ARMS: Advanced Clear-Sky Processor for Ocean (ACSPO) Regional Monitor for SST v2.1

www.star.nesdis.noaa.gov/sod/sst/arms/

(google "sst arms")

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ACSPO Regional Monitor for SST (ARMS)

Global Monitoring and Validation of satellite & blended SST products has been established in NOAA SQUAM in 2009

However, satisfactory global performance does not guarantee uniform & accurate regional performance

Complementing global analyses with regional recommended by the Joint Polar Satellite System (JPSS) Program

In 2016, NOAA ACSPO Regional Monitor for SST (ARMS) system was launched *www.star.nesdis.noaa.gov/sod/sst/arms/*

In March 2018, ARMS was updated to version 2.1.

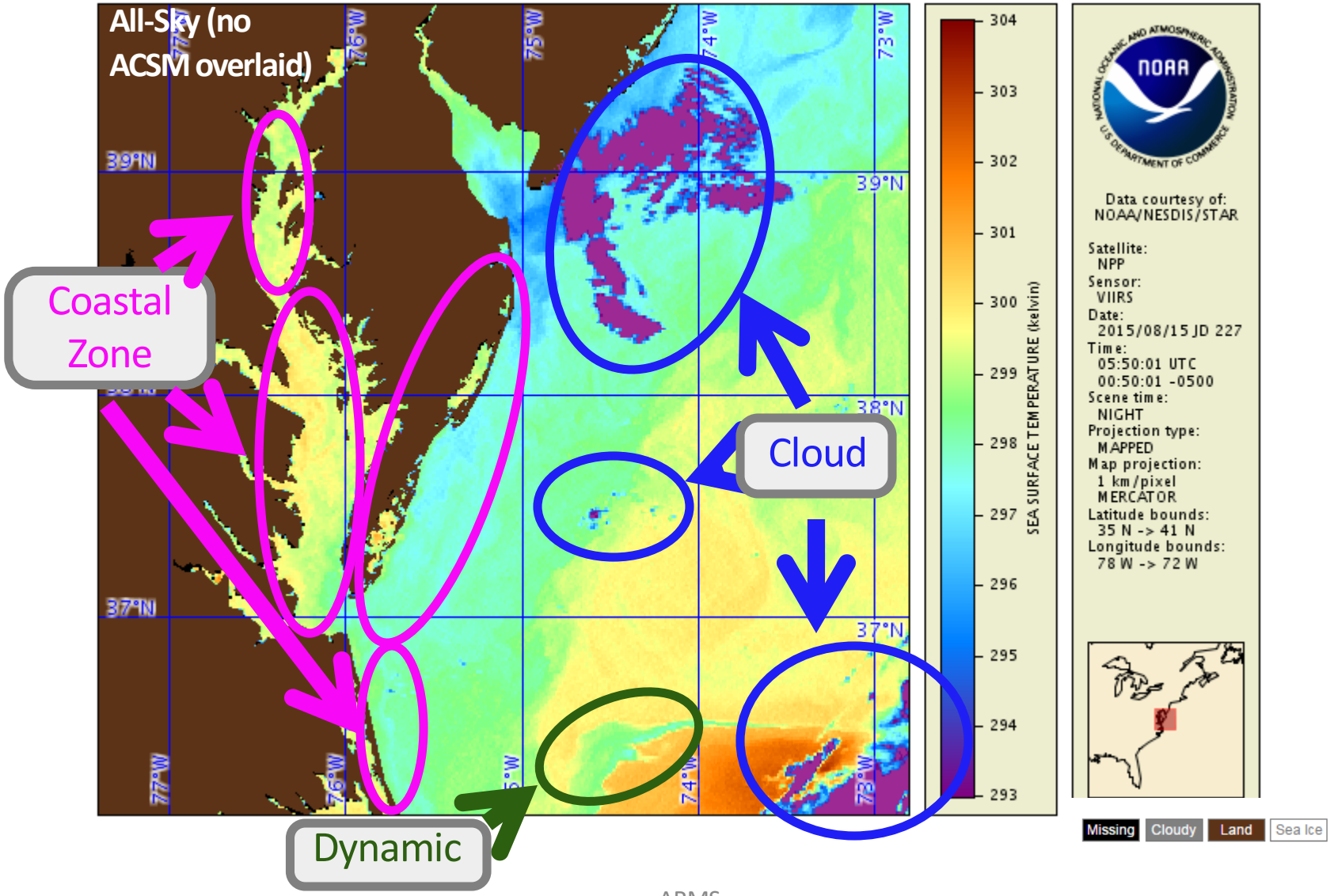
What is ARMS?

1. **A part of the NOAA SST Monitoring system, focused on challenging areas, most interesting to ACSPO users & producers**
   - Coastal/Internal waters
   - Dynamic areas
   - High-latitudes
   - Cloudy regions
2. **Monitors performance of ACSPO SST, clear-sky/ice masks, & SSES**
3. **Checks imagery for quality, accuracy & consistency (across sensors, day/night, ..)**
4. **Inter-compares polar & geo L2/L3U, and hi-res L3S/L4s**

L4
- 0.01° JPL MUR
- 0.05° Met Office OSTIA
- 0.05° NOAA Geo Polar Blended
- 0.08° BoM RAMSSA
- 0.10° Canadian Met Centre CMC

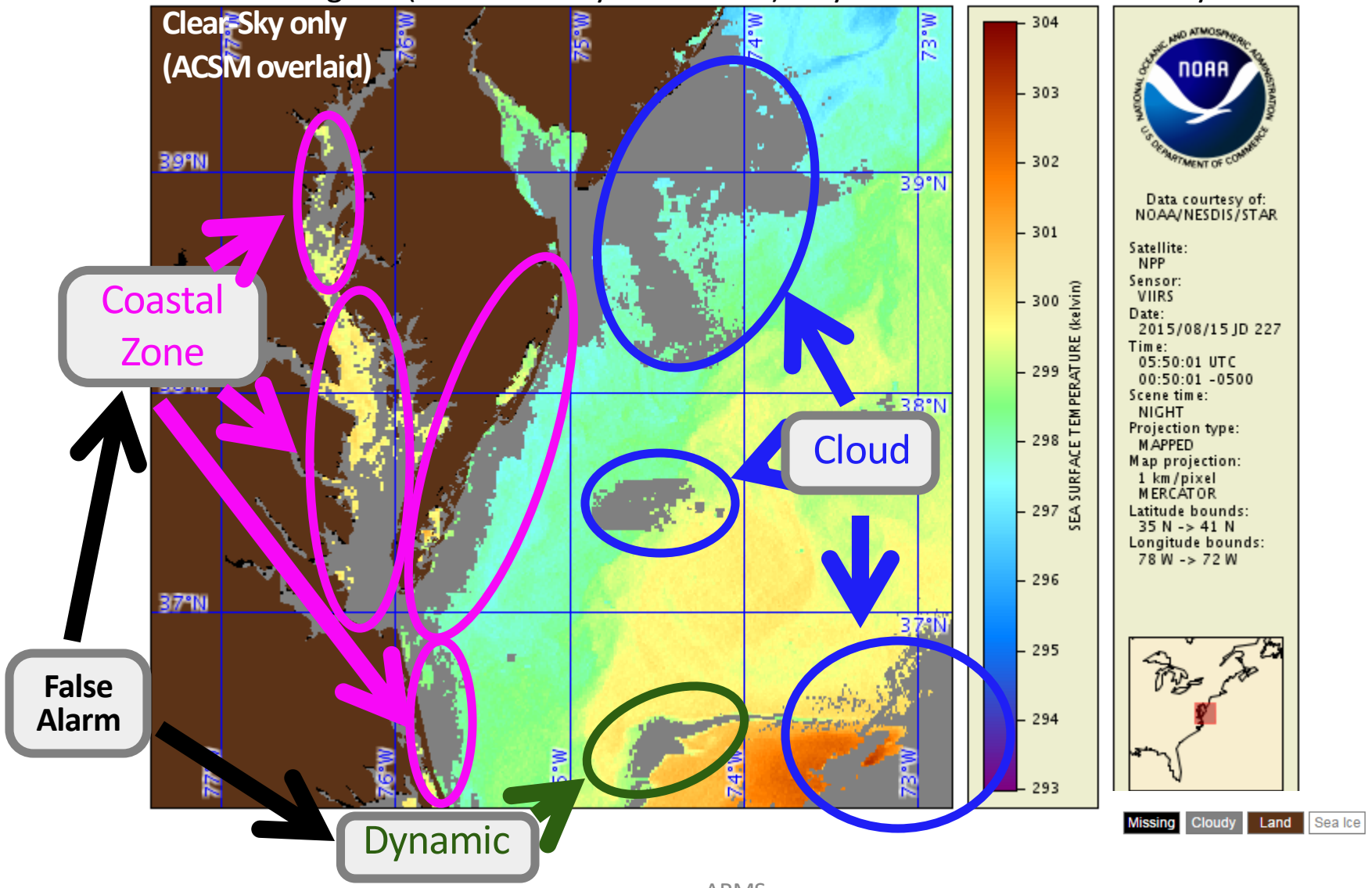
BoM L3S
- 0.02° AVHRR only
- 0.02° AVHRR + VIIRS

ACSPO Clear-Sky Mask May Be Overly Conservative In Coastal / Dynamic areas

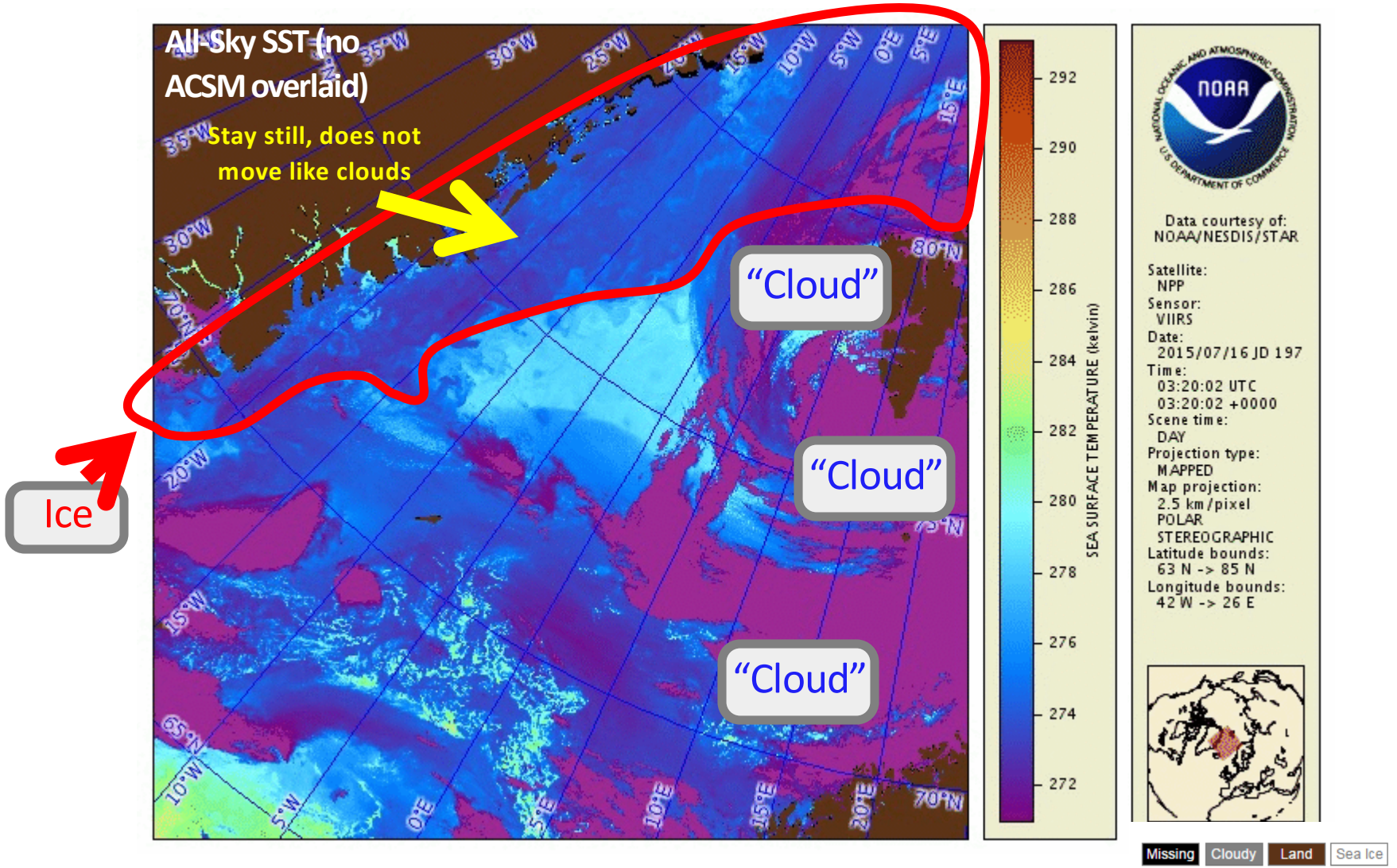


ACSPO Clear-Sky Mask May Be Overly Conservative In Coastal / Dynamic areas

- ✓ The cold regions (coastal and dynamic areas) may be identified as “cloud” by the ACSM



Current ACSPO ice mask comes from 0.1º CMC L4
May not be fully accurate and sufficiently hi-res



