ACSPO Regional Monitor for SST: ARMS v2.1

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Introduction

The NOAA ACSPO (Advanced Clear-Sky Processor for Ocean) Regional Monitor for SST (ARMS; www.star.nesdis.noaa.gov/sod/sst/arms/) system was designed to monitor NOAA SST products online in near real time, focusing on areas of interest to NOAA users, including coastal and internal waters, high-latitudes, dynamic and cloudy regions. Since the 2017 GHRSST Meeting in Qingdao, China, ARMS has been updated to version 2.1 (v2.1). Compared to the previous version, the page response time has significantly improved. A geotationary sub-page was added, which allows user to check the hourly Level 2 collated (L2C) hourly data, and the corresponding gridded (L3C) SSTs from ABI onboard G16/17 and from AHI onboard H08. In addition, two L3S (super-collated) Australian BoM SST products are added. Adding reanalysis SSTs for different platforms and time series of clear-sky-ratio are underway.

ARMS: ACSPO Regional Monitor for SST

- ARMS v2.1 comprises polar (29 regions) and geo (22 regions) pages
- Monitored are clear- and all-sky SSTs & ΔSST = Sat − CMC L4 SST from the following satellites
  - **Polar:** SNPP/N20 VIIRS, N18/19 GAC AVHRR, Metop-A/B FRAC/GAC, Terra/Aqua MODIS
  - **Geo:** G16/17 ABI,H8 AHI
- Polar page displays L2P (swath) & 0.02° equal-grid L3U
- Geo page displays hourly collated swath L2C & 0.02° equal-grid L3C SSTs
- Animation button ▶ in geo page allows playing movies of hourly images

Fig. 1: Screenshot of the ARMS system: polar (top, set as default) and geo (bottom) pages.

