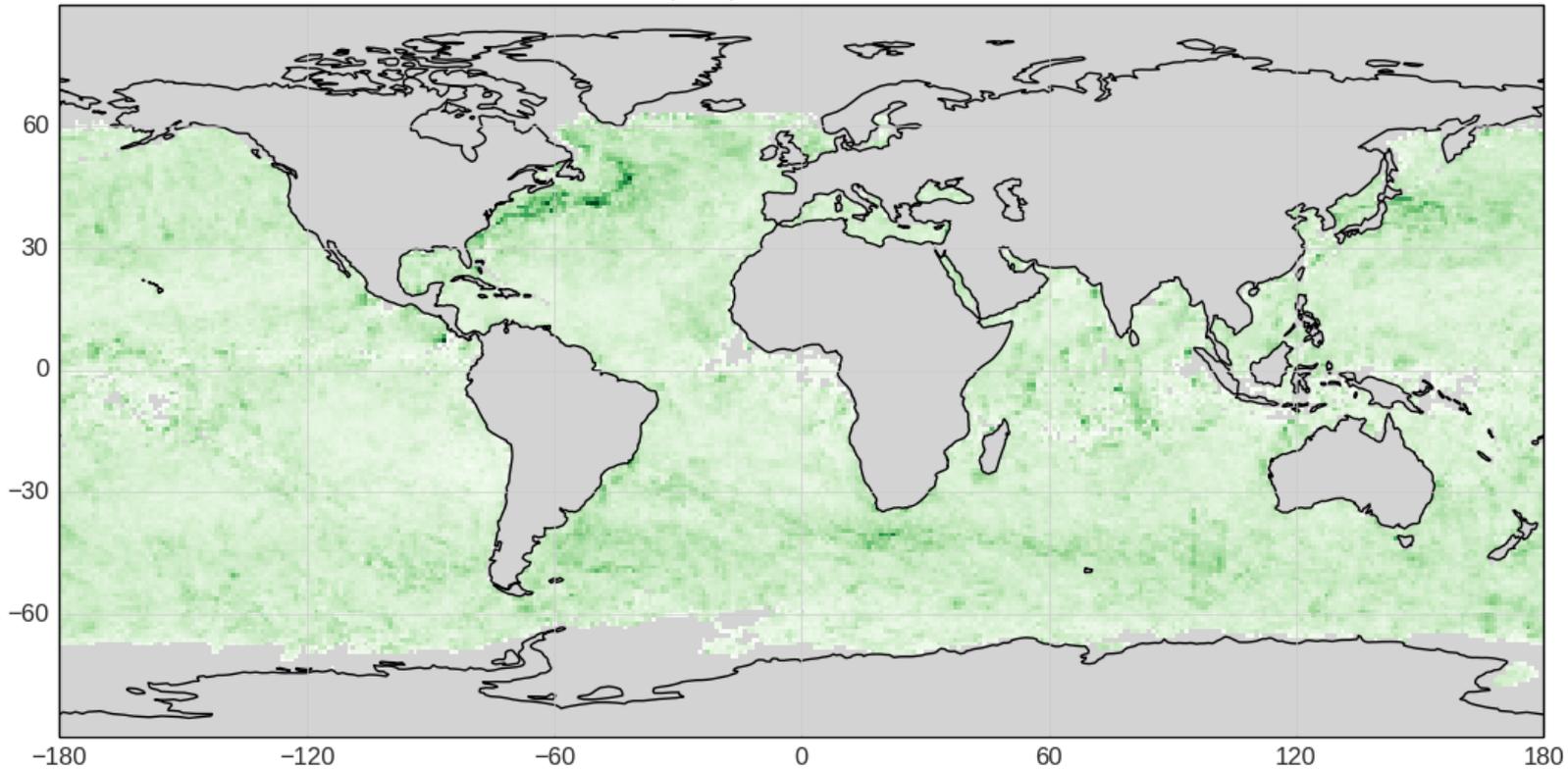
5,667,354 collocations

Standard deviation (kelvin)