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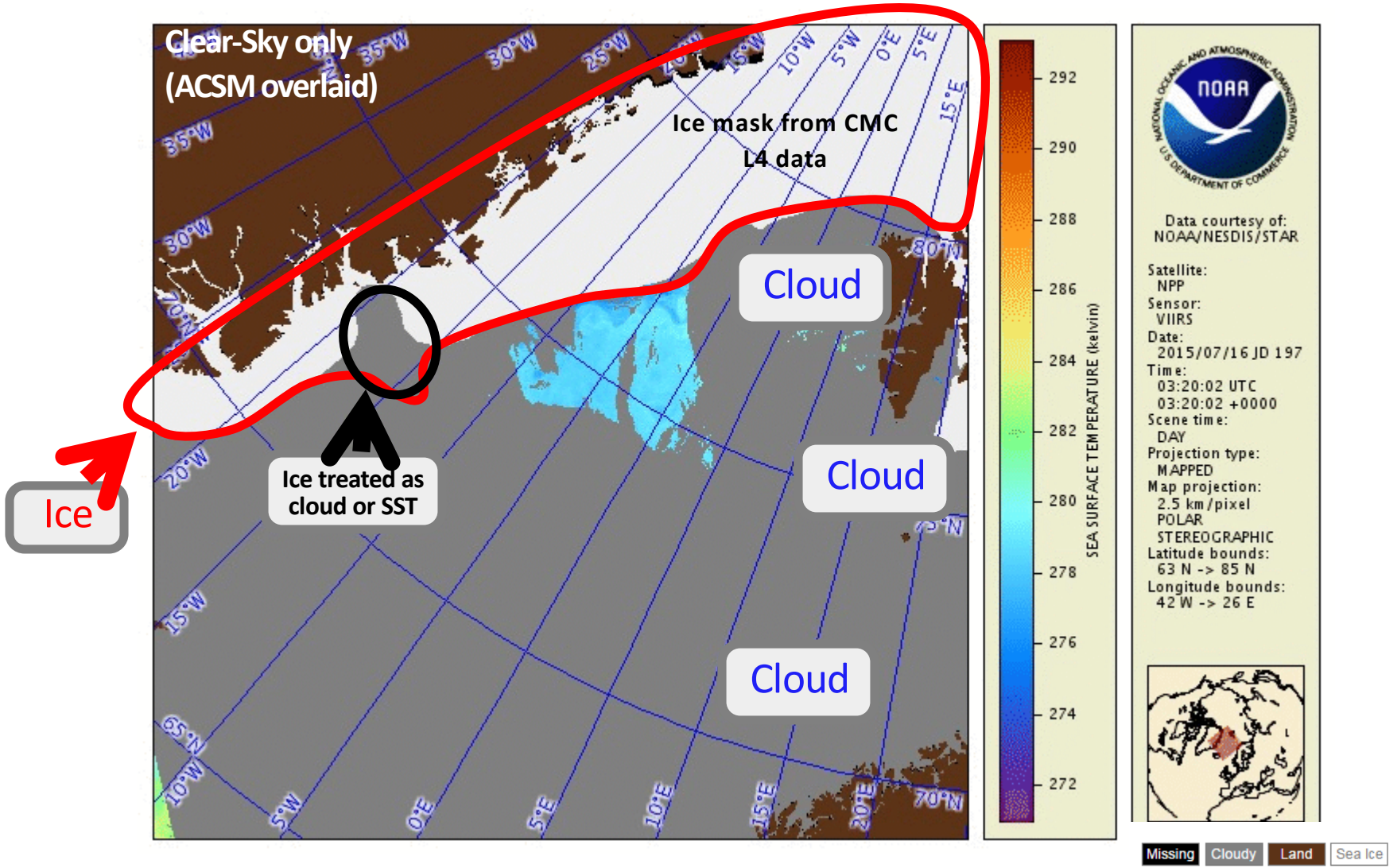
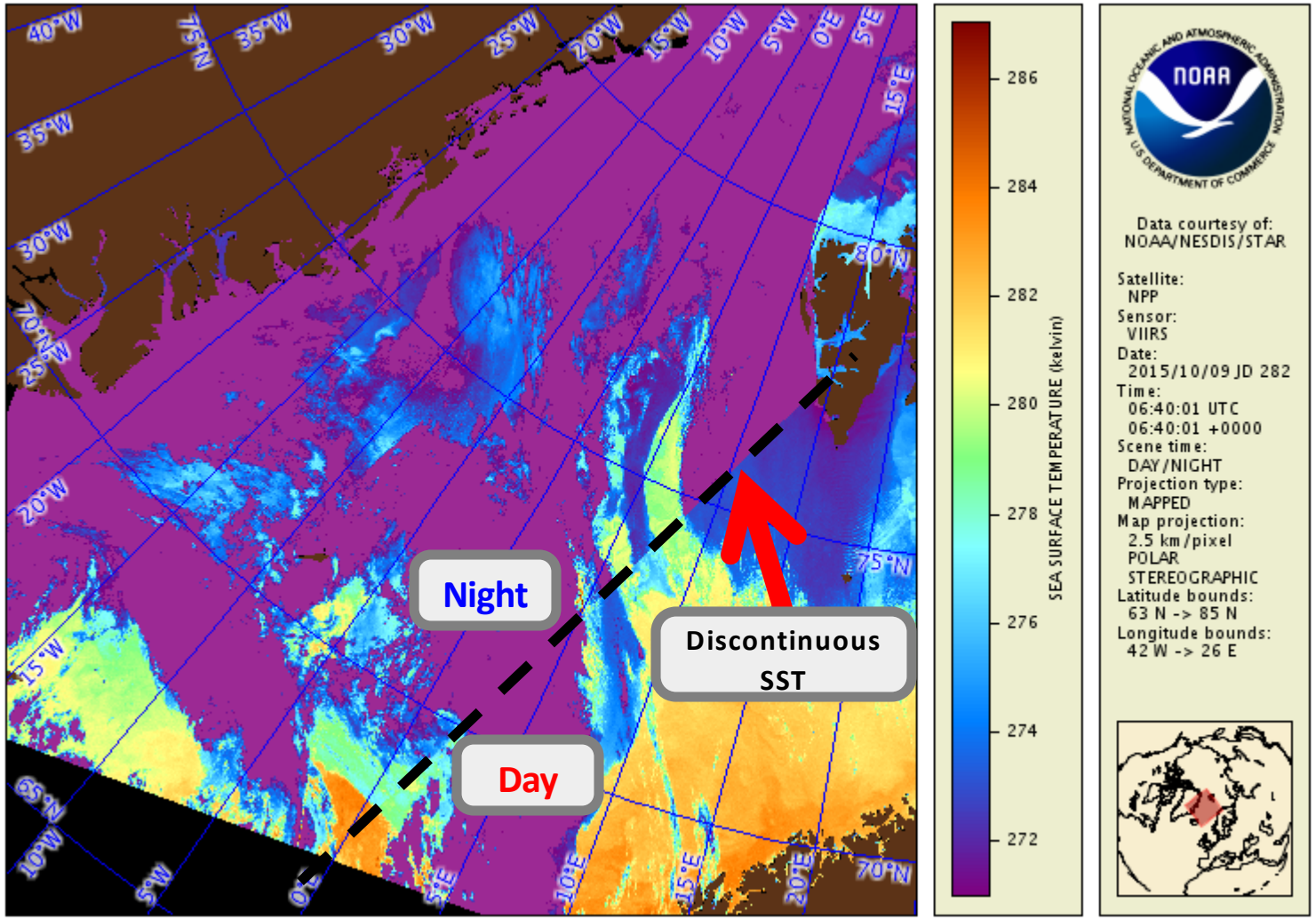


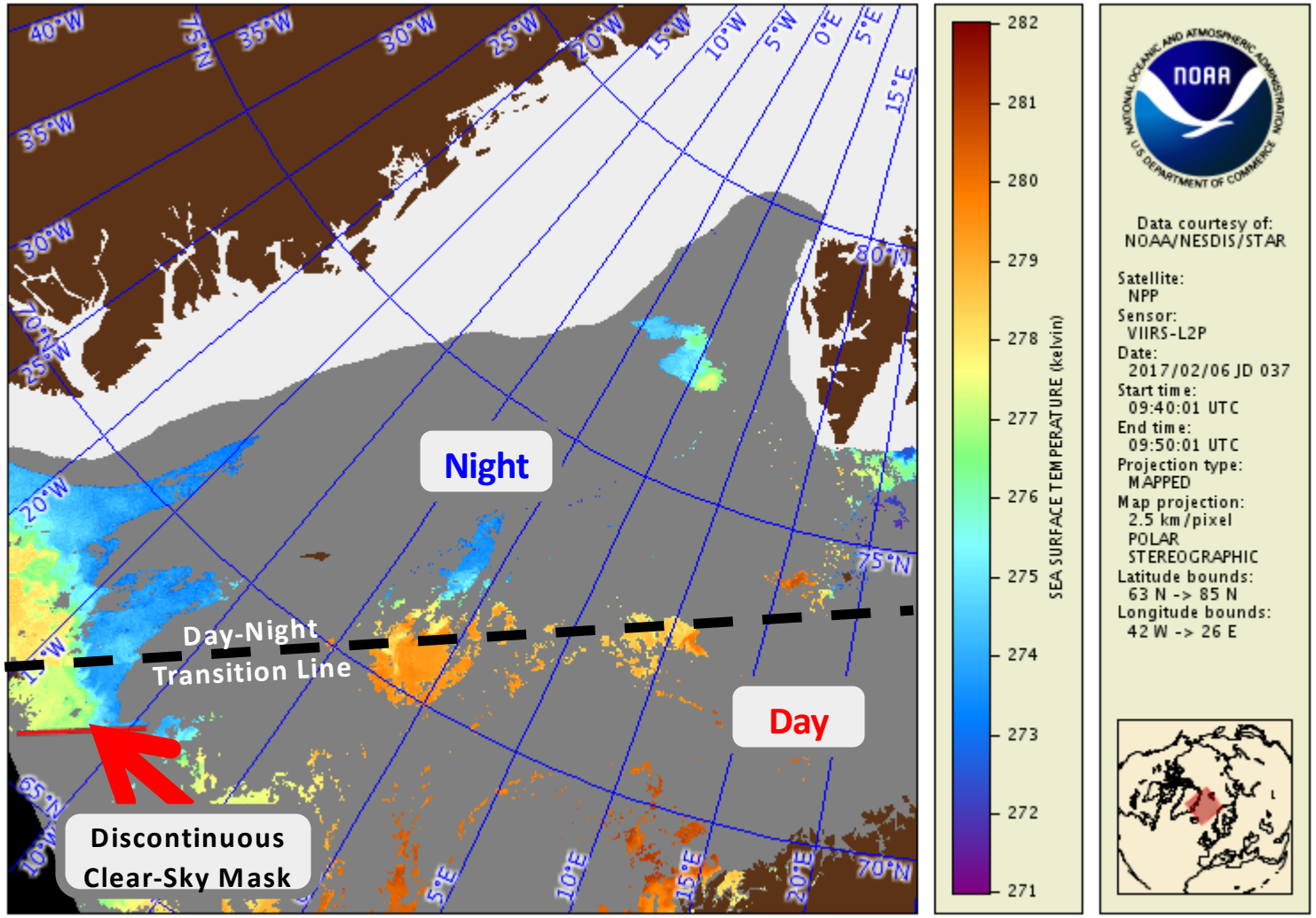
Sea ice and cold water may be identified as “cloud” by the ACSM

Example #3: Discontinuities in day/night transition zone



Daytime and Nighttime SST algorithms are different, which may cause discontinuities

Example #3: Discontinuities in day/night transition zone



SST and cloud mask algorithms may switch over at different solar zenith angles

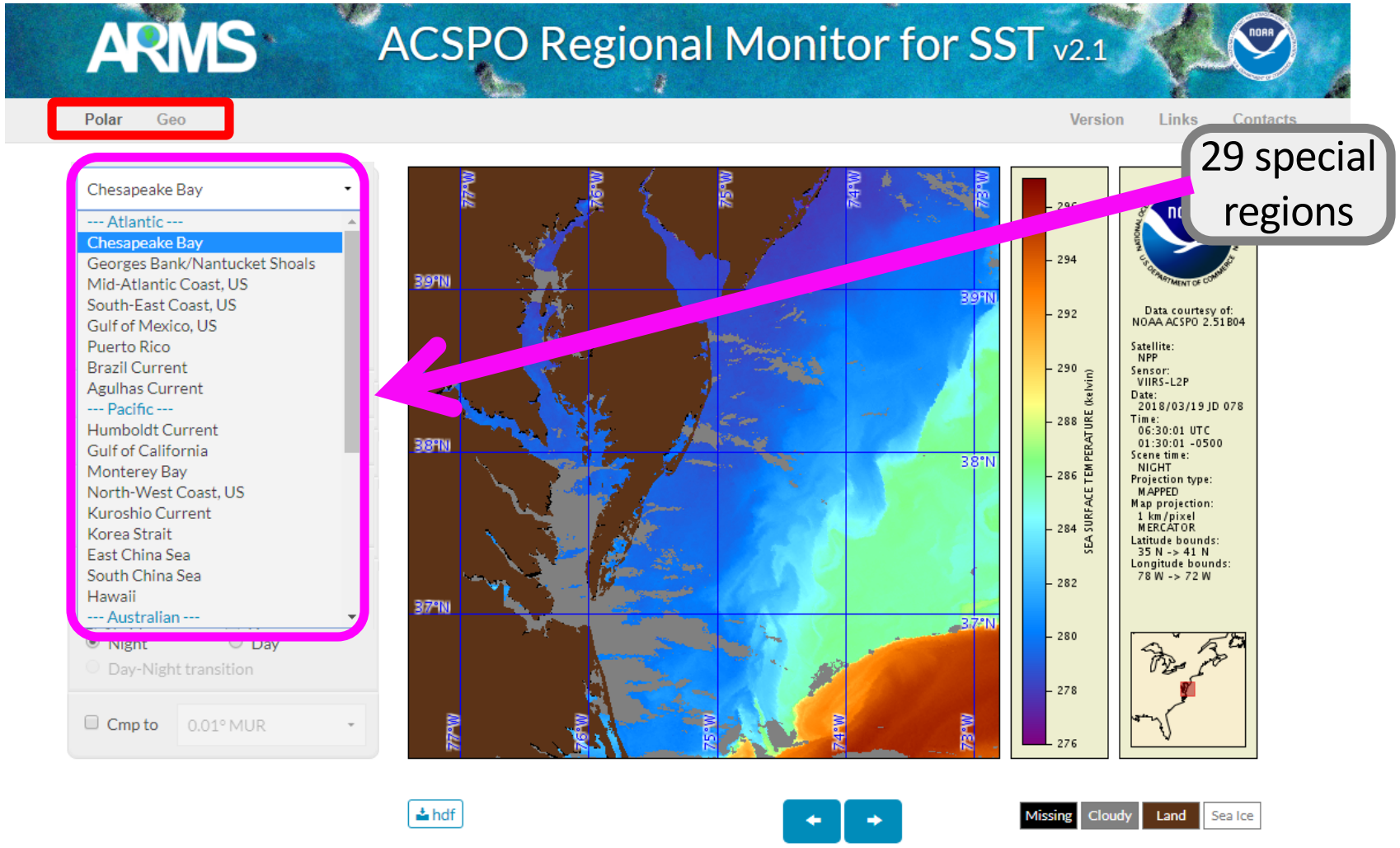
What's new in ARMS v2.1

1. **Since GHRSST-XVIII, ARMS was upgraded from v1.2 to v2.1**
   - Page response time has significantly improved
2. **New geostationary subpage added**
   - Hourly collated L2C and L3C SSTs
   - GOES-16 (G16) ABI and Himawari-8 (H08) AHI
   - Comparison to L3S & L4 SSTs available
3. **SSES bias correction on/off button available**
4. **A complete line of ACSPO 0.02deg L3U SSTs added**
   - Polar: VIIRS (SNPP/N20), AVHRR (N18/19, Metop-A/B, GAC&FRAC), MODIS (Aqua/Terra)
   - Geo: ABI (G16) and AHI (H08)
5. **Per users' requests, # of special regions increased from 21 to 29**
6. **Added regional hi-res L4 SSTs (total L4s = 5)**
   - 0.08° BoM RAMSSA
7. **L3S SST (Australia BoM)**
   - 0.02° AVHRR only
   - 0.02° AVHRR + VIIRS
8. **New thermal front product is being tested offline**

ARMS Polar Subpage

ARMS 2.1 – polar

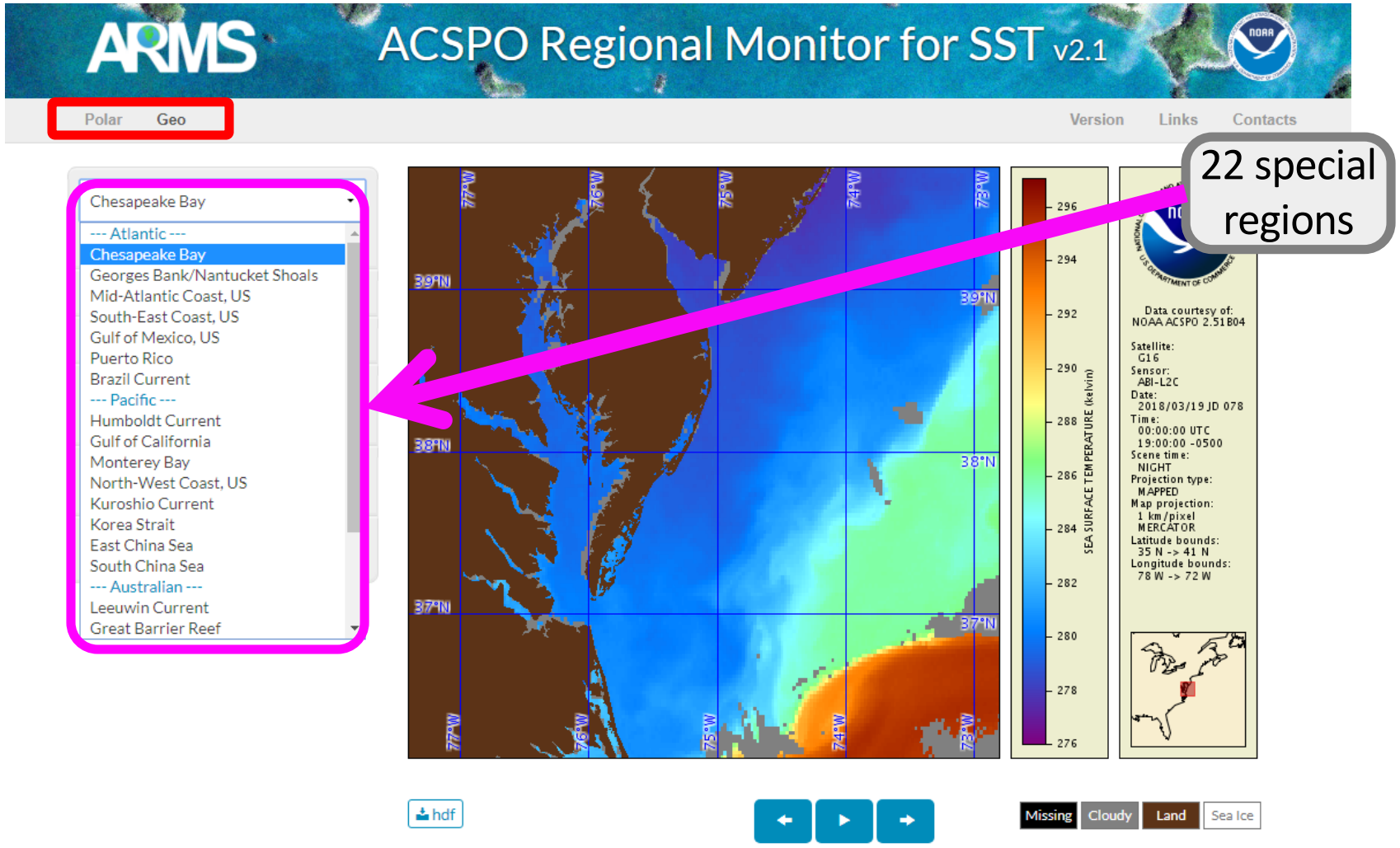
- ✓ Polar page is set as default. Geo page was added in 2.1.
- ✓ # of regions is now 29, # of L4s 5, and two BoM L3Ss added