- SSTs without and with SSES bias correction available.
- User can compare ACSPO SSTs with four global hi-res L4 SSTs (0.01° JPL MUR, 0.05° Met Office OSTIA, 0.05° NOAA Geo Polar Blended, 0.10° Canadian Met Centre, CMC), one regional L4 SST (0.09° BoM RAMSSA), and two BoM L3S SSTs (0.09°).
- Time coverage: 18 Jul 2015 − present
- Figures stratified into 3 categories based on scene time: day, night, and day/night. (The day/night category shows scenes with daytime and nighttime pixels present; often observed in high-latitudes).
- Information about the satellite, projection, region etc. displayed in the right panel
- SST is color-coded according to the color bar. Other scene types shows as follows: Missing=Black; Cloud=Grey; Land=Brown; Ice=White.
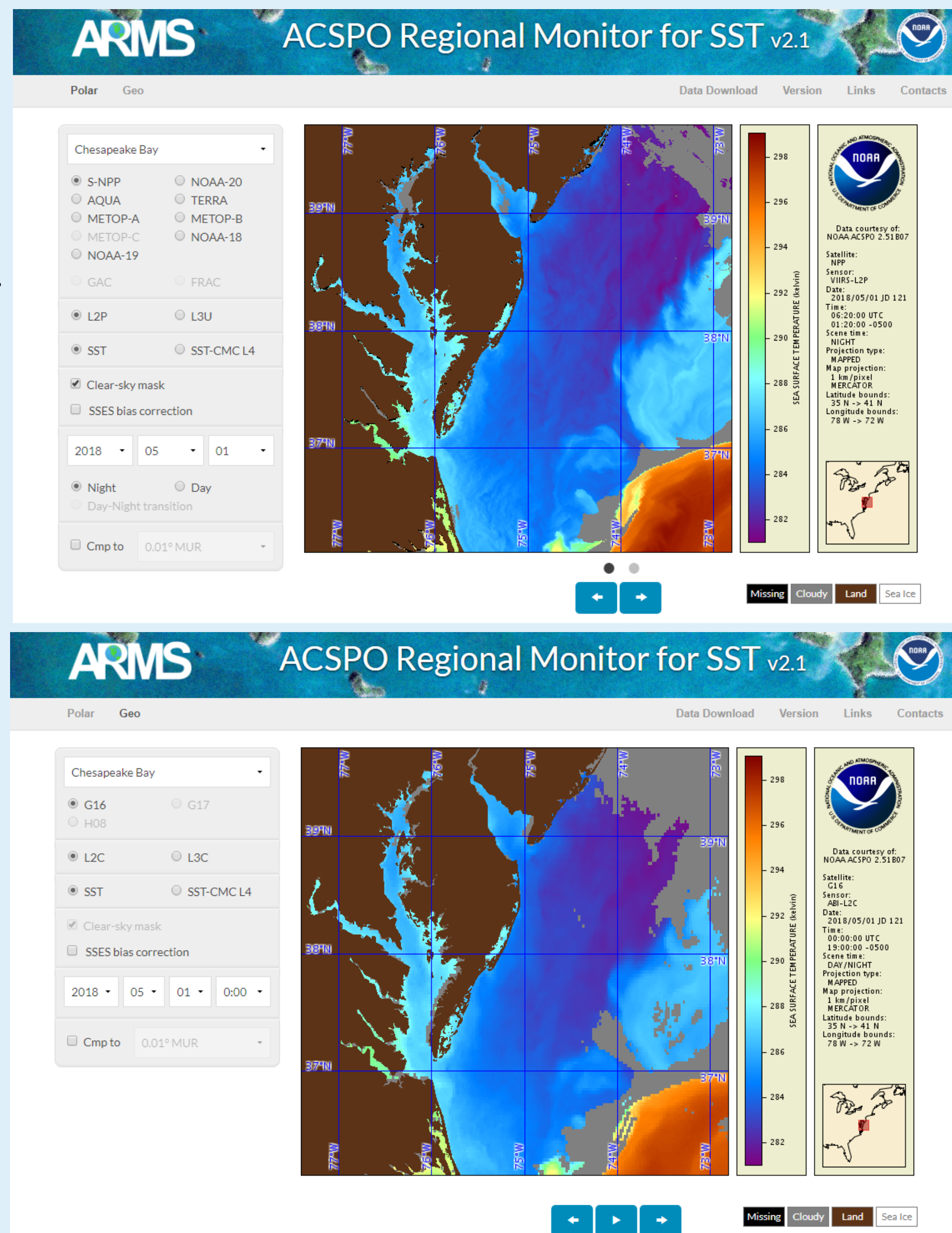- Png images can be saved off the ARMS page.

Geostationary L2/3C SSTs

- Hourly collated L2/3C SST products for G16/17 ABI and H08 AHI are available in ARMS v2.1.
- Currently only clear-sky SSTs are available for L2/3C SSTs.
- Geo L2/3C SSTs have larger coverage than polar/geo L2P/3U SSTs, in regions with scattered cloud
- L2/3C also reduce residual cloud available in L2P/3Us

VIIRS NPP L2P   **AHI H08 L2C**

BoM L3S   **MUR L4**

Fig. 2: Example of AHI L2C SST comparison with VIIRS L2P, BoM L3S and MUR L4 SSTs in a cloudy GBR region.

