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

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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](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](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)
- Aerosol optical thickness (AOT) at 0.55 \(\mu\)m
- 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

Mean (kelvin)

-2.0 -1.6 -1.2 -0.8 -0.4 0.0 0.4 0.8 1.2 1.6 2.0
Results: VIIRS – AMSR-2 SST (all)

151,784,044 collocations

Standard deviation (Kelvin)
Results: VIIRS – AMSR-2 SST (Jan 2016; day)

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

151,784,044 collocations
Results: VIIRS – CMC SST (all)
Results: AMSR-2 – CMC SST (all)
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)
Results: VIIRS – AMSR-2 SST
(Jan 2016; night)
Results: SST residual and AOT (one week; day)
Results: SST residual and AOT (one week; night)