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

www.star.nesdis.noaa.gov/sod/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 more regional focus was recommended by the Joint Polar Satellite System (JPSS) Program Office

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

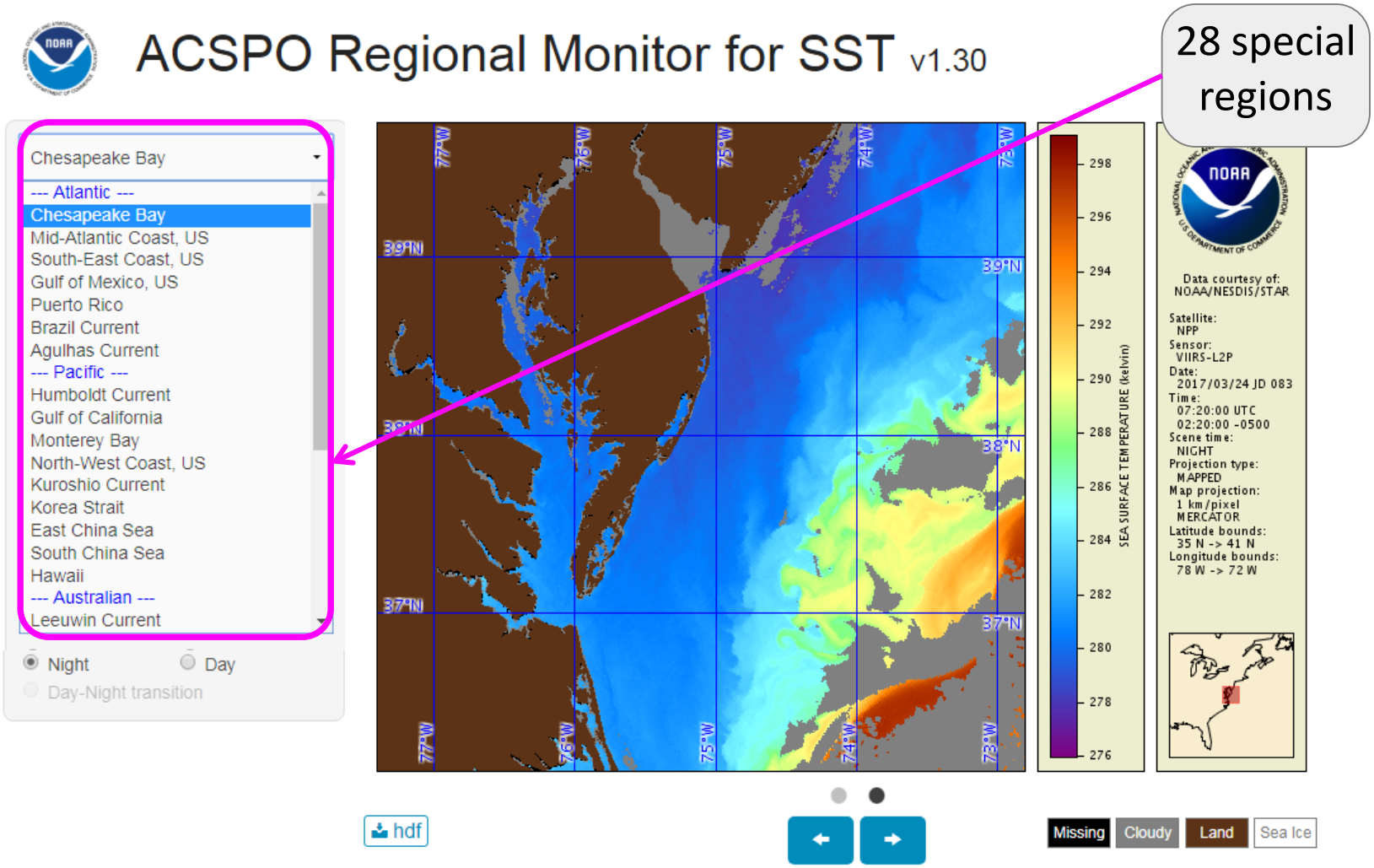
What is ARMS?

1. **A part of the NOAA SST Monitoring system, focusing on challenging areas, most interesting to data users & producers**
   - Coastal/Internal waters
   - Dynamic areas
   - High-latitudes
   - Cloudy regions
2. **Monitors regional performance of ACSPO SST & clear-sky mask**
3. **Checks for image quality, accuracy & consistency**
4. **Compares polar vs. geo ACSPO SSTs**
   - Himawari-8 AHI
   - GOES-16 ABI
5. **Compares ACSPO L2/L3 SSTs with several hi-res L4 SSTs**
   - 0.01° JPL MUR
   - 0.05° Met Office OSTIA
   - 0.05° NOAA Geo Polar Blended
   - 0.09° RAMSSA
   - 0.10° Canadian Met Centre CMC

Regions in ARMS

Regions in ARMS

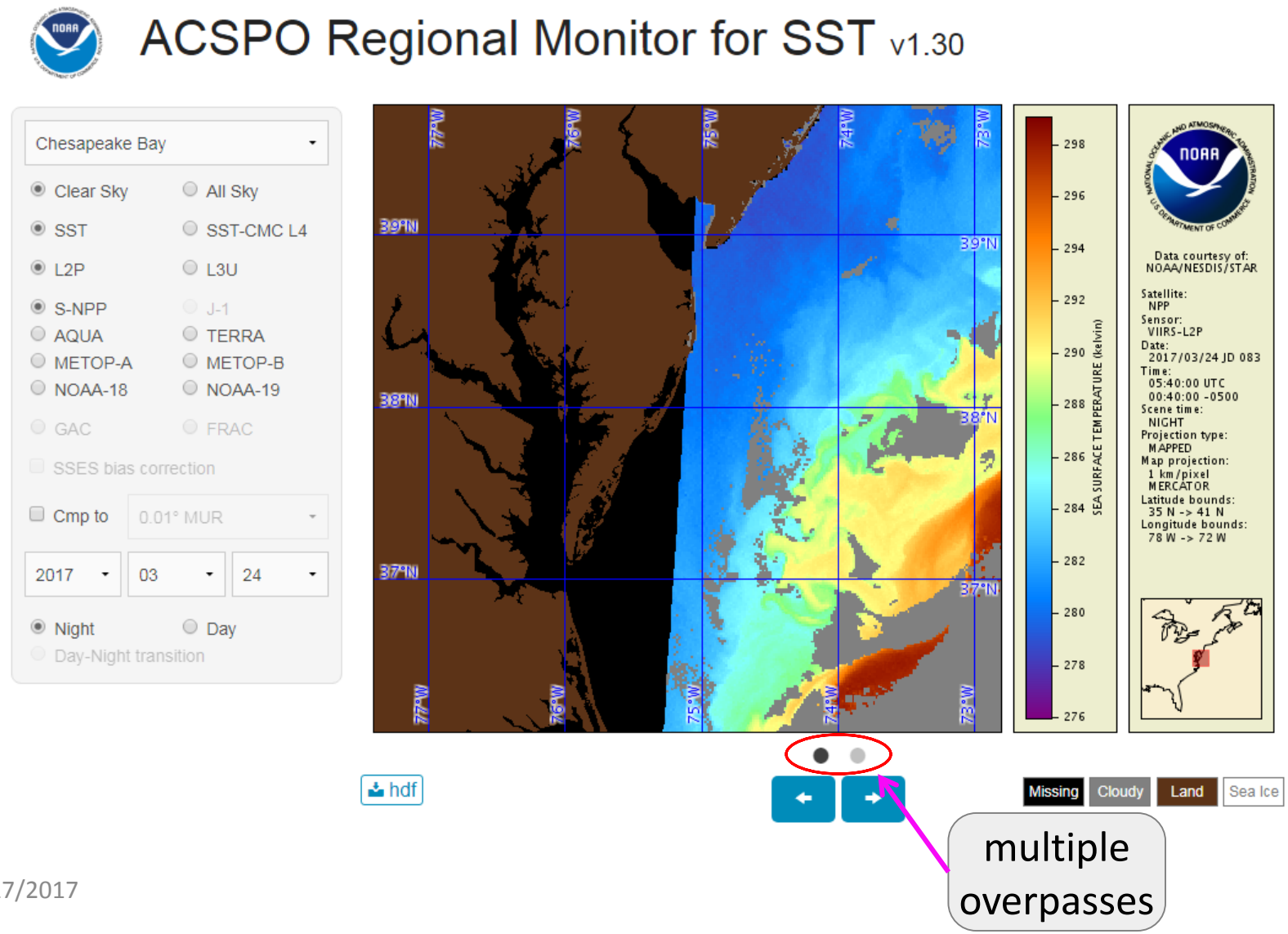
- ✓ Currently, ARMS includes 20 special regions (can be changed/expanded based on users needs)