- Polar single-look imagery (e.g., VIIRS) captures fewer valid SST pixels. As a result, L3S SST has fewer valid data and MUR L4 may be noisy
- In contrast, AHI L2/3C has much more valid SST pixels. Inclusion of geo L2/3C SSTs in L3S/L4 can suppress the noise in L4 and fill the missing areas in L3S.
- The new L2/3C clearly shows superiority in coverage and fewer residual cloud compared to single-look polar L2P/3U data, and compared to "sub-sampled" geo L2P/3U data employed in previous ACSPO version
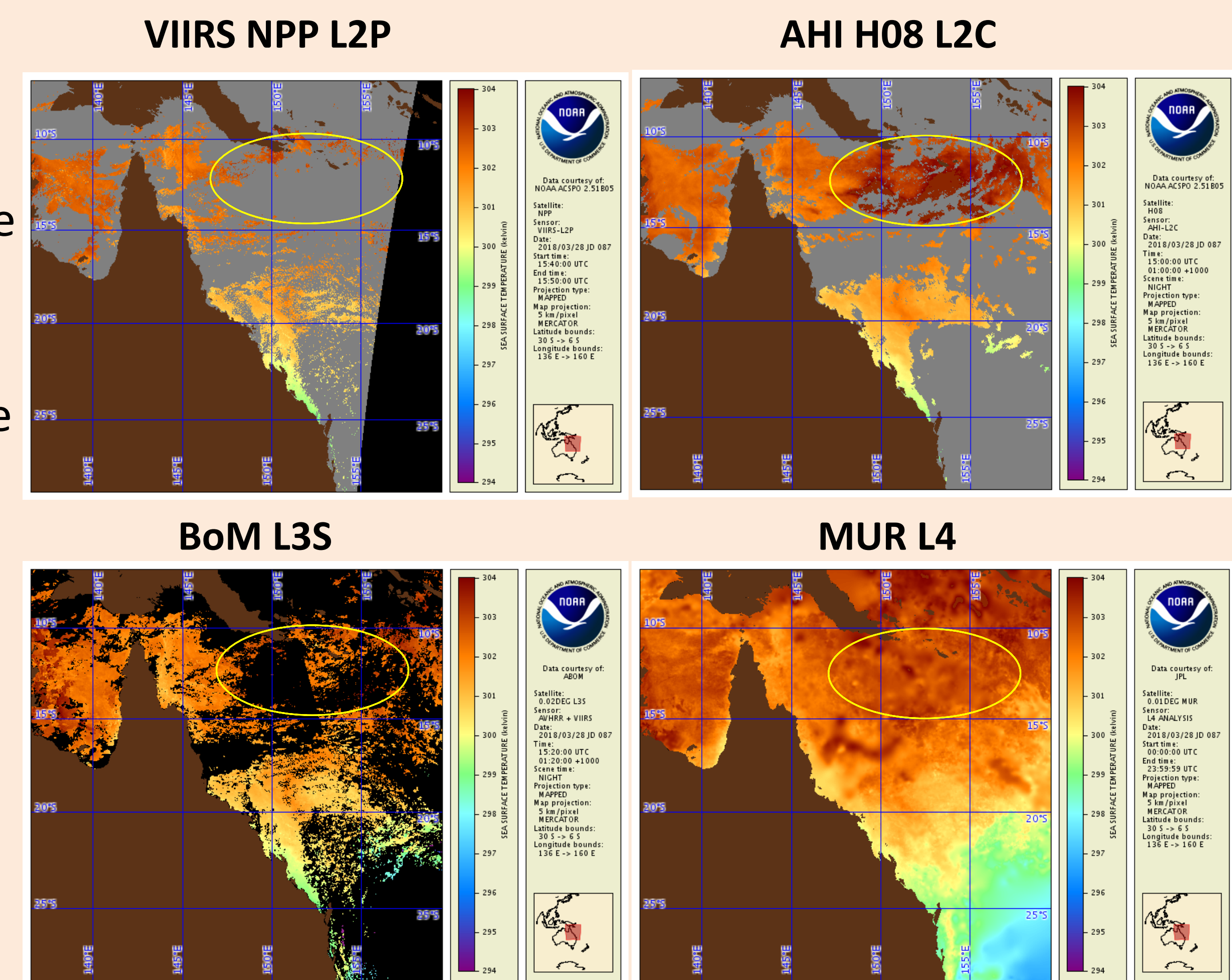
Effect of SSES on Imagery