Results: VIIRS – AMSR-2 SST

(Jan 2016; night)

8,988,588 collocations
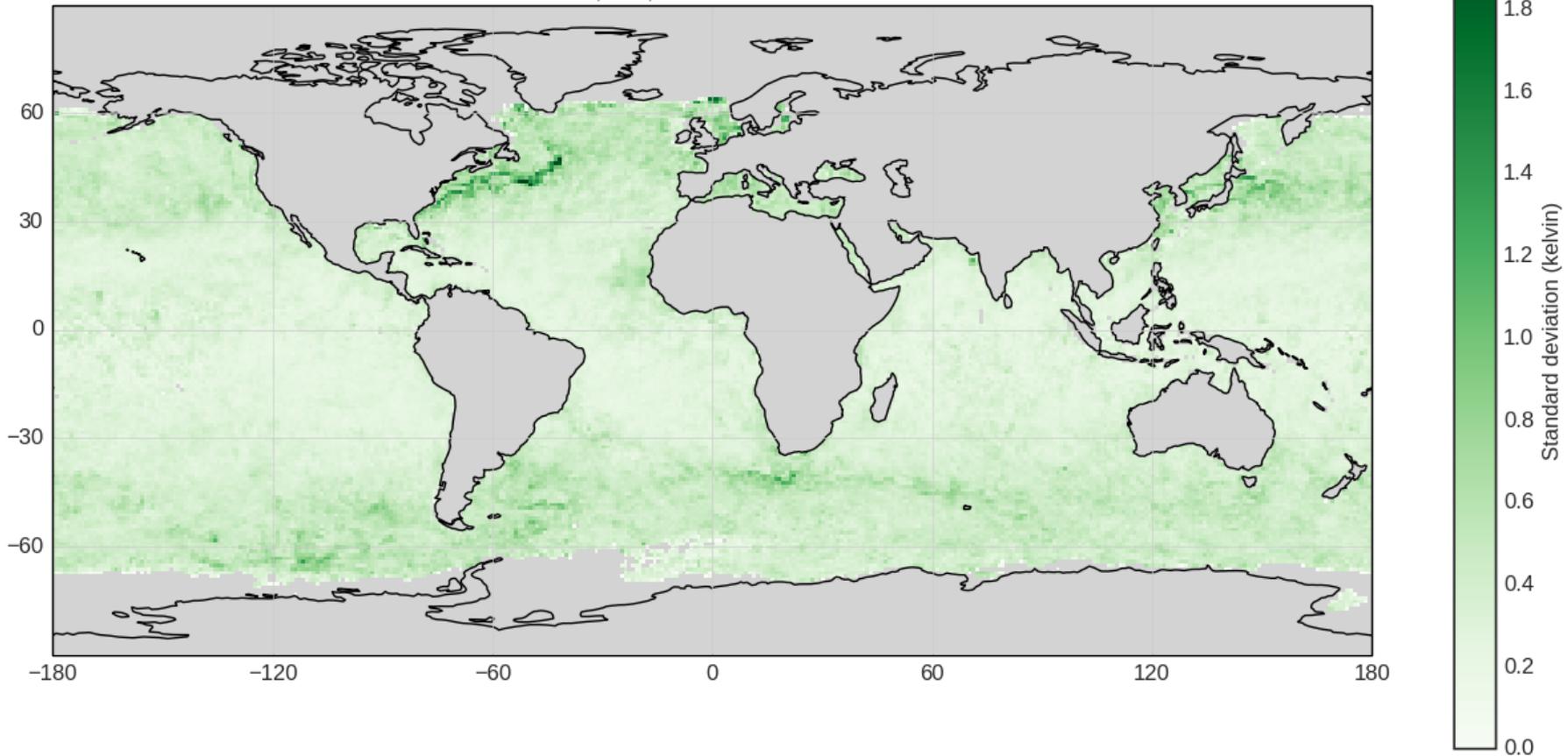
Results: SST residual and AOT (one week; day)

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