Multiple Overpasses

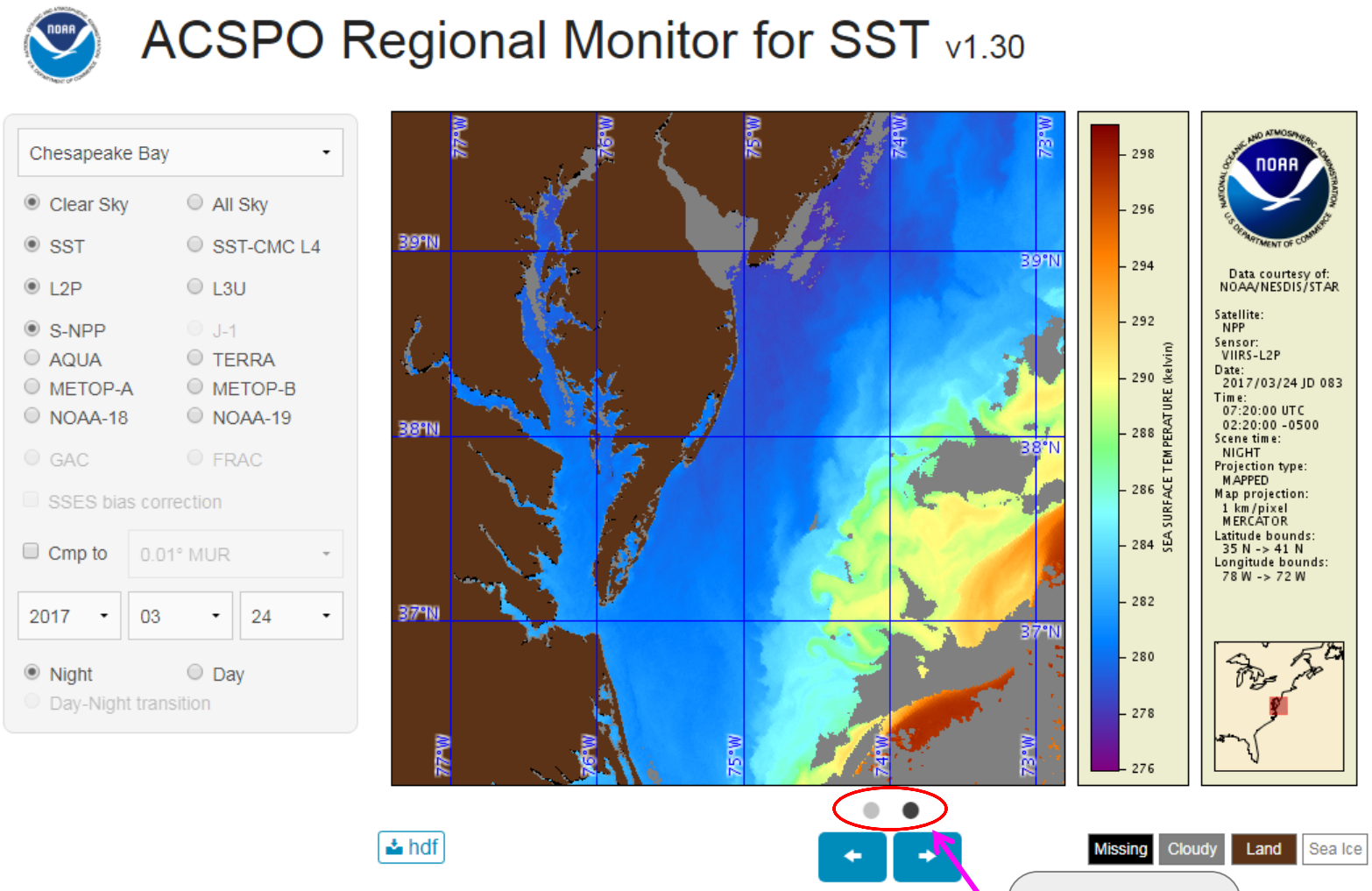
Multiple Overpasses

- ✓ Polar satellite may overfly the same region twice per day/night (or more, in high latitudes)



Multiple Overpasses

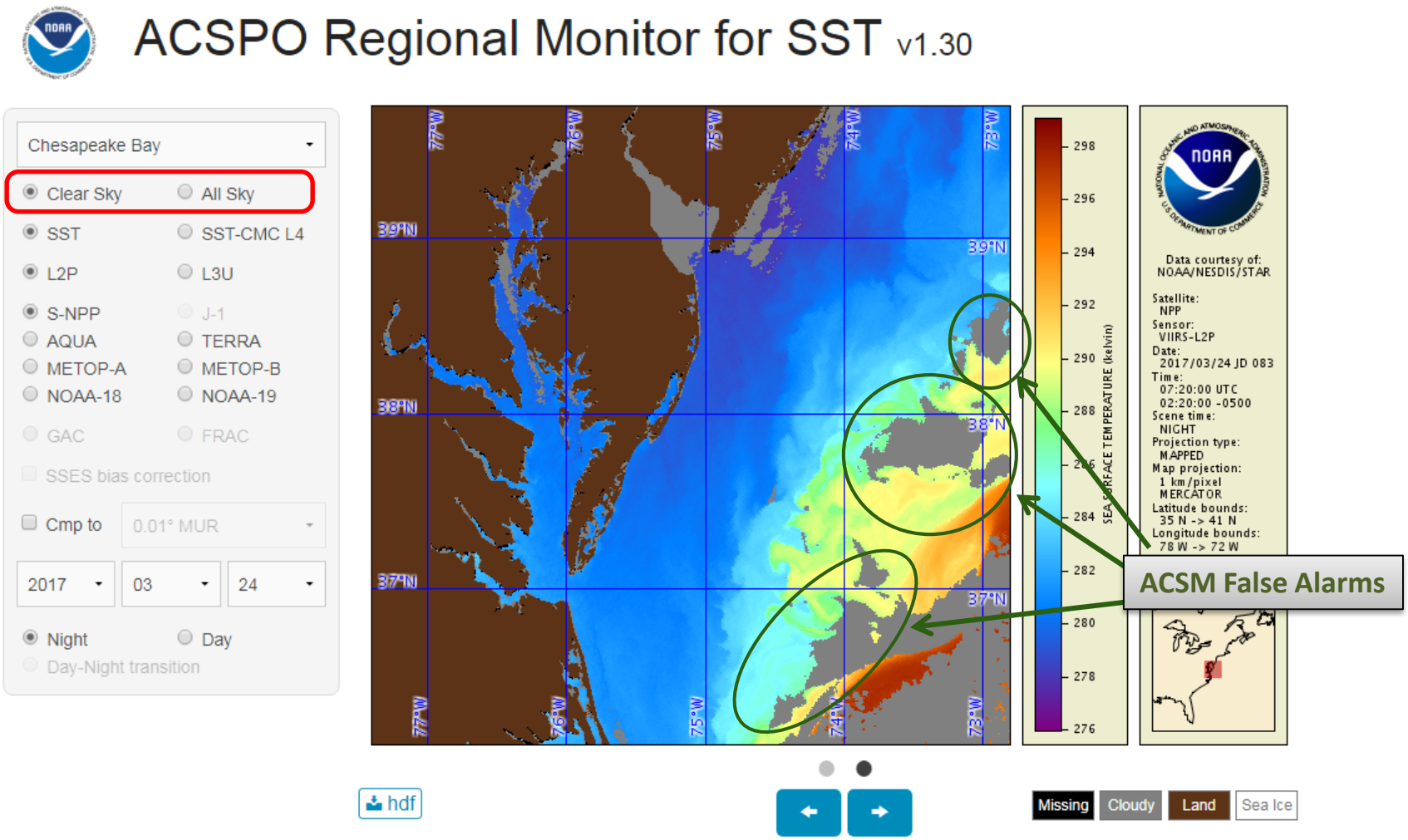
- ✓ Display different overpasses; aggregating different overpasses → L3C products