ARMS Geostationary Subpage

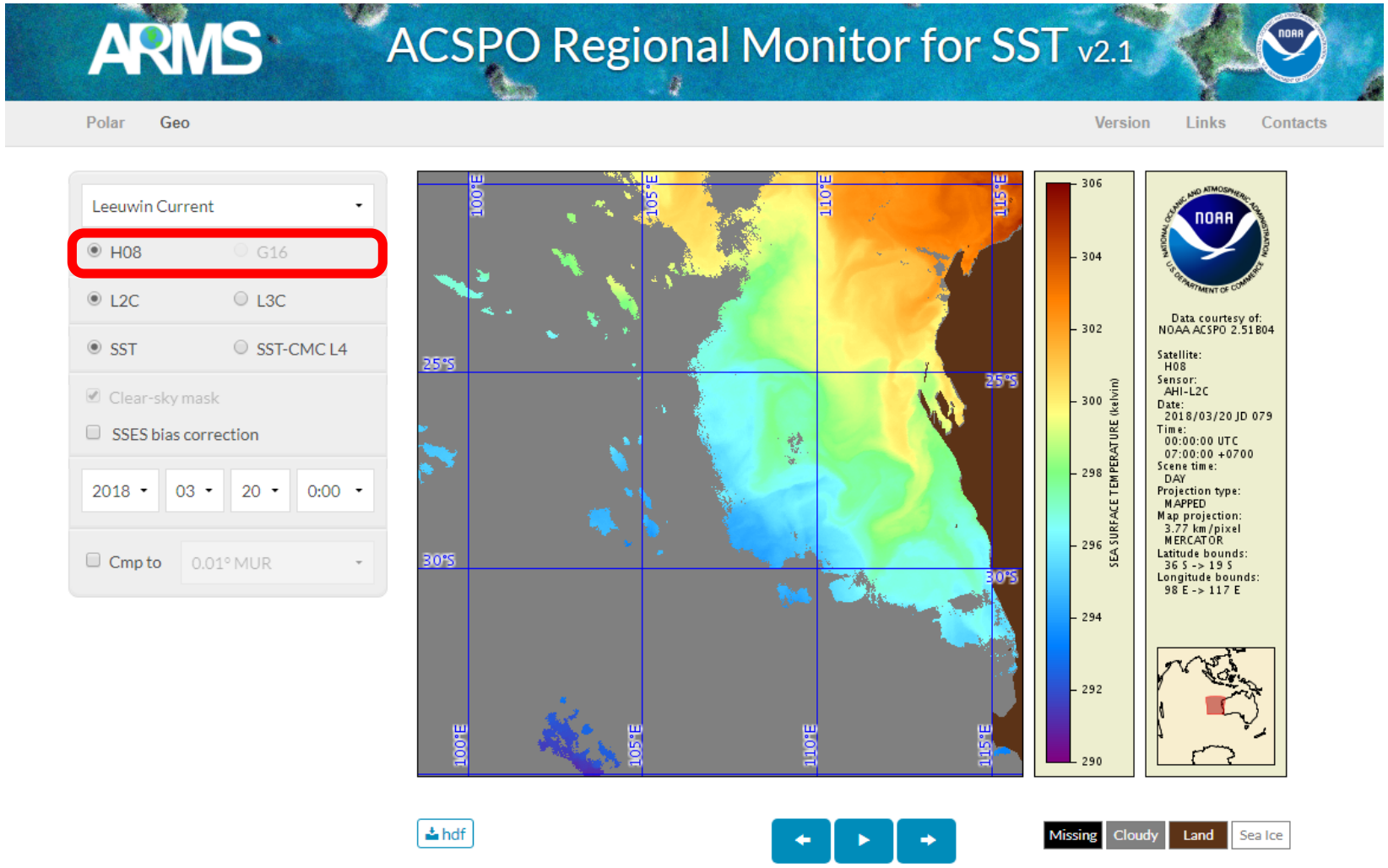
ARMS 2.1 – geostationary

- ✓ 22 regions total: 12 regions for G16 ABI, 10 for H08 AHI
- ✓ Hourly collated L2 and L3 geostationary SSTs monitored



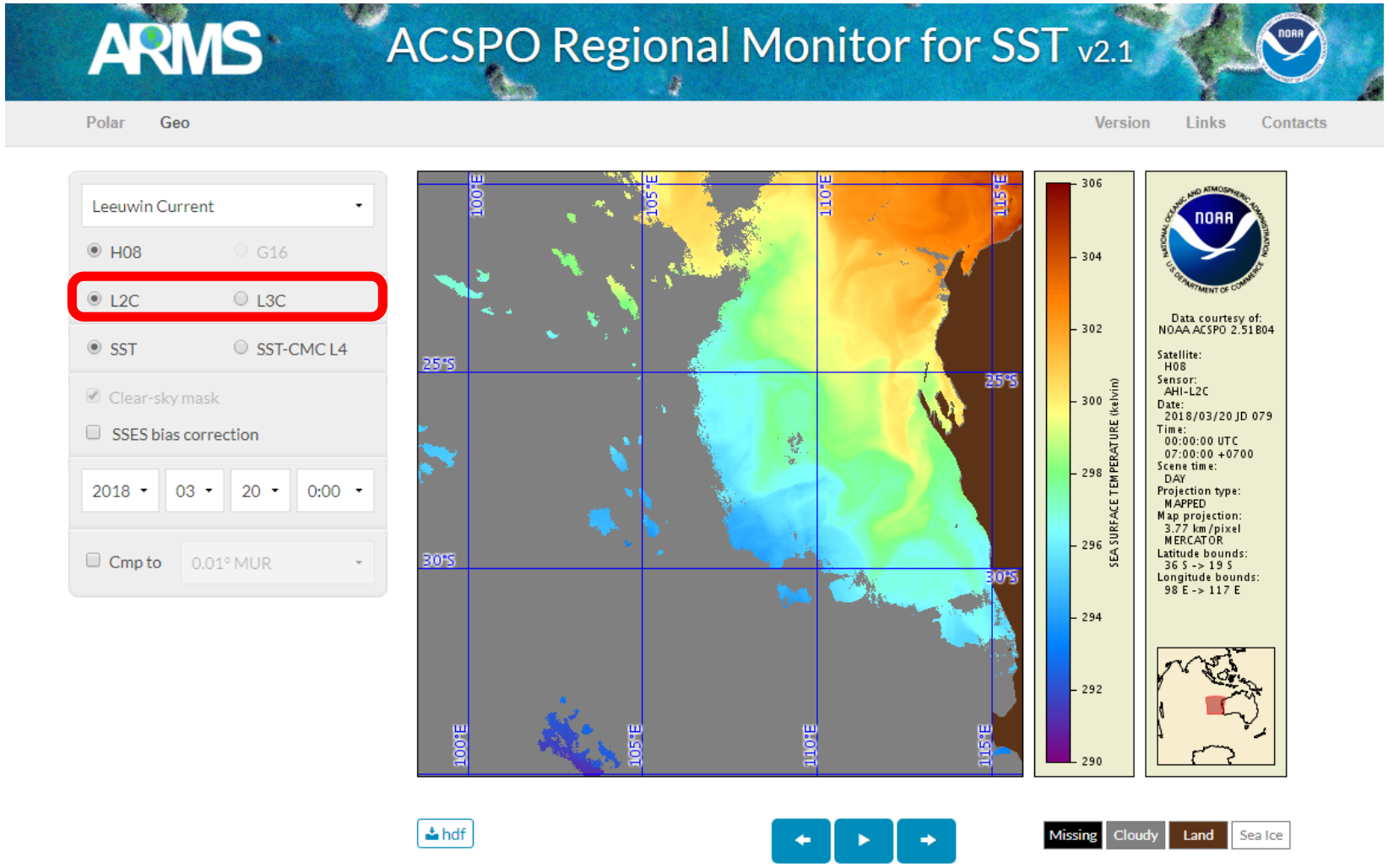
ARMS v2.1 – geostationary

- ✓ 22 regions total: 12 regions for G16 ABI, 10 for H08 AHI
- ✓ The available sensor is automatically selected with region



ARMS v2.1 – geostationary

- ✓ L2C: hourly collated geostationary L2P SSTs, see Matt's presentation Thu AM
- ✓ L3C: gridded L2C (using the current L3U code)



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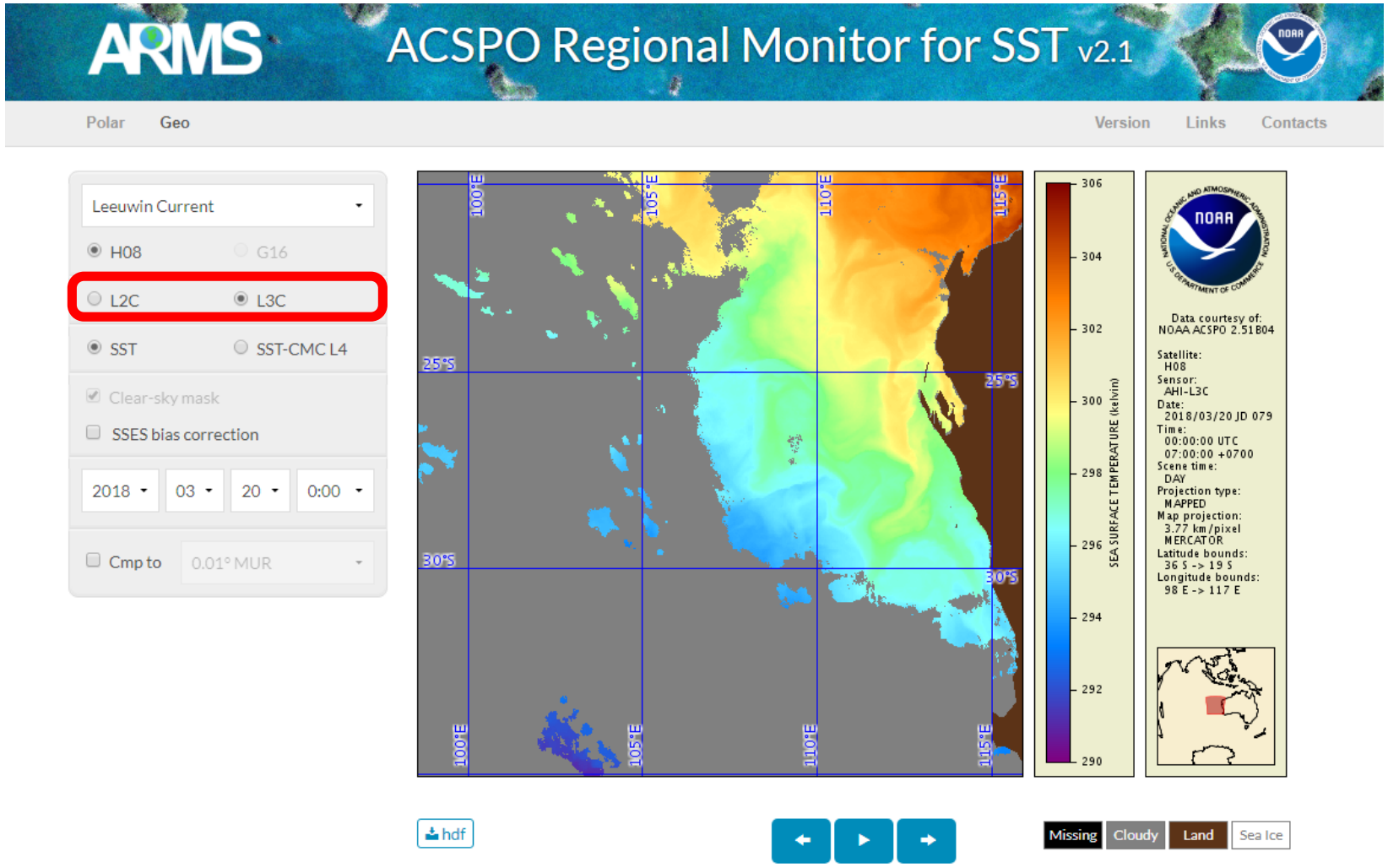
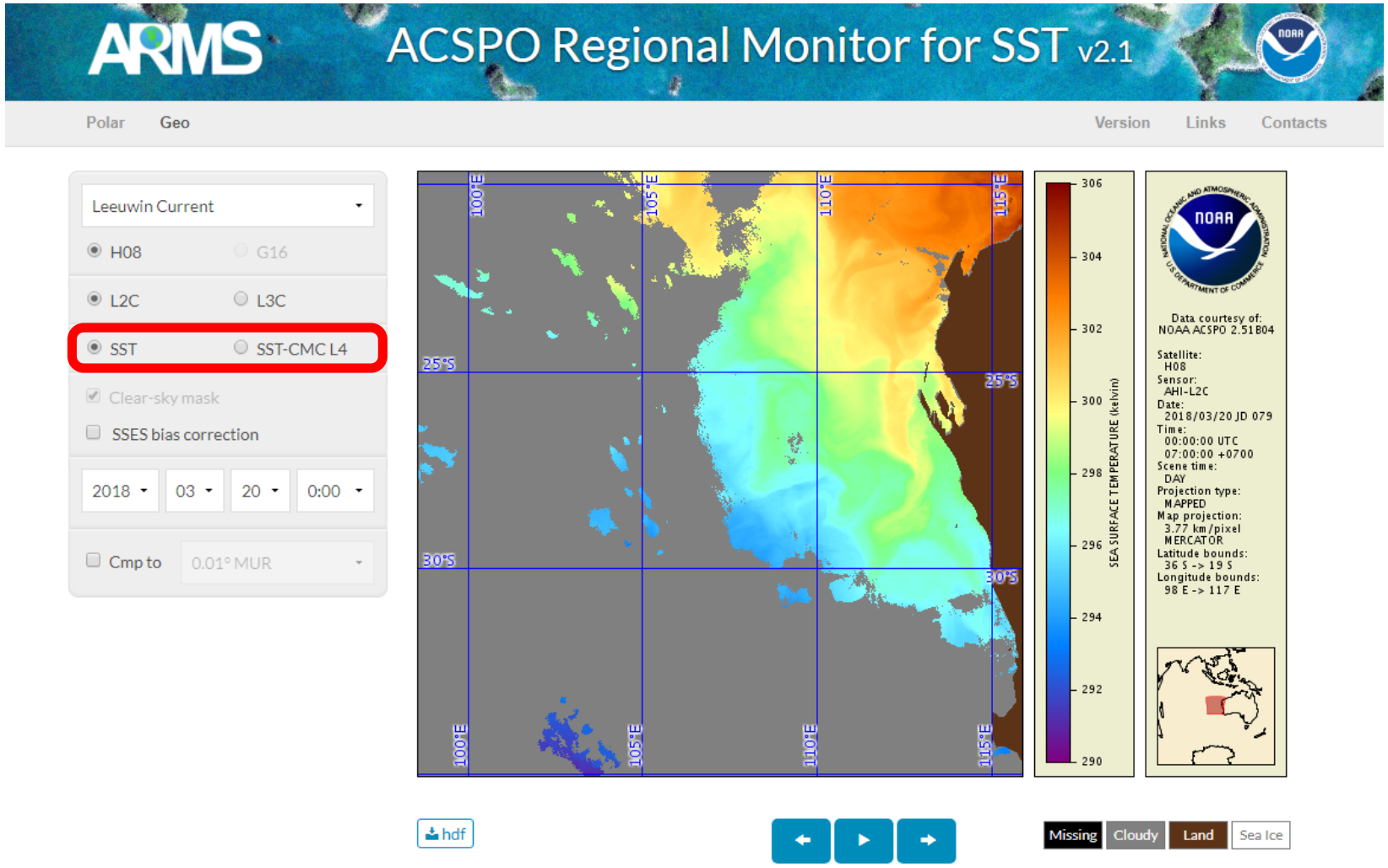