- SSES bias correction brings satellite SST closer to *in situ* SST
- It reduces regional & view zenith angle biases in regression SST, effects of residual cloud, and diurnal warming
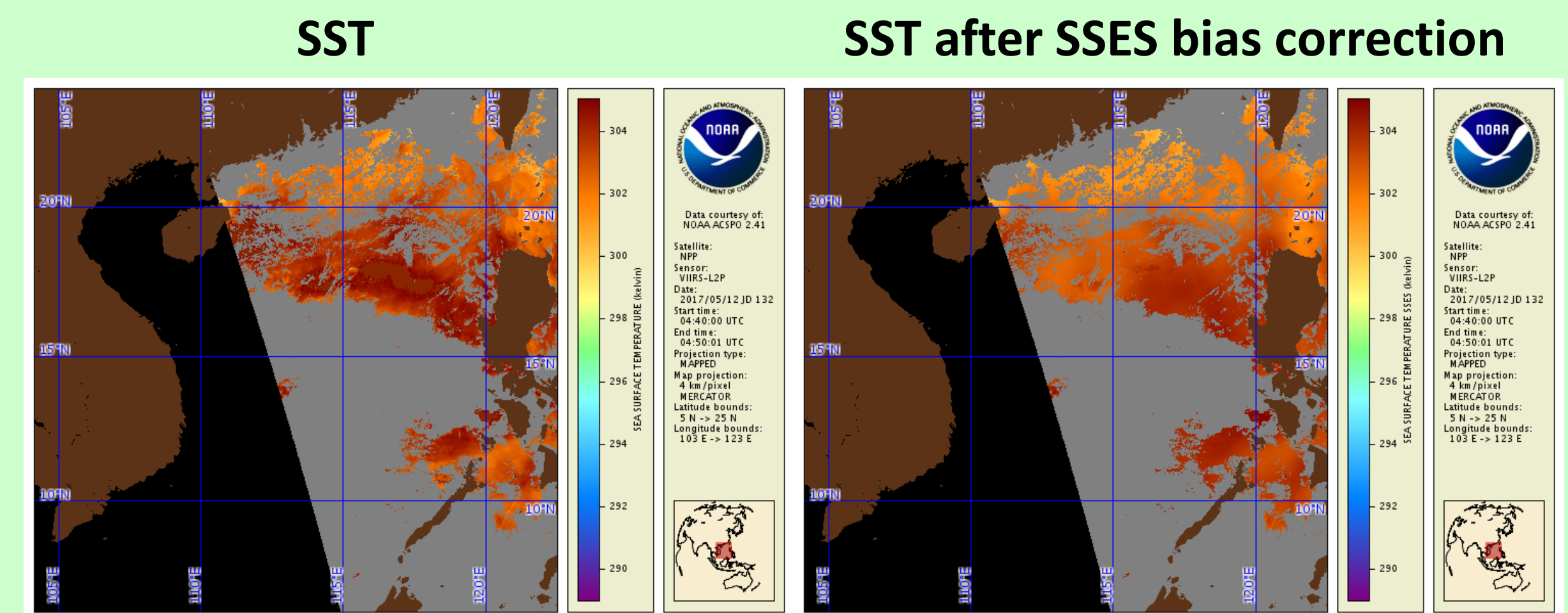

SST   **SST after SSES bias correction**

Fig. 3: Example of SST without/with SSES bias correction from SNPP VIIRS in South China Sea on 12 May 2017. Local time is 12:40:00 to 12:50:00.

Fig. 3 shows the effect of SSES bias correction on the diurnal warming signal.