Clear-sky and All-sky SSTs/ΔSSTs

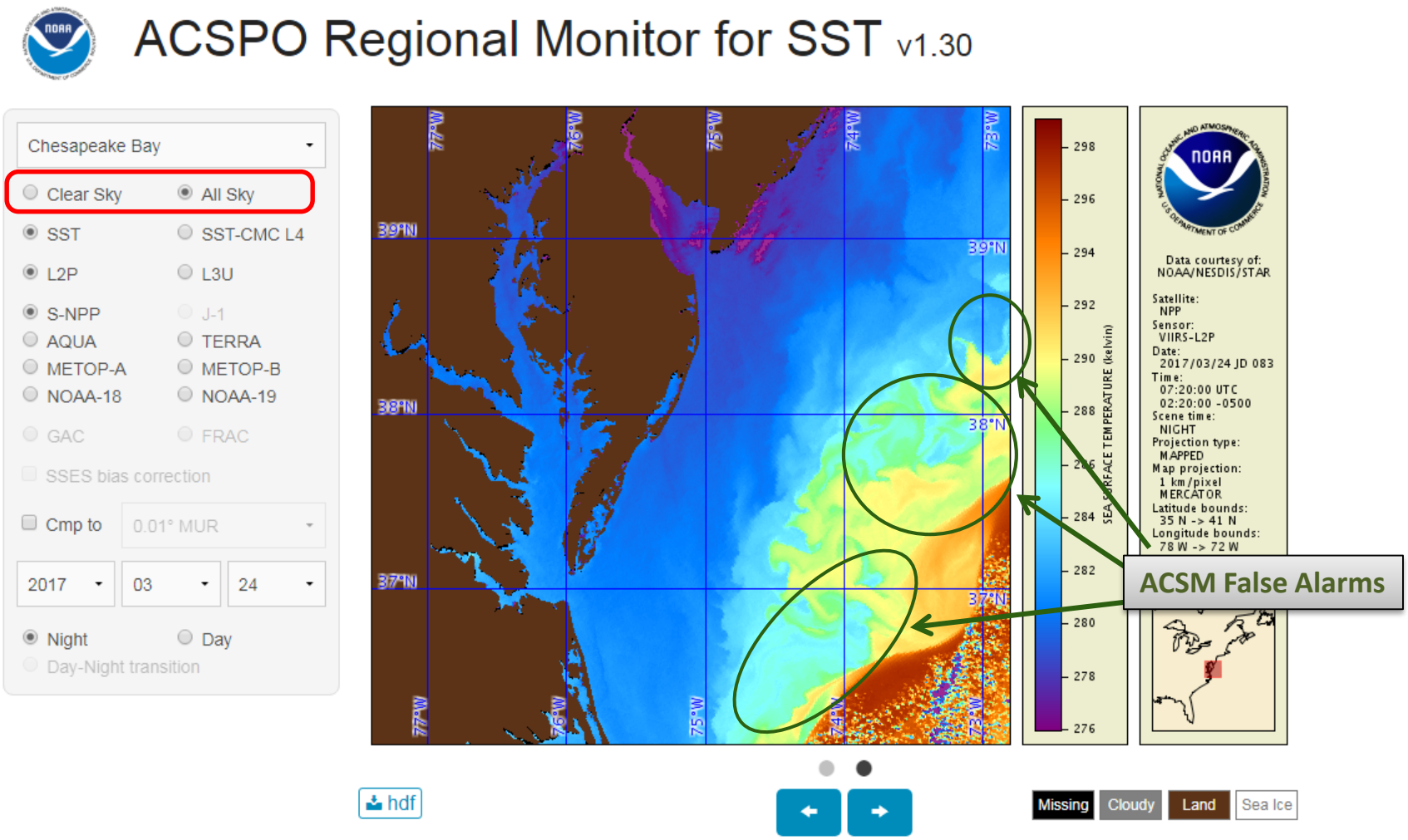
ARMS Interface: Clear-sky and All-sky SSTs/ΔSSTs

- ✓ Monitoring: Clear-sky and All-sky SSTs and ΔSSTs=SST-Ref. SST (CMC L4)