ARMS v2.1 – geostationary

- ✓ SST and ΔSST (SST – CMC L4) available
- ✓ Only clear-sky masked SST available for L2C and L3C



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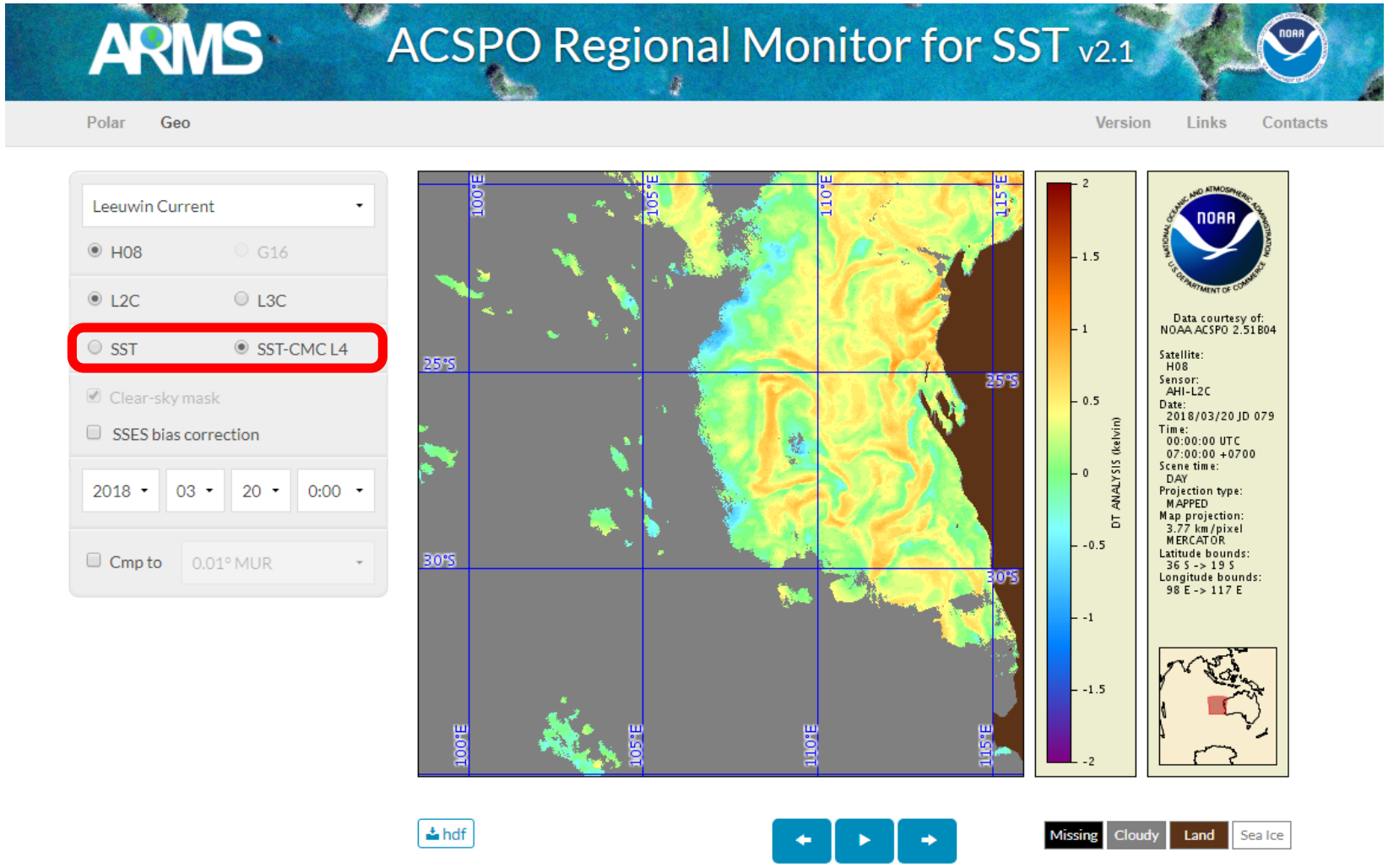
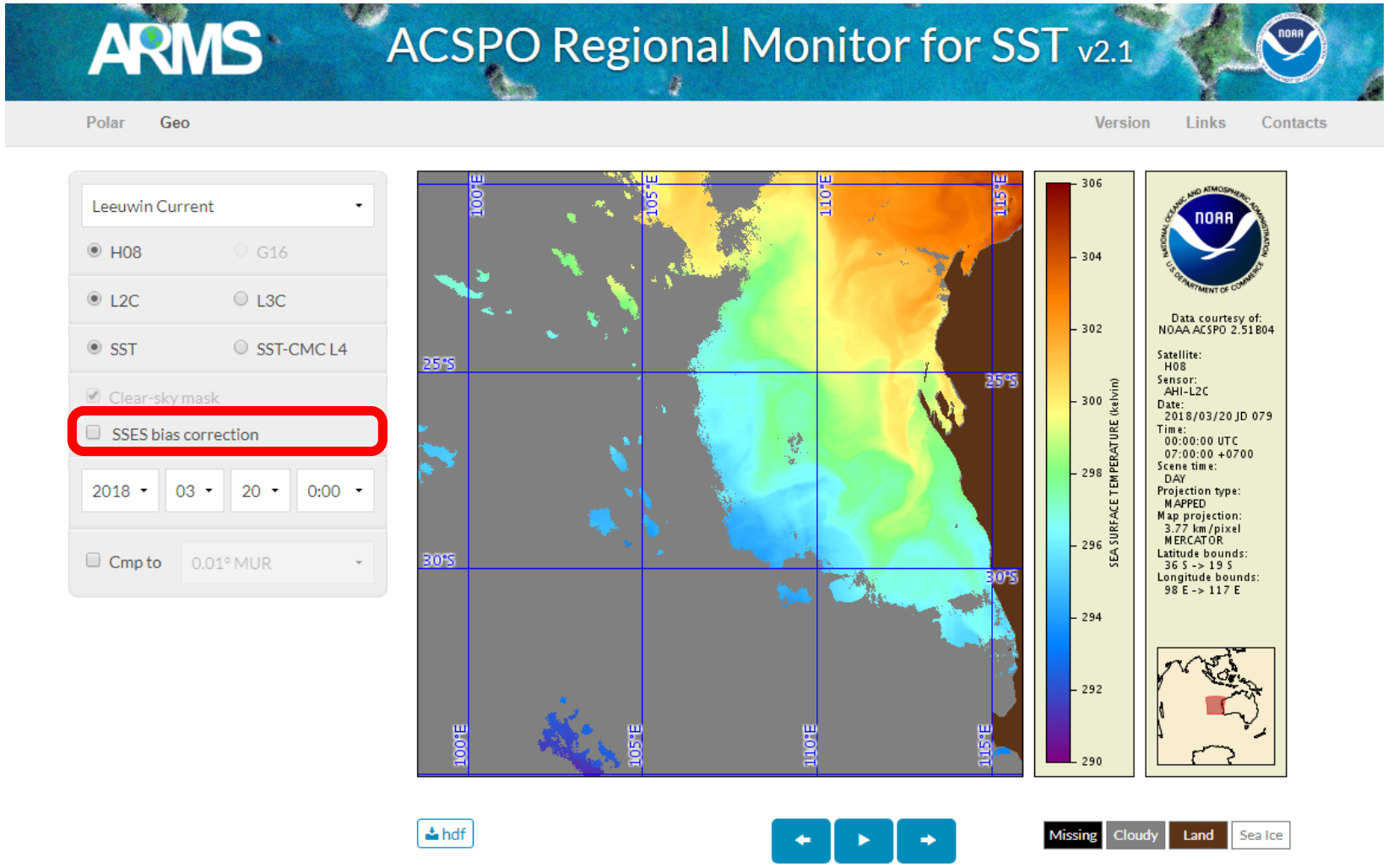


ARMS v2.1 – geostationary

- ✓ SSES bias correction reduces errors in SST due to regional biases/effects of residual cloud/view zenith angle/diurnal warming



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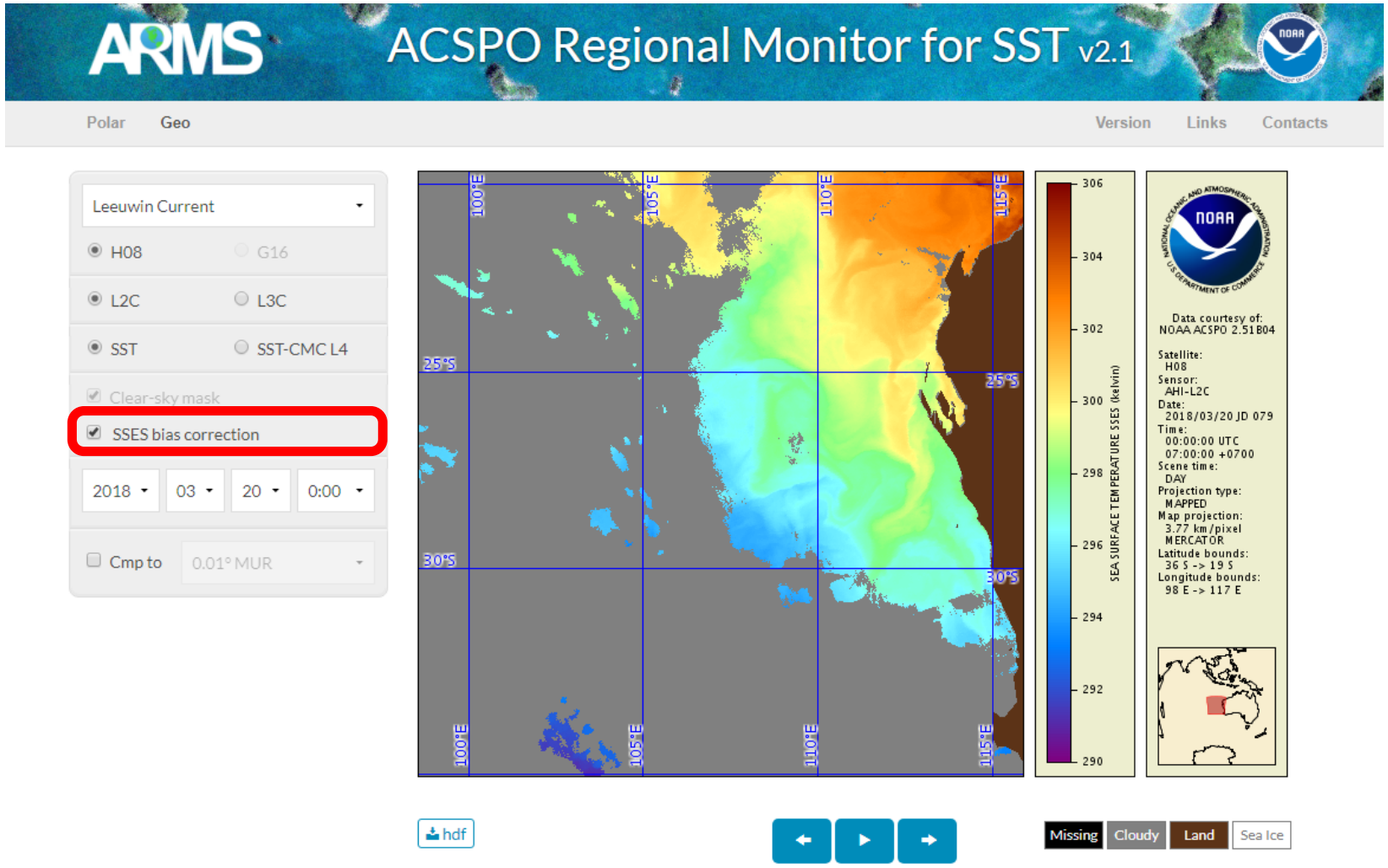
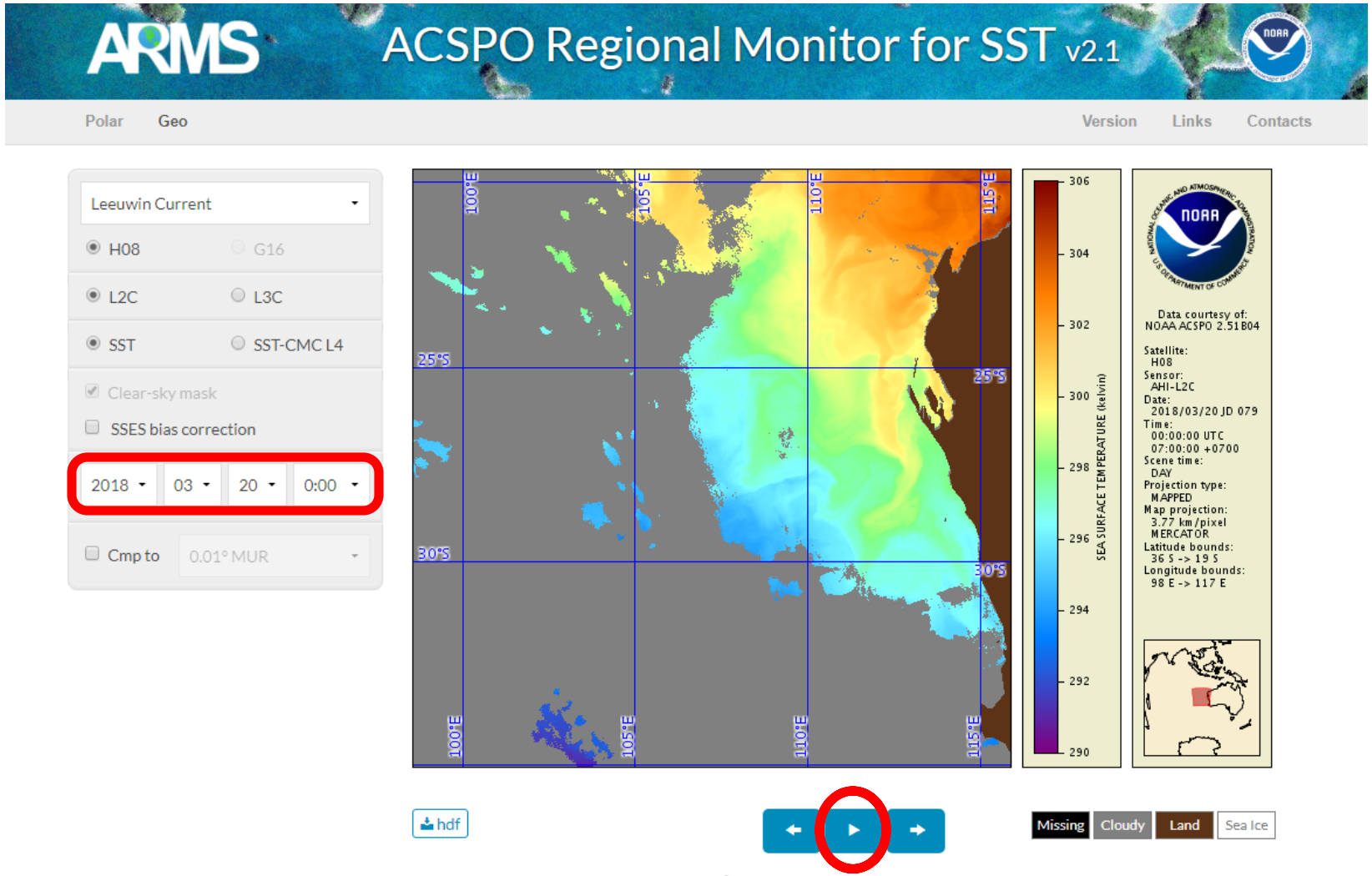