ACSPO L3U vs. L2P

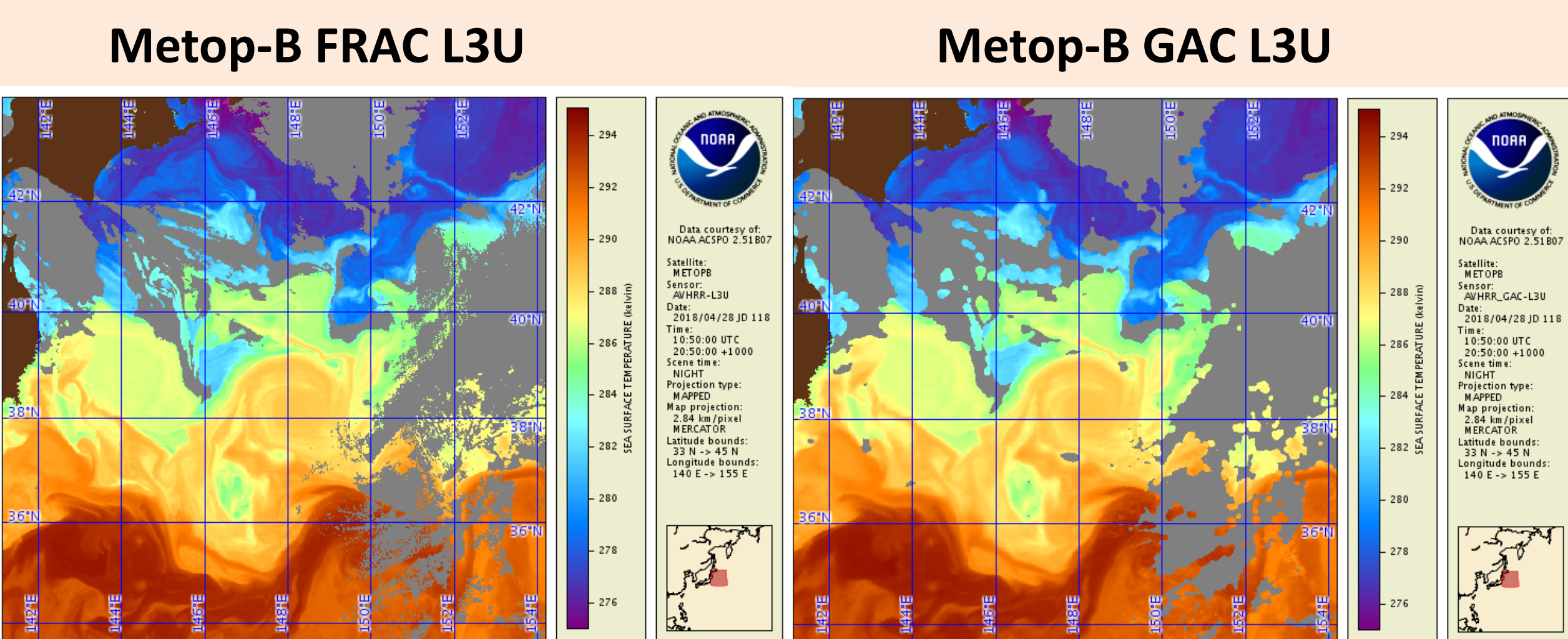

Metop-B FRAC L3U   **Metop-B GAC L3U**

Fig. 4: An example of FRAC vs. GAC L3U from Metop-A AVHRR.

- A complete line of consistent ACSPO L3U SSTs is now produced and monitored in ARMS v2.1, from all polar and geo sensors processed in ACSPO, including SNPP/N20 VIIRS, N18/19 AVHRR GAC, Metop-A/B AVHRR FRAC and GAC, Terra/Aqua MODIS, G16/17 ABI, and H08 AHI.
- Spatial resolution of L3U is 0.02° for all polar and geo, high- and low-resolution sensors.
- In general, ACSPO L3U has a comparable data coverage to L2P. Data noise is reduced, while the spatial patterns are well preserved (the locations of fronts, currents, *etc.*).
- 0.02° GAC L3U has closer feature resolution to FRAC L3U (Fig. 4). In comparison, GAC L2P is much closer than FRAC L2P.
- The masking flags (cloud/ice/land mask, *etc.*) in ACSPO L3U are identical to those in L2P.

Summary

- The ACSPO Regional Monitor for SST (ARMS: www.star.nesdis.noaa.gov/sod/sst/arms/) updated to v2.1. The page response time has significantly improved.
- Geostationary subpage allows users to check hourly L2/3C SST evolution, and compare with L4/L3S SSTs.
- L3U SSTs available for all ACSPO platforms. 0.02° GAC L3U shows comparable feature resolution with that in FRAC L3U.
- Per users' request, the number of special regions increased from 21 to 29; number of L4 SSTs increased to 5; two BoM L3S SSTs added.
- The future work includes adding reanalysis SSTs for different platforms and time series of clear-sky-ratio for users to select overpasses with more valid data.