ARMS Interface: Clear-sky and All-sky SSTs/ΔSSTs

- ✓ All-sky SST helps to identify over-screening of clouds



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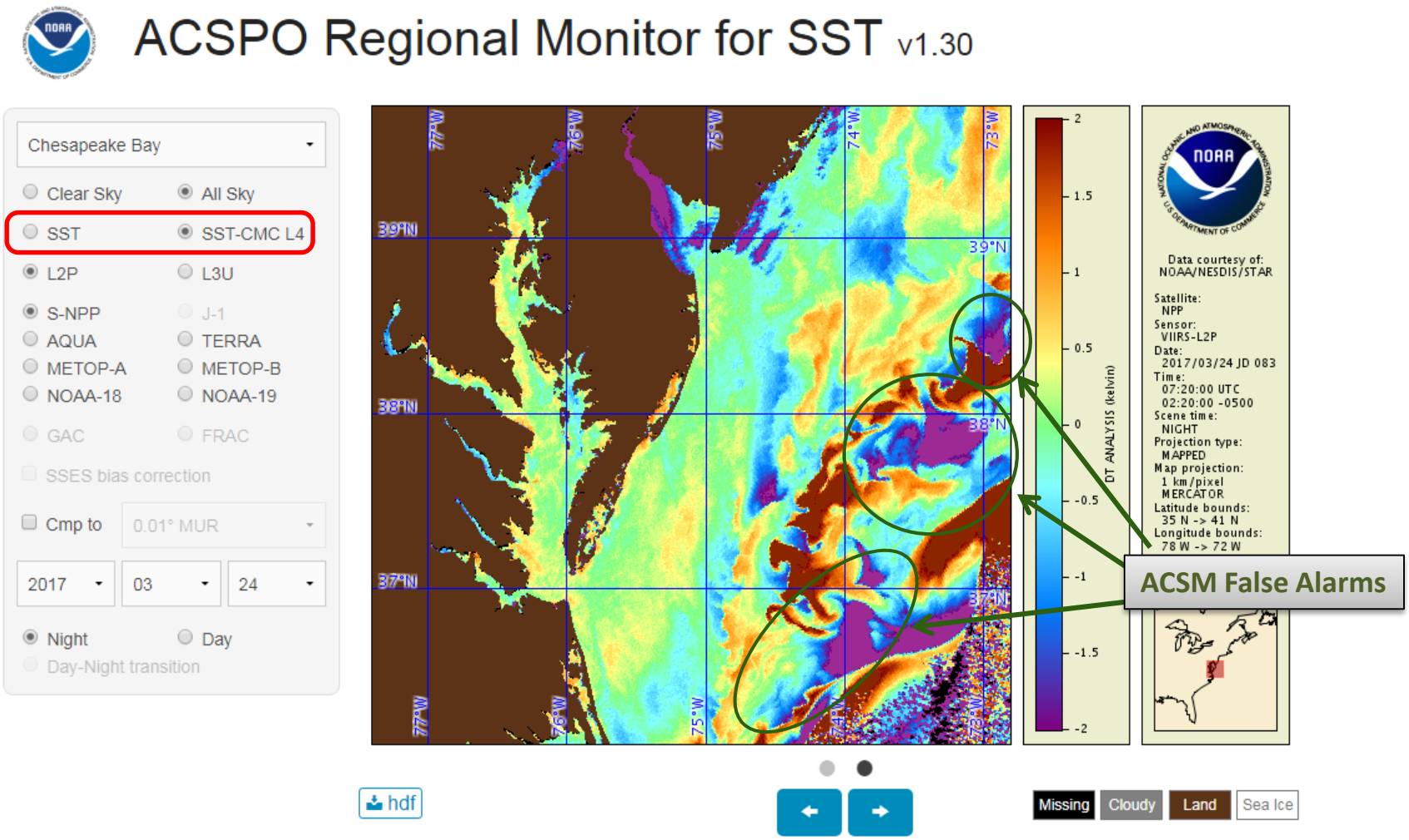
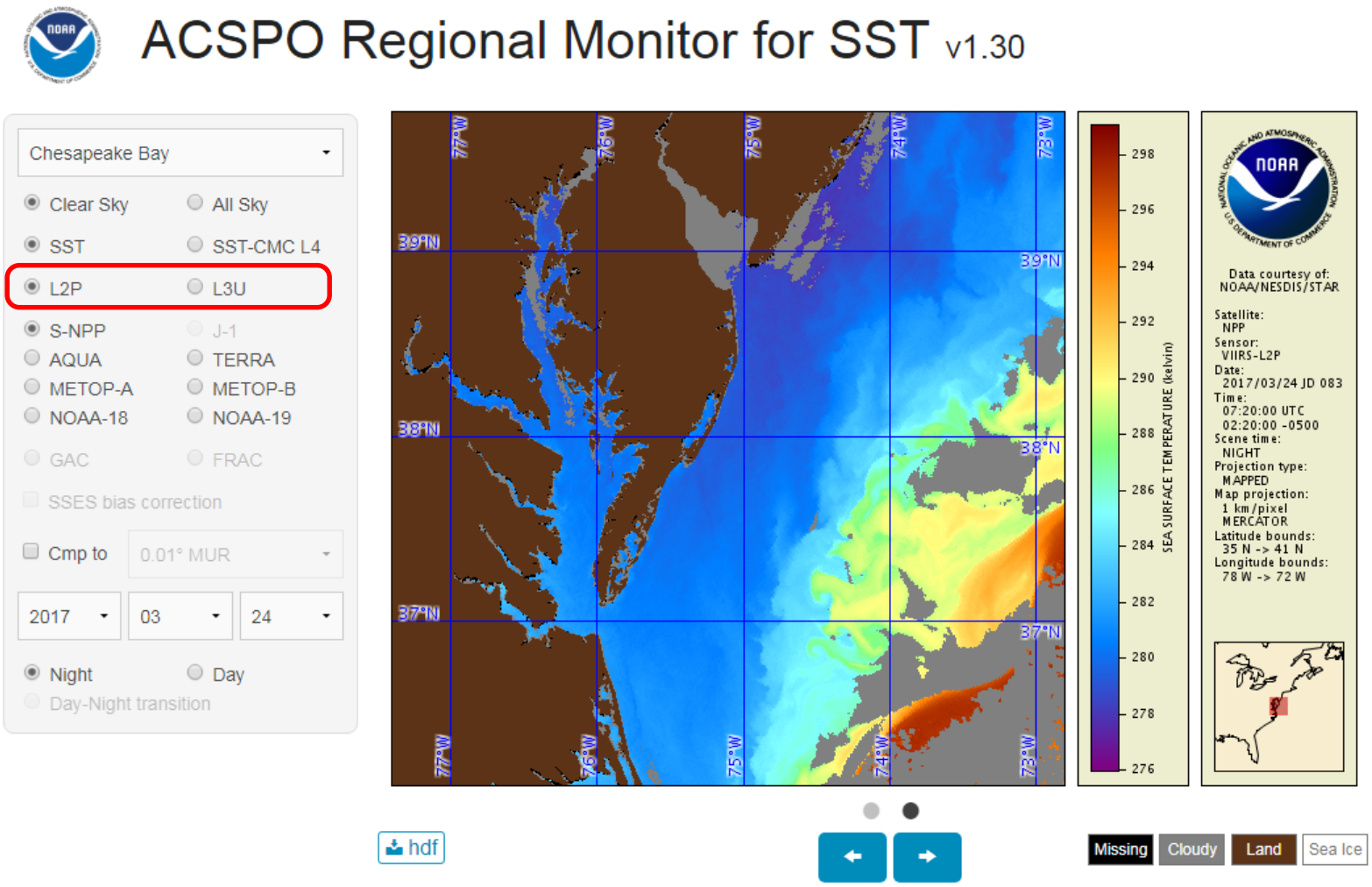