ARMS v2.1 – geostationary

- ✓ UTC times from 00 to 23 in step of 1hr
- ✓ Loop over 24hrs is available



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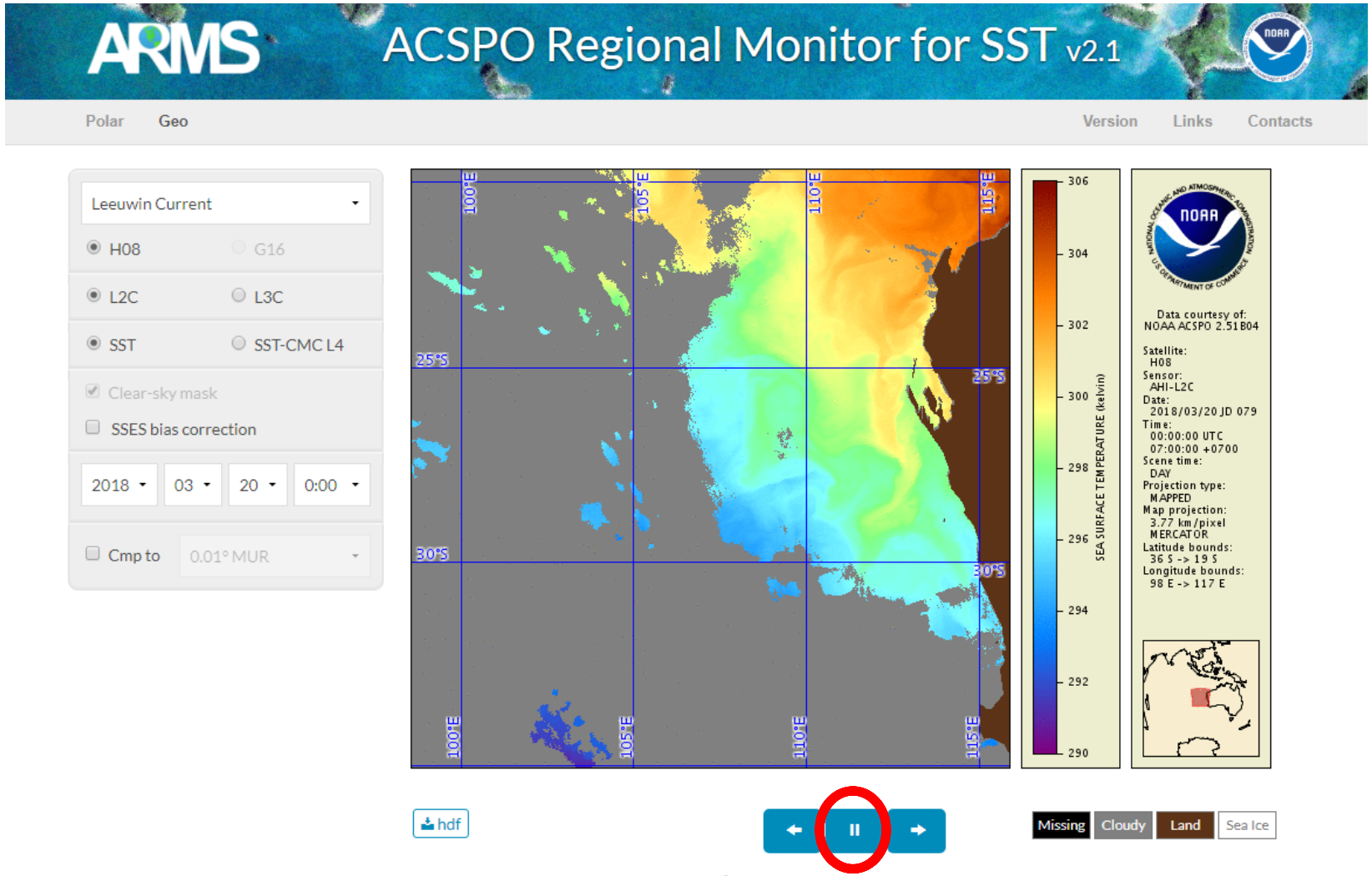
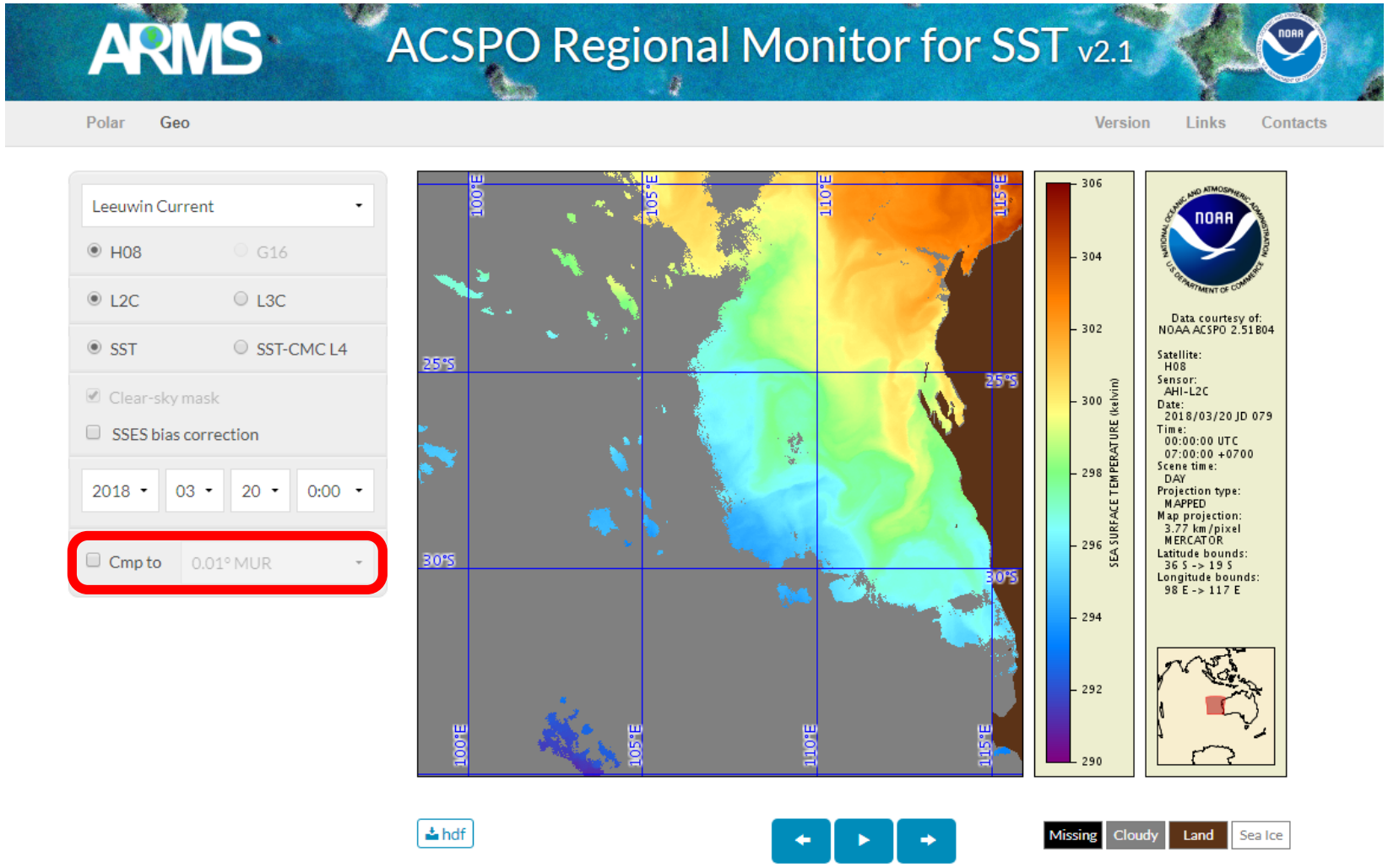


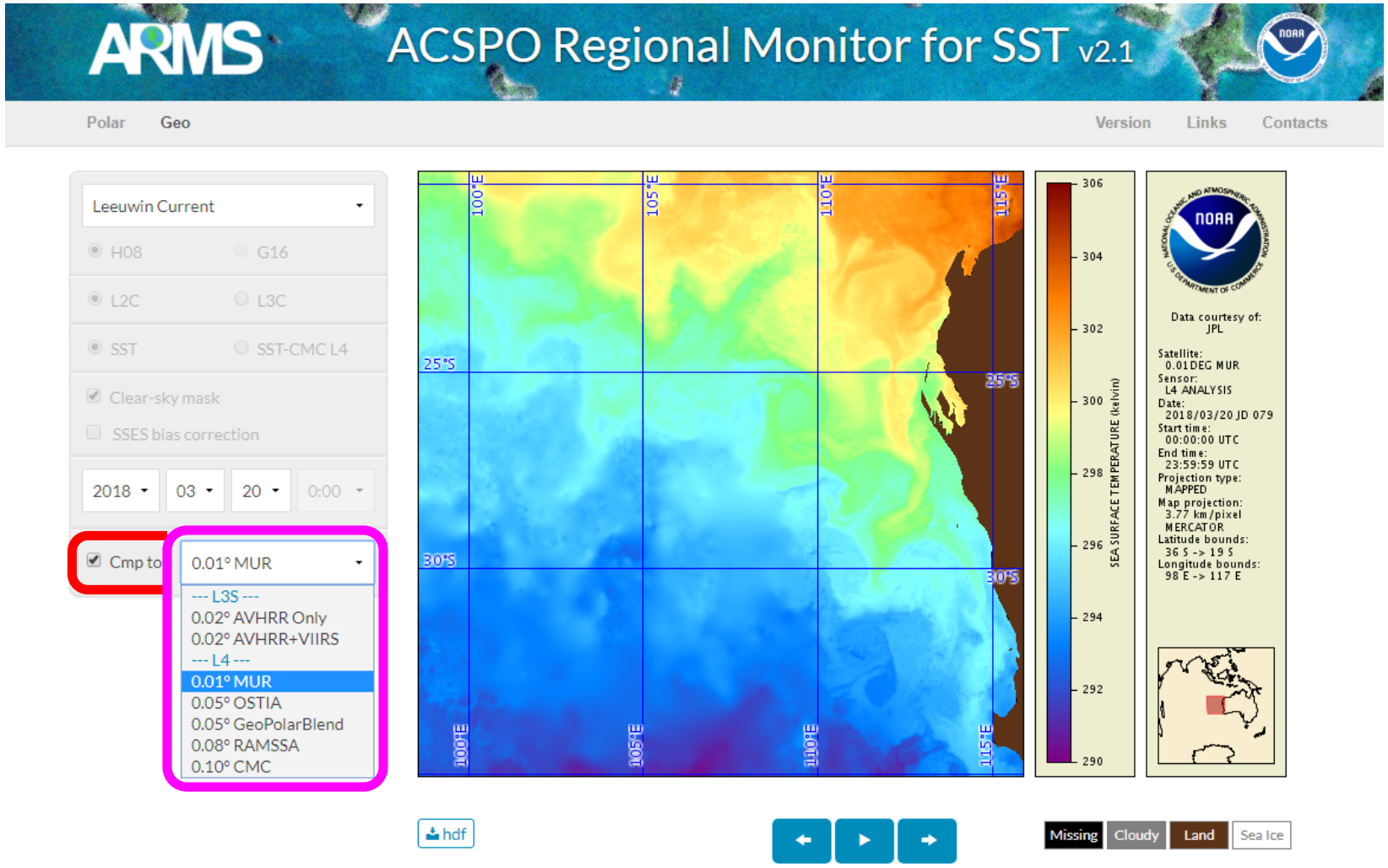
ARMS v2.1 – geostationary

- ✓ Comparison to partners' L4s and L3Ss
- ✓ BoM RAMSSA and L3S available for 6 regions around Australia



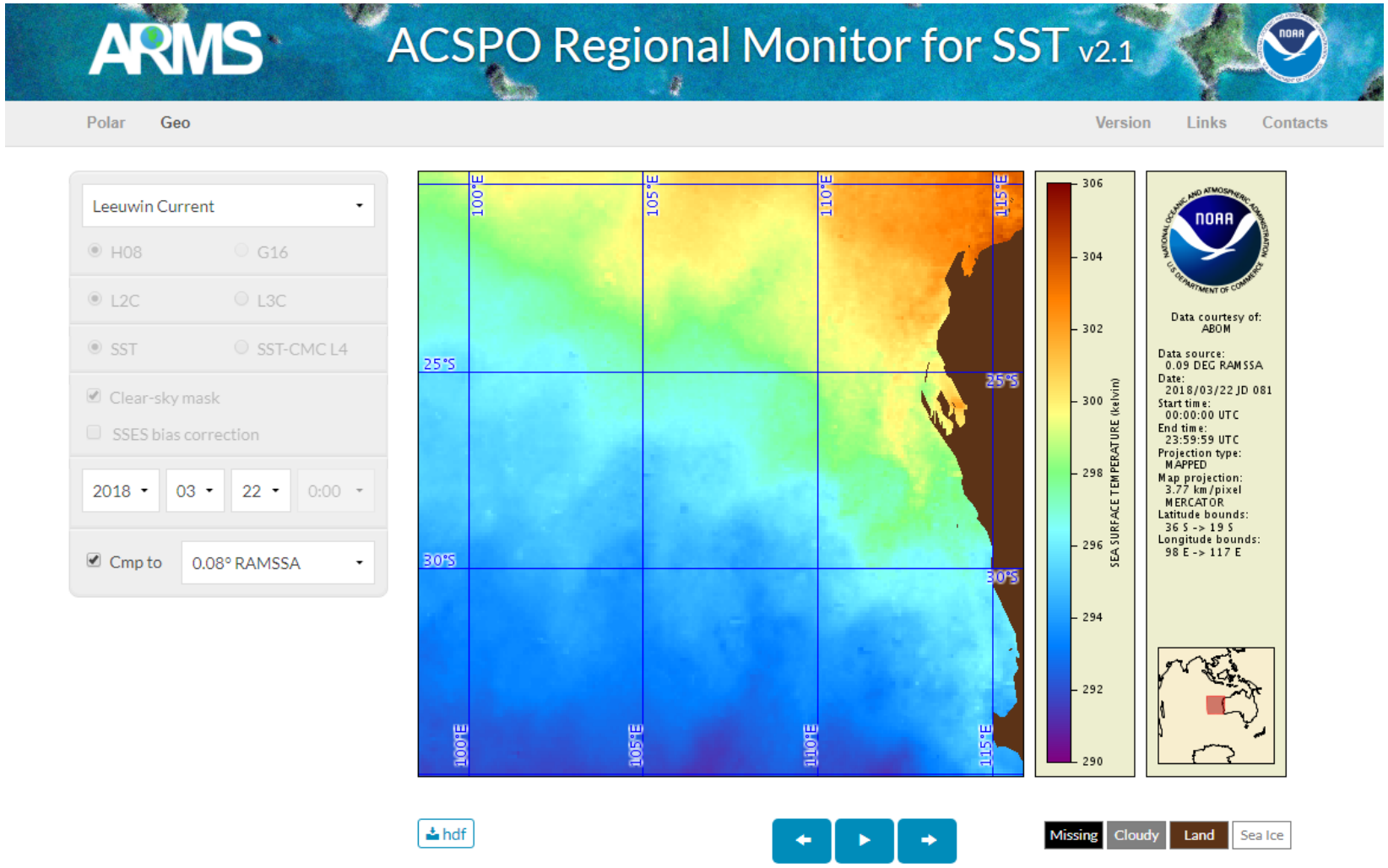
ARMS v2.1 – geostationary

- ✓ 0.01° MUR well reproduces features under clear skies
- ✓ May be less accurate elsewhere



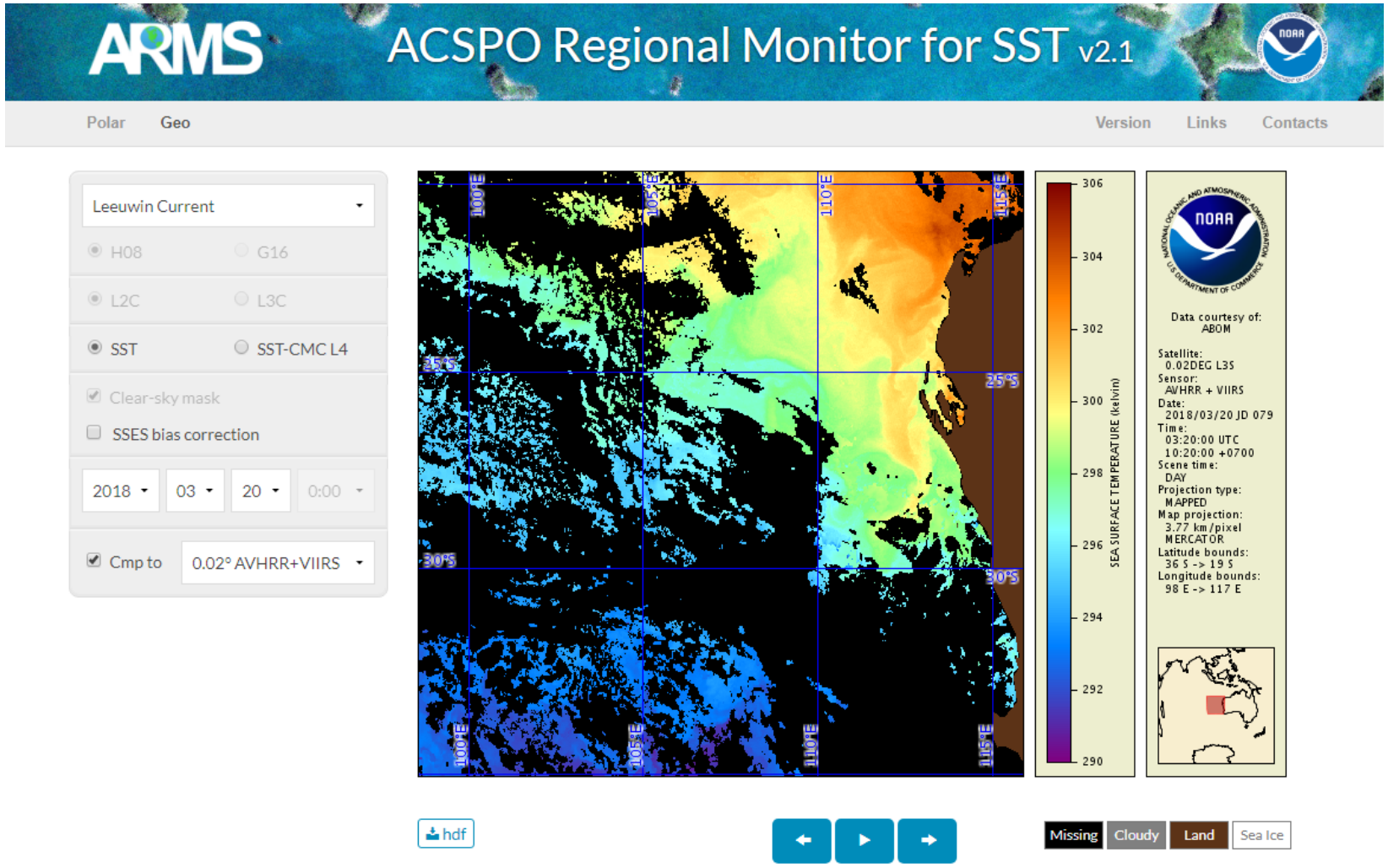
ARMS v2.1 – geostationary

- ✓ 0.08° RAMSSA captures major features under clear skies
- ✓ Shows more noise under clear-skies and elsewhere



ARMS v2.1 – geostationary

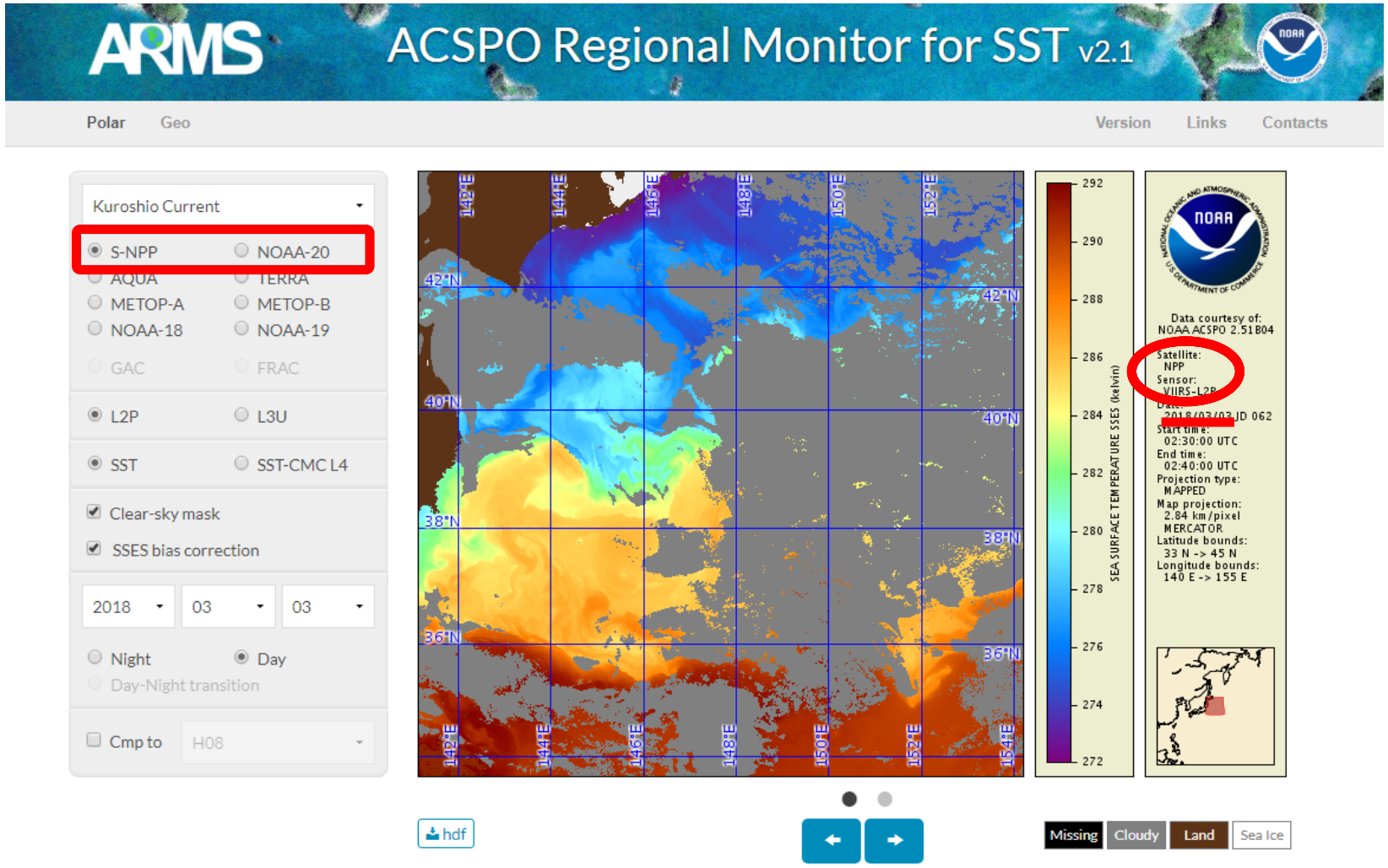
- ✓ BoM L3S: (AVHRR + VIIRS) has larger coverage than (AVHRR-only)
- ✓ Also, it generally tends to preserve features under clear skies



Polar vs. Geo SSTs

ARMS v2.1

- ✓ VIIRS onboard N20 available from 4 Jan 2018
- ✓ The performance is similar to SNPP VIIRS



ARMS v2.1

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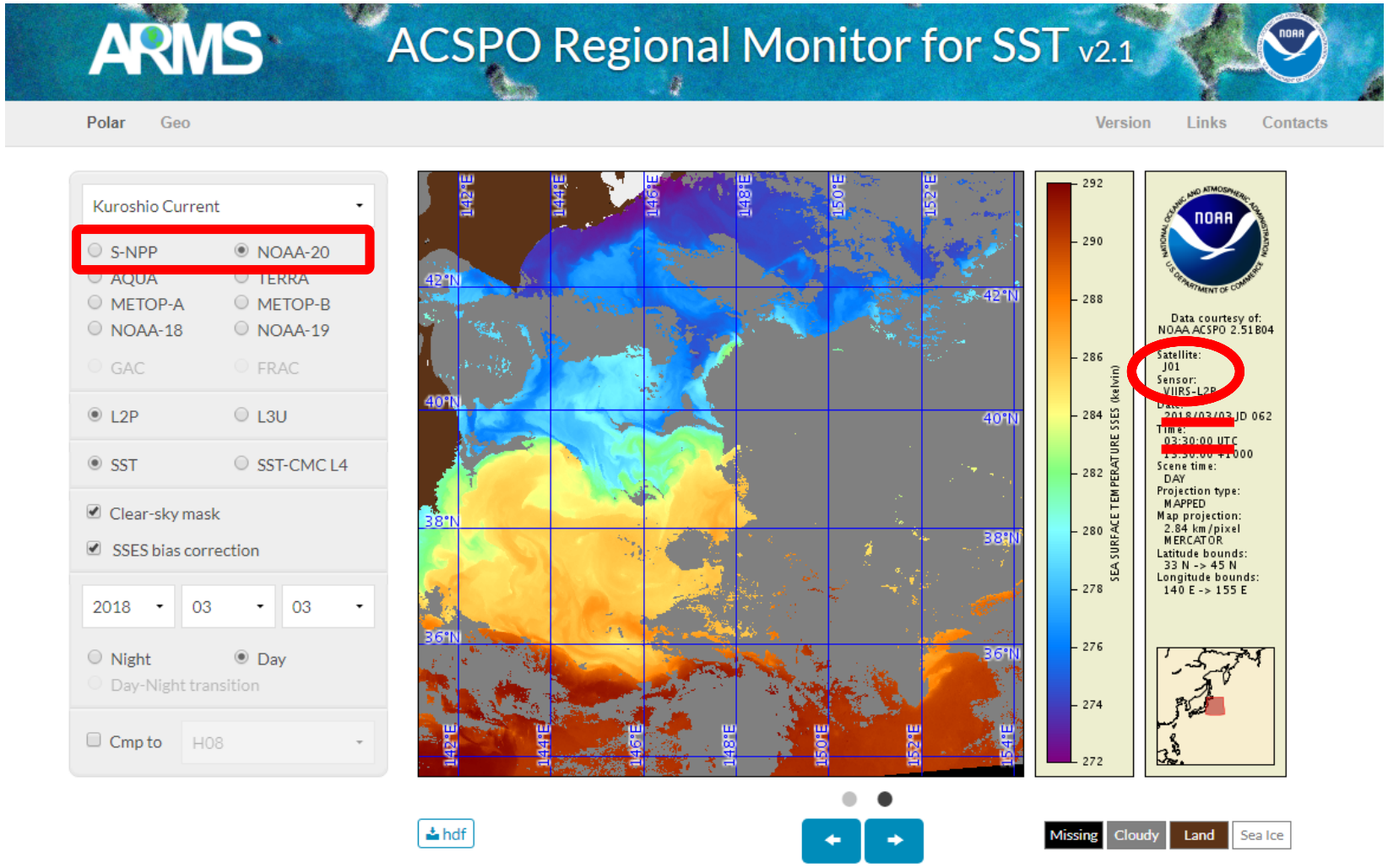
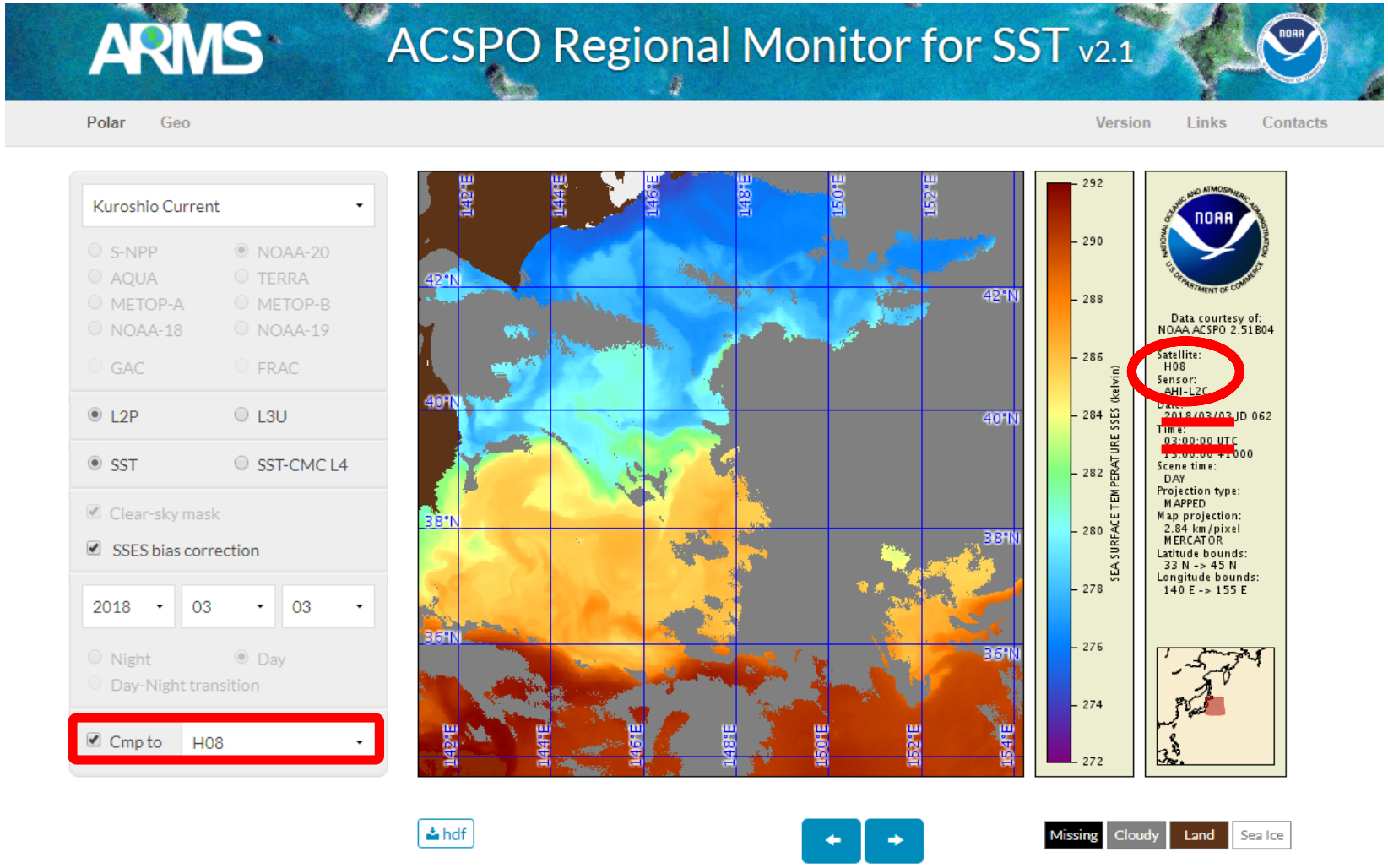