Data Levels

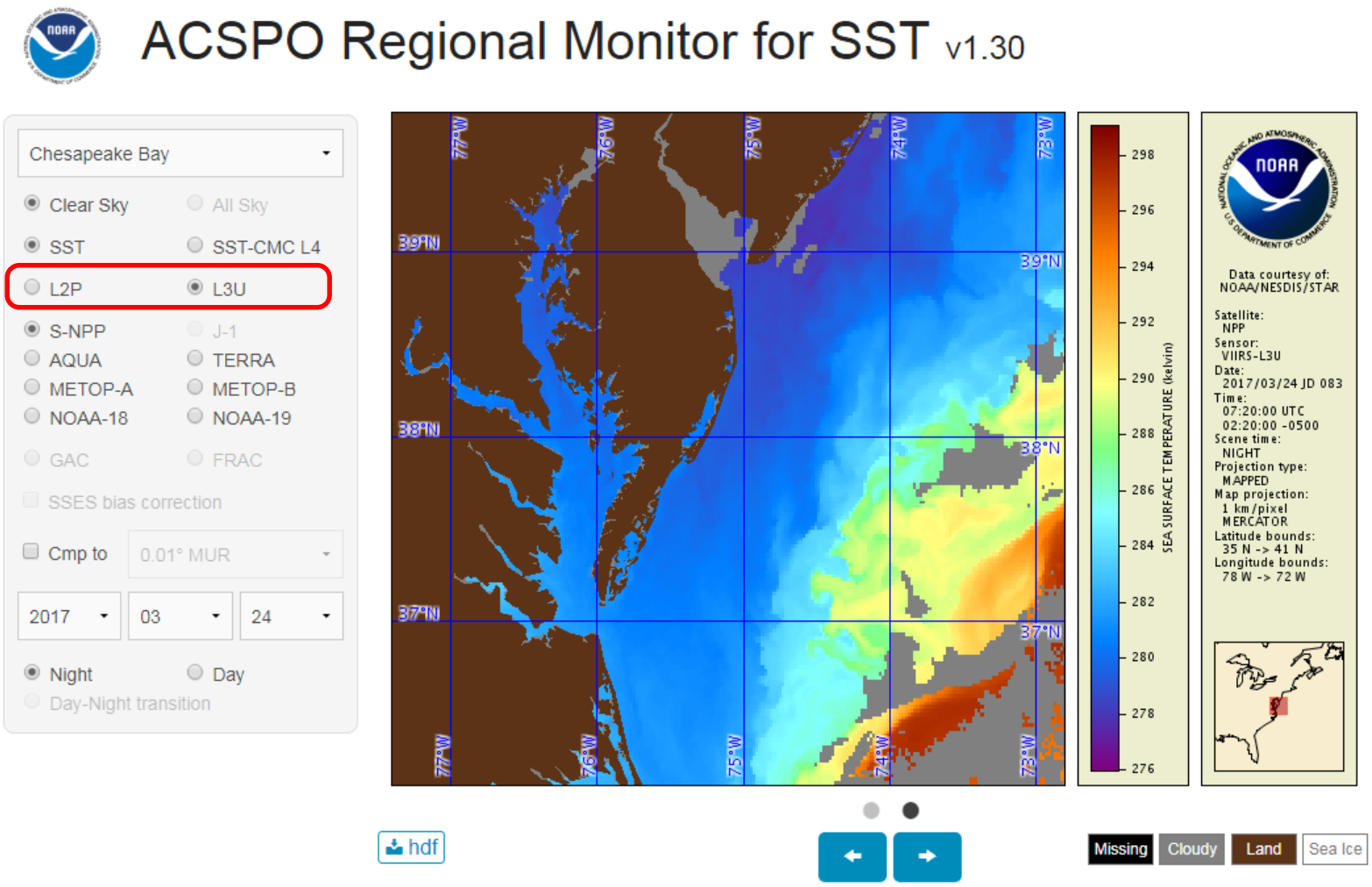
ARMS Interface: L2P

For visualization in ARMS, L2P is remapped to equal-grid (resolution is region specific; always 512×512)



ARMS Interface: L3U (un-collated)

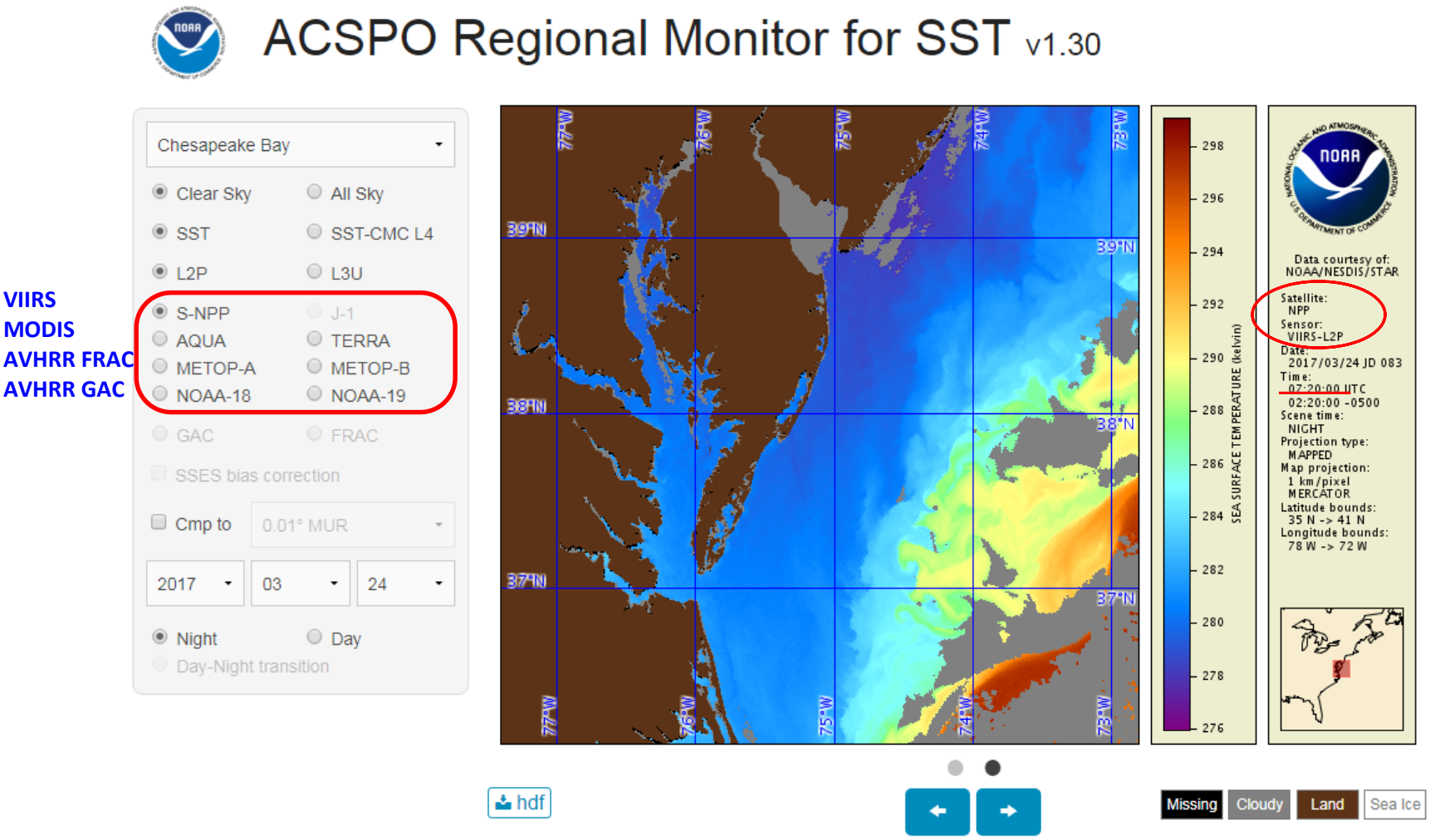
L3U is also remapped to a projection/resolution consistent with re-projected L2P