ARMS v2.1

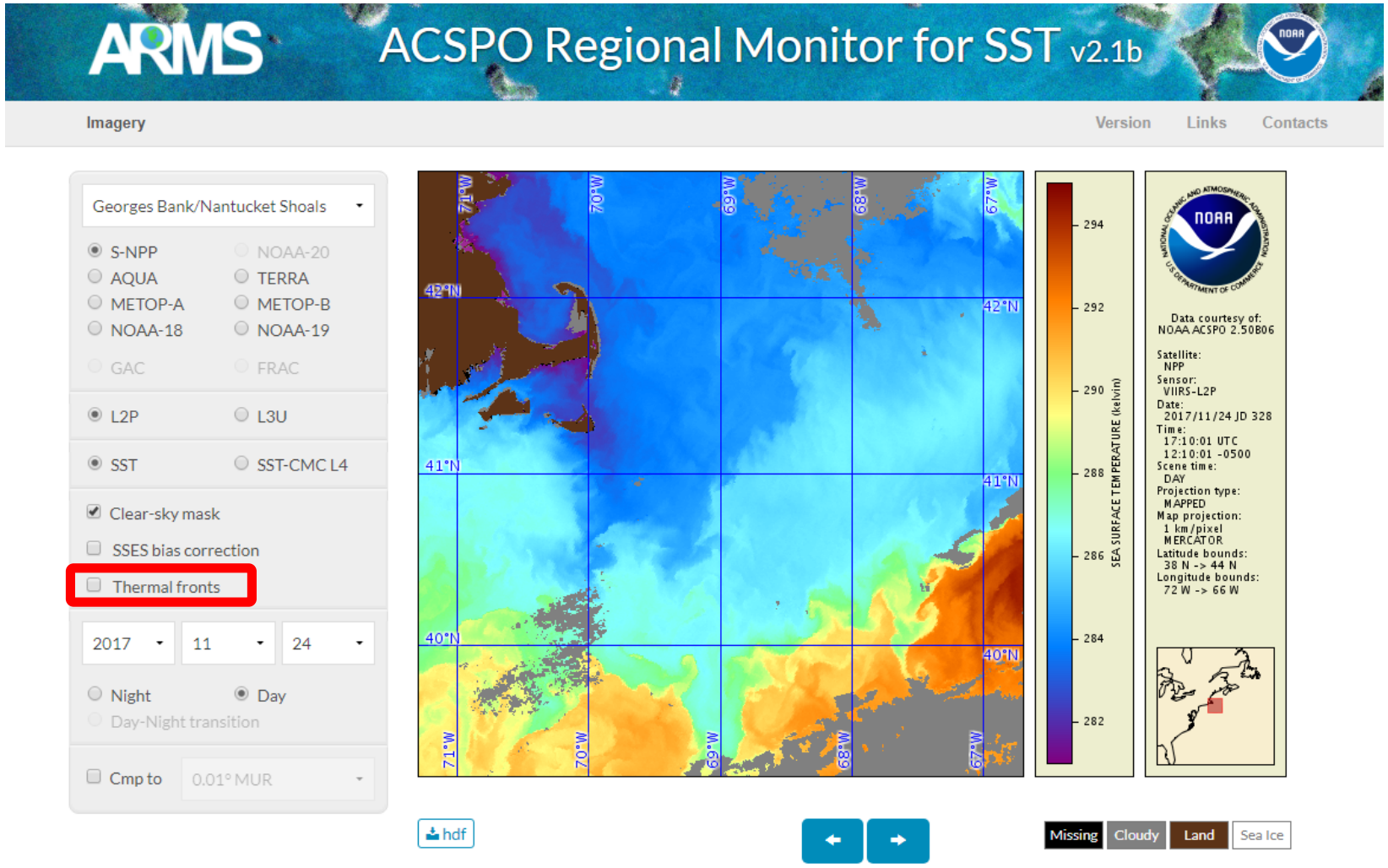
- ✓ Comparison to geostationary L2C/L3C available
- ✓ The geo SST with closest time is displayed for comparison



Future work: Thermal fronts (Currently under testing)

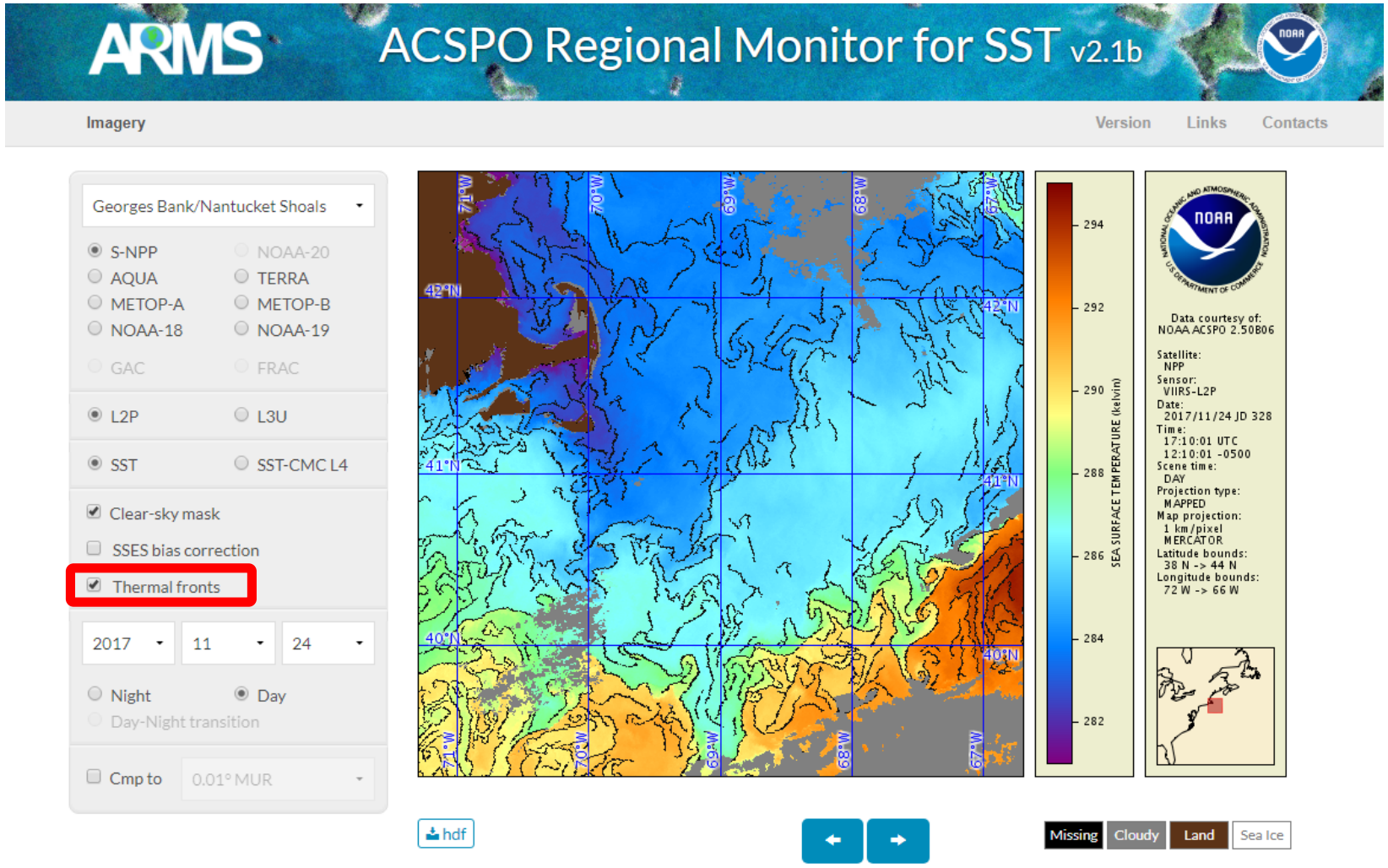
ARMS v2.1 – thermal fronts

✓ Thermal fronts are available in one of ARMS testing page



ARMS v2.1 – thermal fronts

✓ Four regions: Chesapeake Bay, Georges Bank/Nantucket Shoals, Monterey Bay, Southern GBR



Conclusion

Status of ARMS

- # of polar regions=29; geo regions=22 (12 ABI + 10 AHI). 5 L4 SSTs. 2 BoM L3S
- Geo page is instrumental to verify performance of G16/H08 SST
- L3U and SSES bias-corrected SSTs are available for all platforms
- Page response time is sufficient to perform product analyses/comparisons

Observations

- Geo collated SST coverage/performance is comparable to polar
- All L2/3s suffer from residual problems with cloud (leakages, false alarms) and ice masks, SST (residual VZA- & cross-sensor biases), SSES algorithms
- L3U is high quality: feature resolution comparable to or better than L2P
- ARMS provides useful feedback to L4 and L3S partners

Future Work

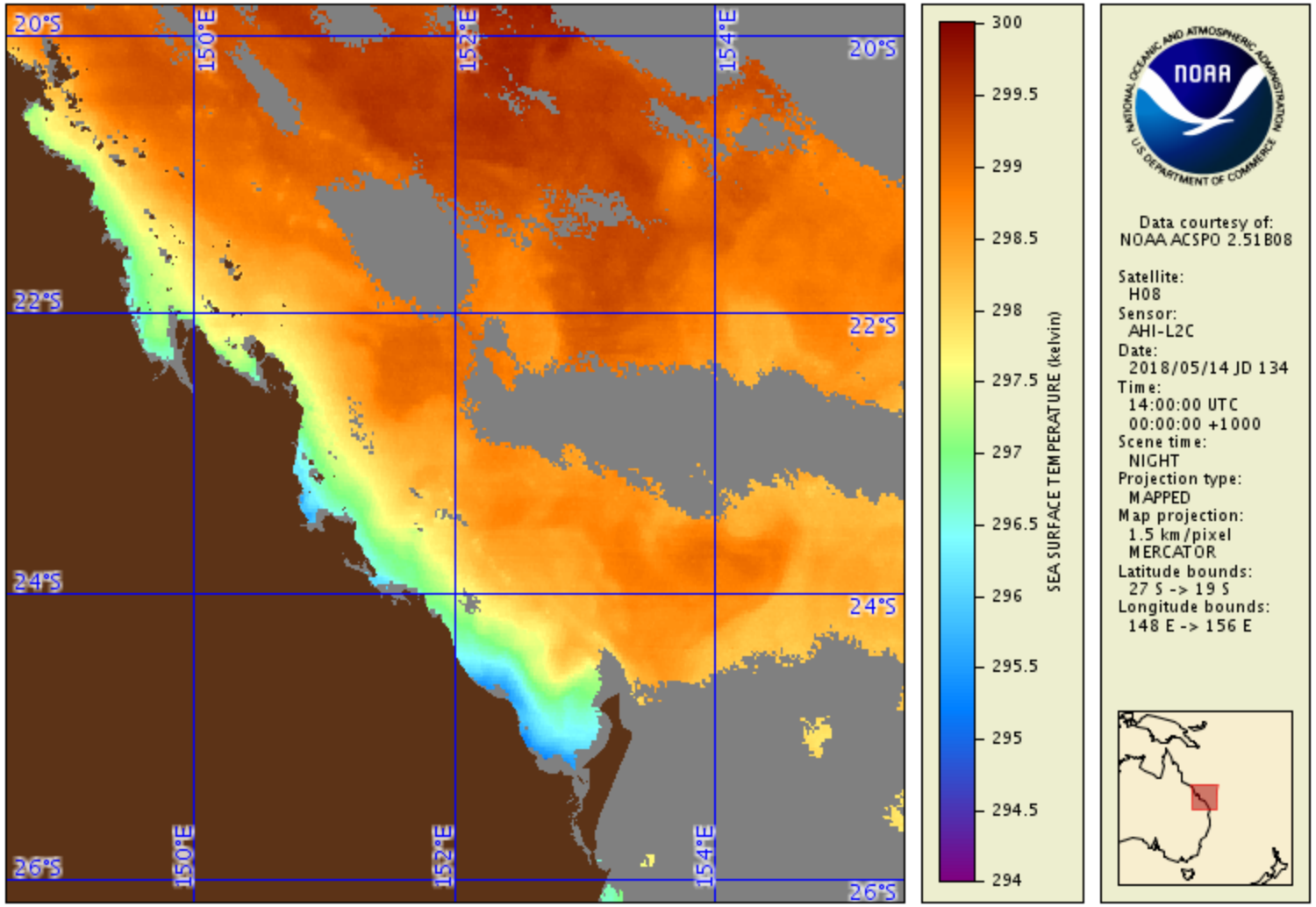
- Add G17, Metop-C and Reanalysis SSTs, once data become available
- Work with users, and make additions/revisions to ARMS as needed

Thank you!