Platform / Sensor Selection

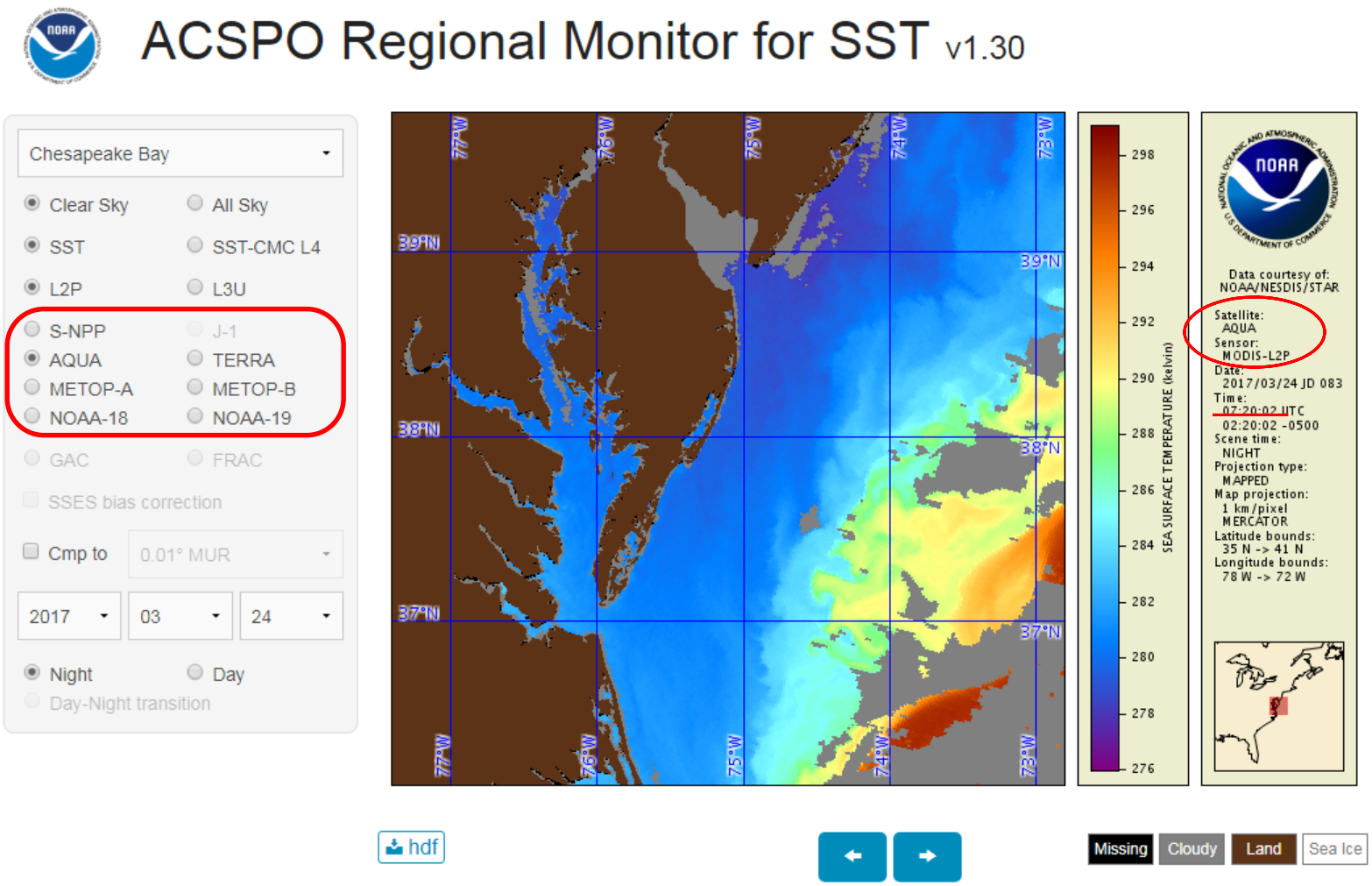
ARMS Interface: Product Selection

- ✓ Monitoring: VIIRS onboard NPP, MODIS onboard Aqua/Terra, AVHRR onboard Metop-A/B, NOAA-18/19



ARMS Interface: Product Selection

- ✓ Similar pass-time for NPP & Aqua; slightly different data coverage/cloud mask



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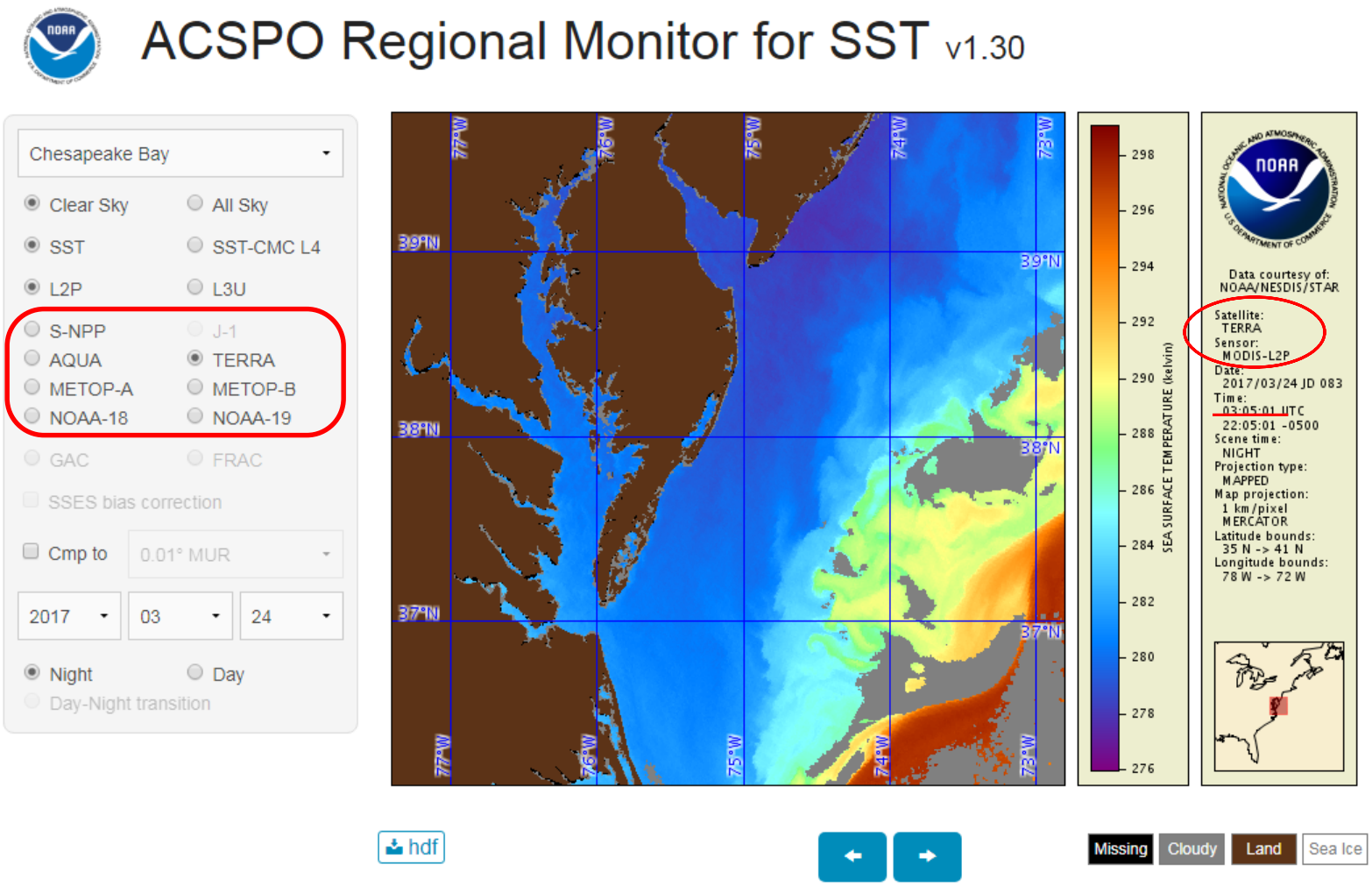
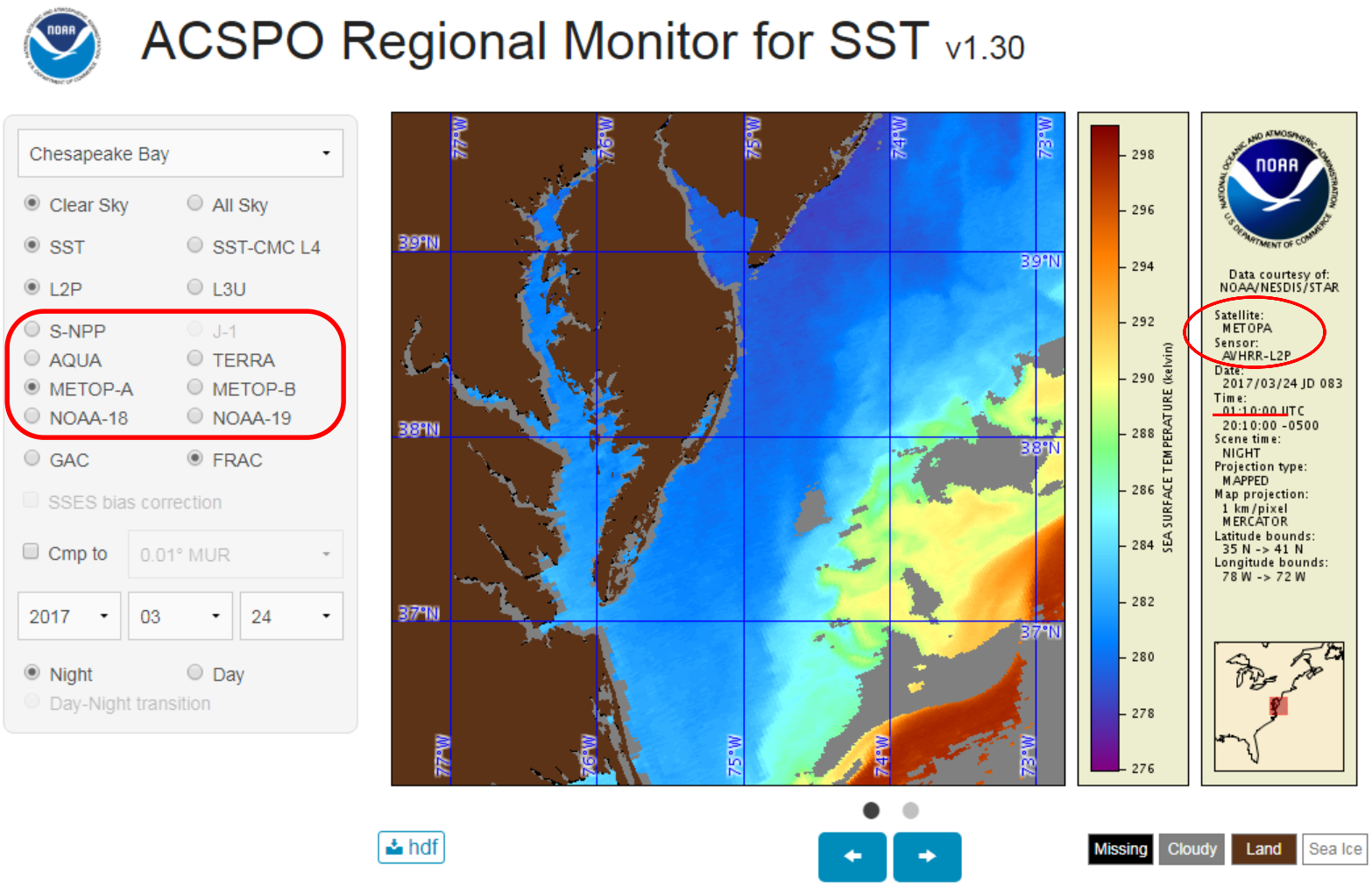


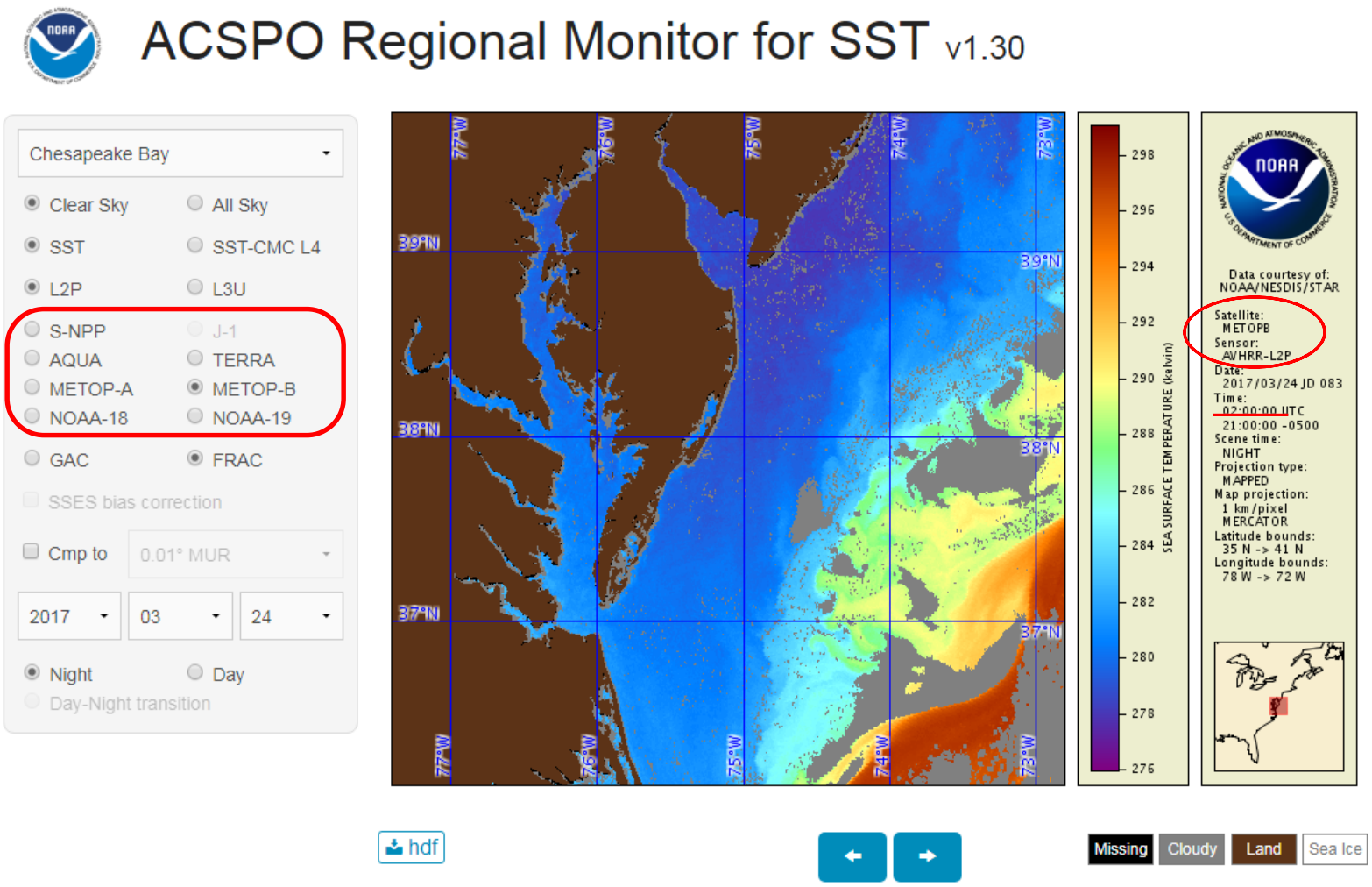
ARMS Interface: Product Selection

- ✓ FRAC Metop-A has warmer temperature compared to MODIS Aqua and FRAC Metop-A



ARMS Interface: Product Selection

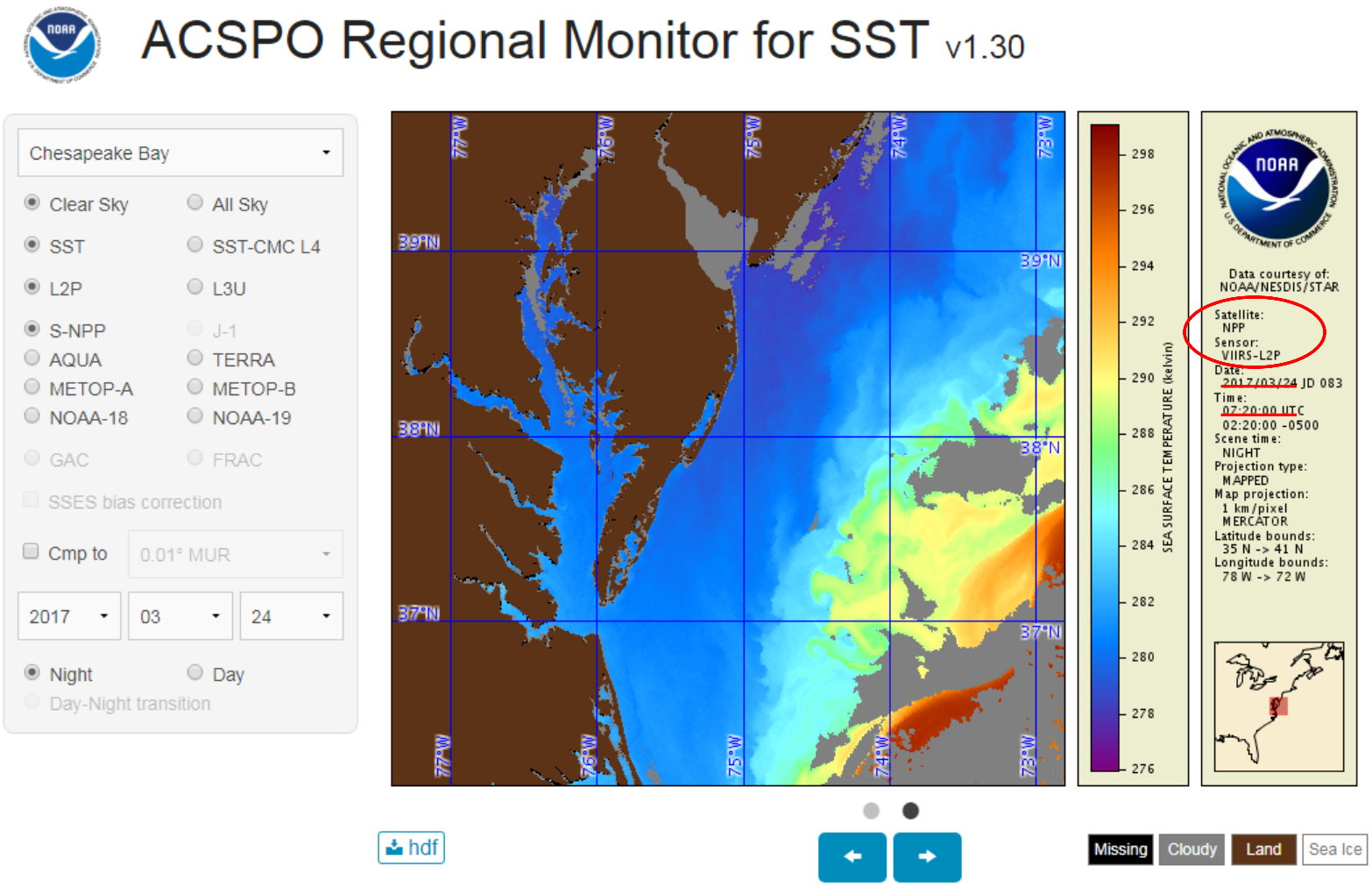
✓ Multiple overpasses of different platforms → L3S (super-collated) product



Comparison to L4 SSTs