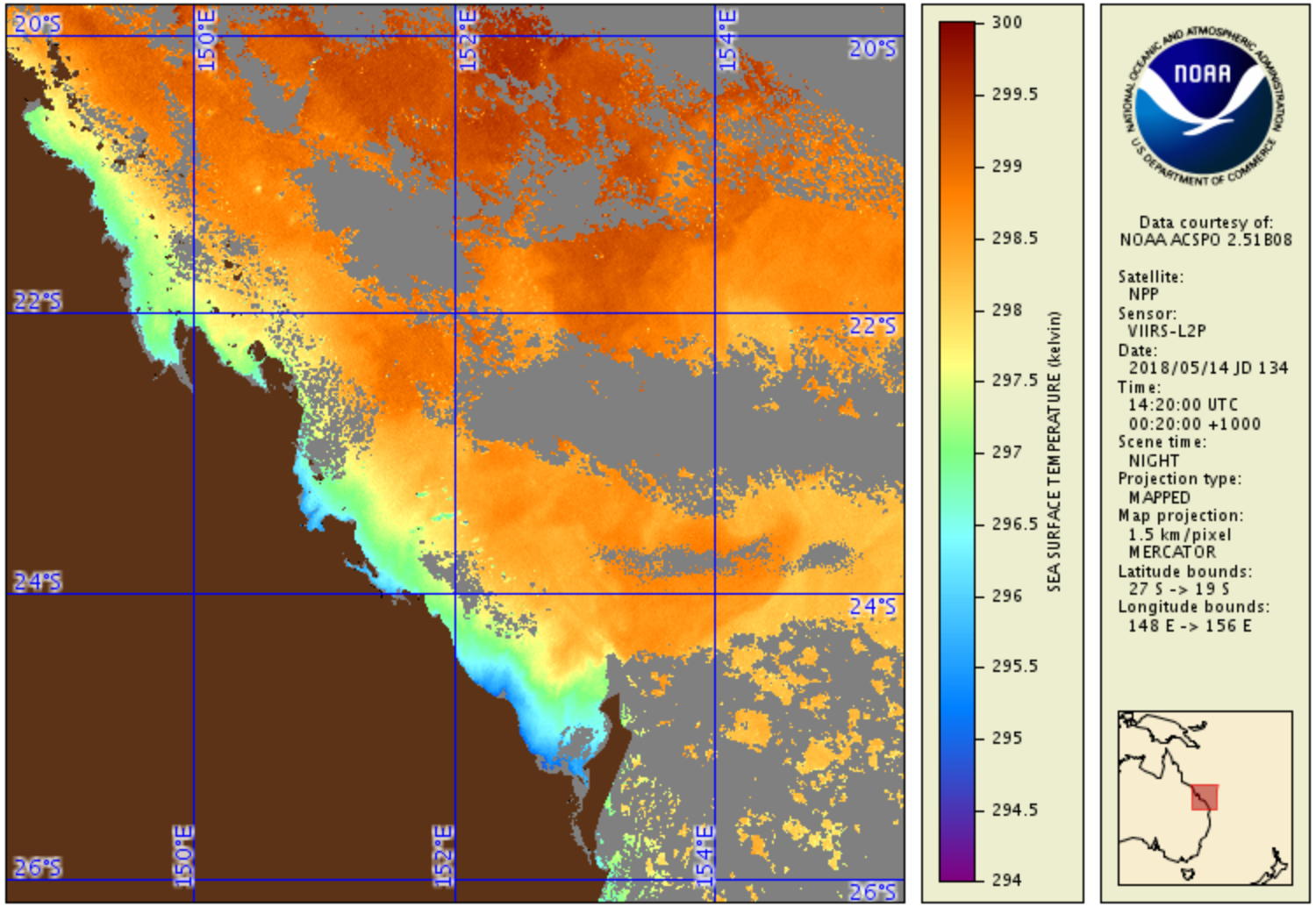
Back-Up Slides

Great Barrier Reef
from Geo, Polar, L3S and L4s

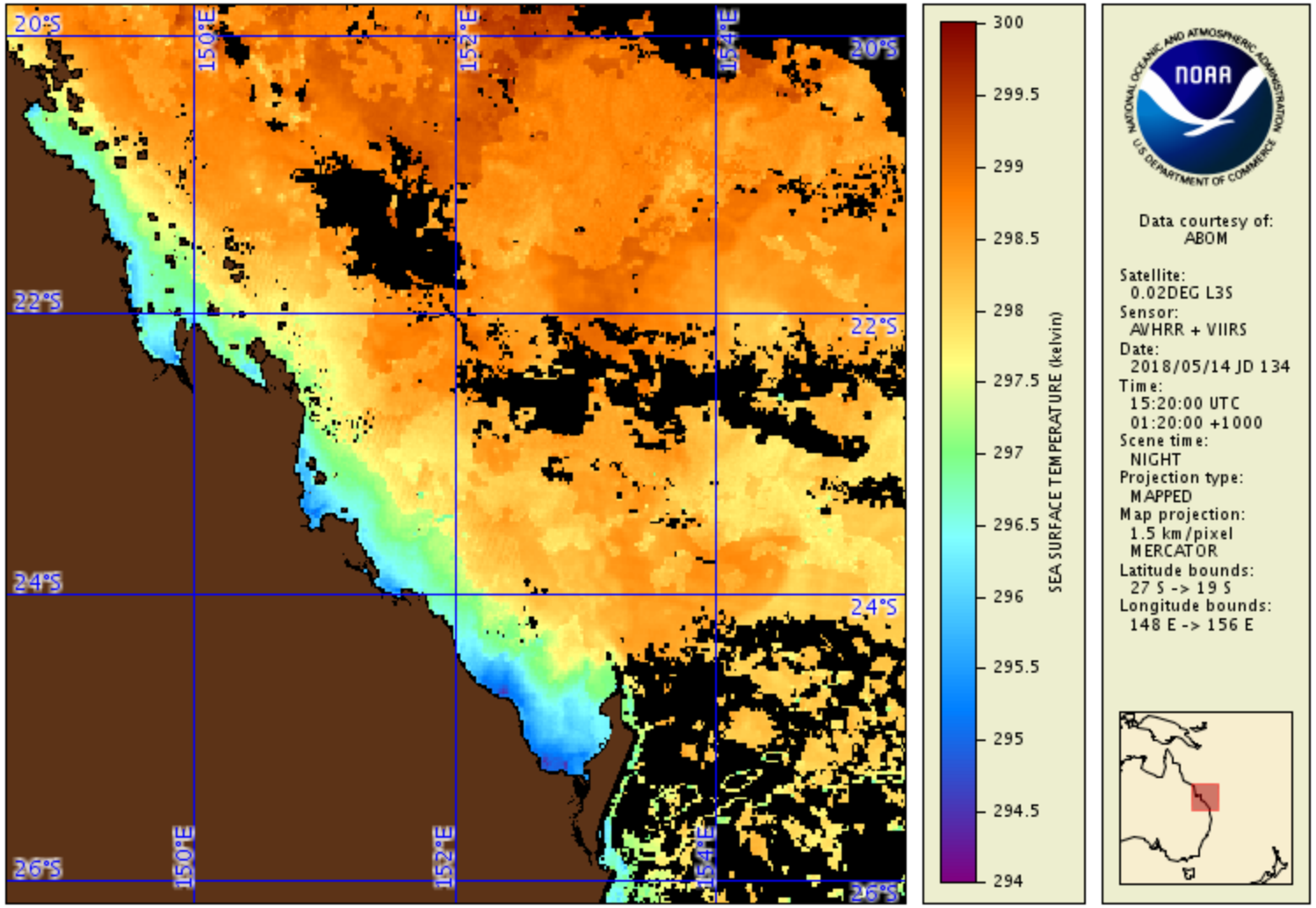
22 May 2018 – H08 AHI



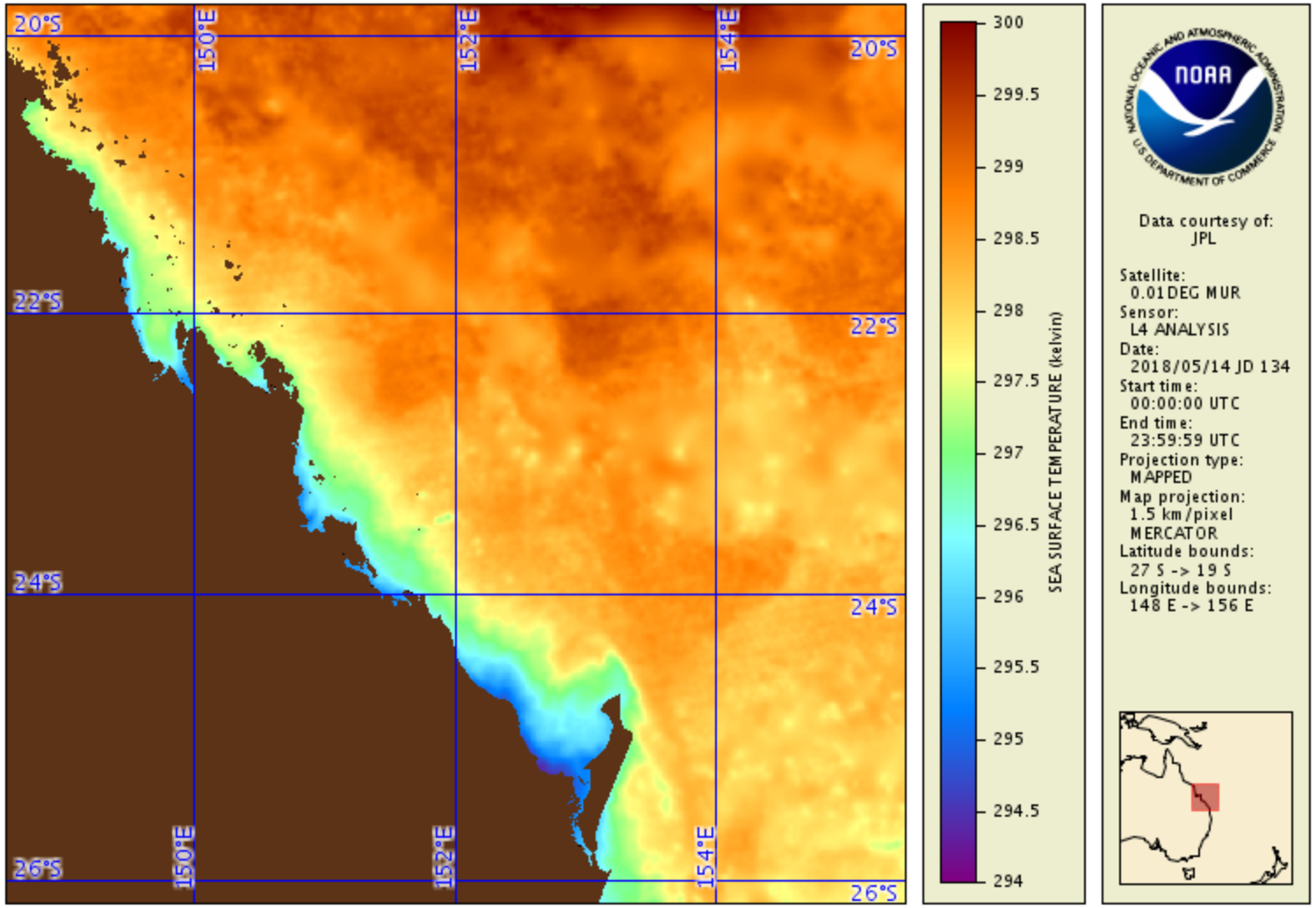
14 May 2018 – SNPP VIIRS Night



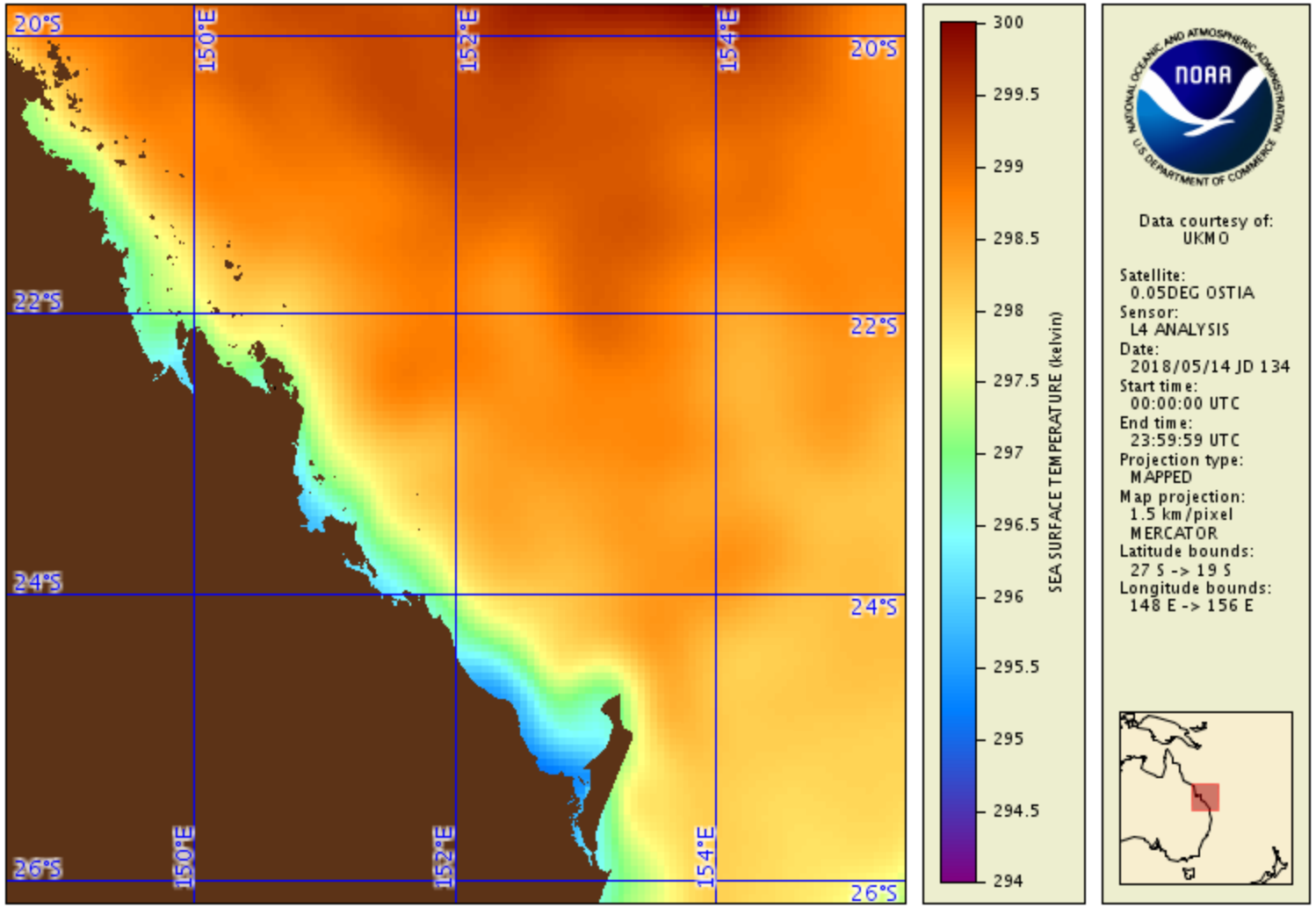
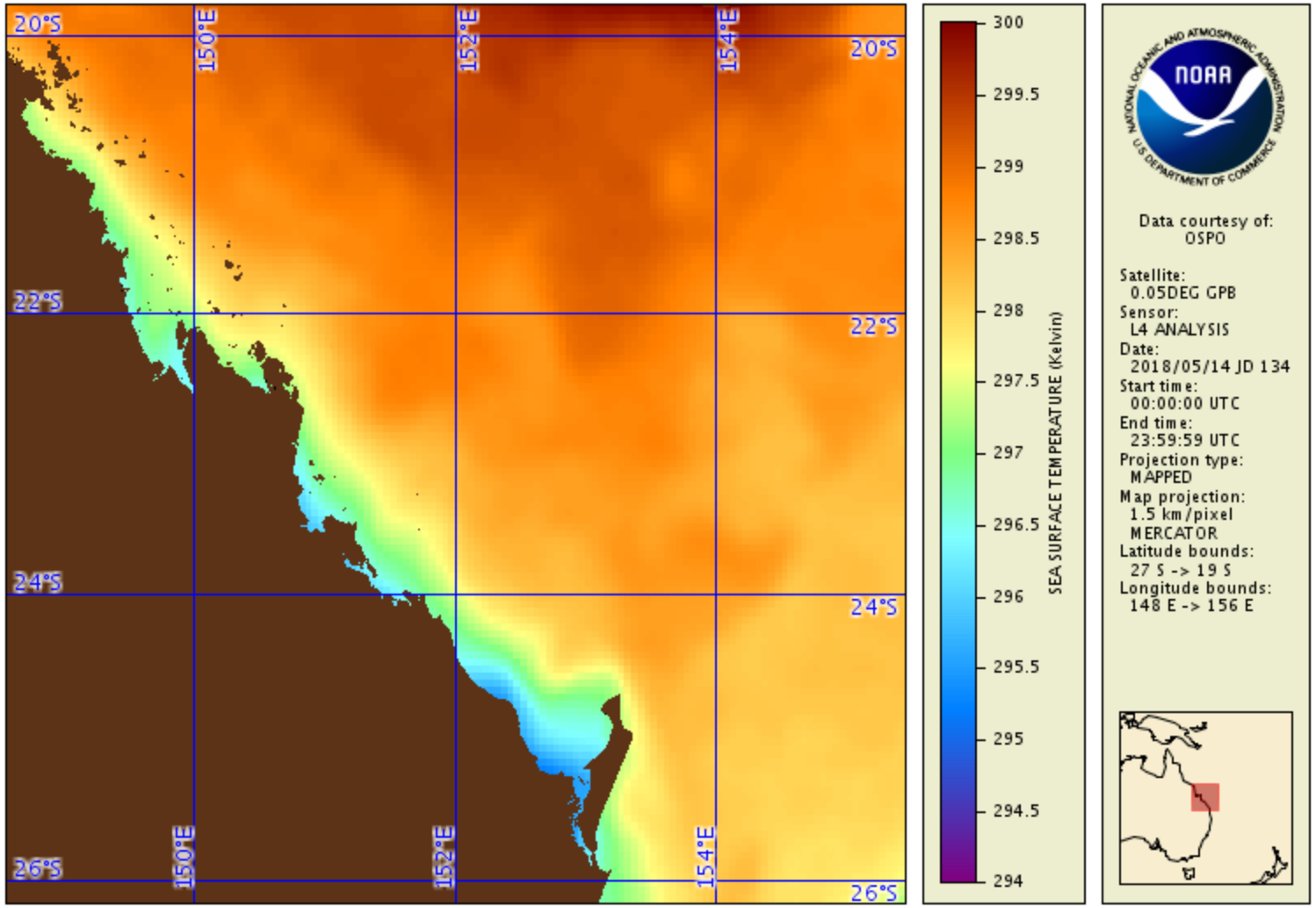
22 May 2018 – BoM (AVHRR+VIIRS) L3S Night



22 May 2018 – MUR



22 May 2018 – OSTIA



22 May 2018 – NOAA Geo-Polar Blend