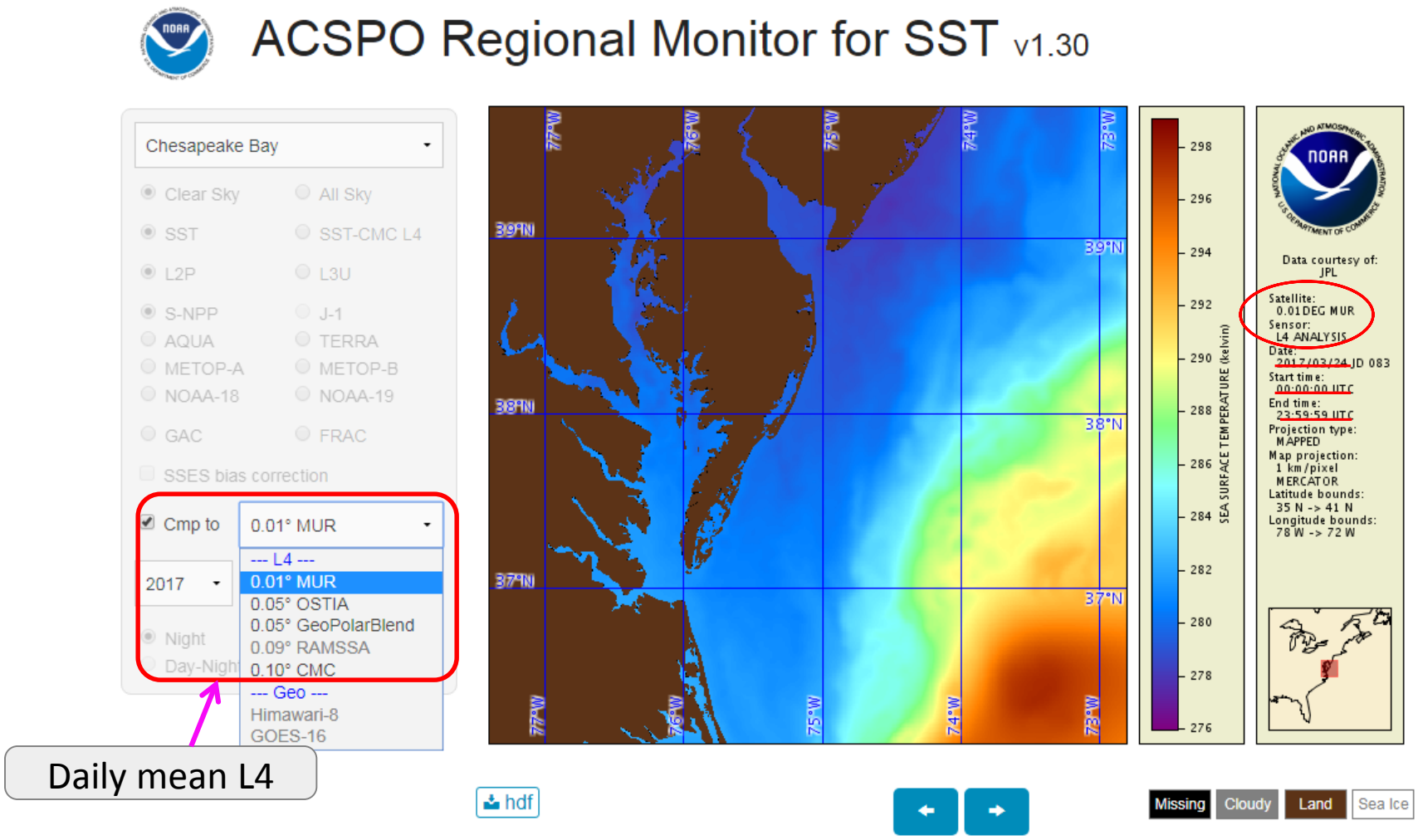
ARMS Interface: Comparison to L4 SSTs

✓ Including four L4 SSTs: 0.01° MUR, 0.05° OSTIA, 0.05° Geo_Polar_Blended, 0.09° RAMSSA, 0.10° CMC



ARMS Interface: Comparison to L4 SSTs

✓ 0.01° MUR shows more details where VIIRS_NPP data are available



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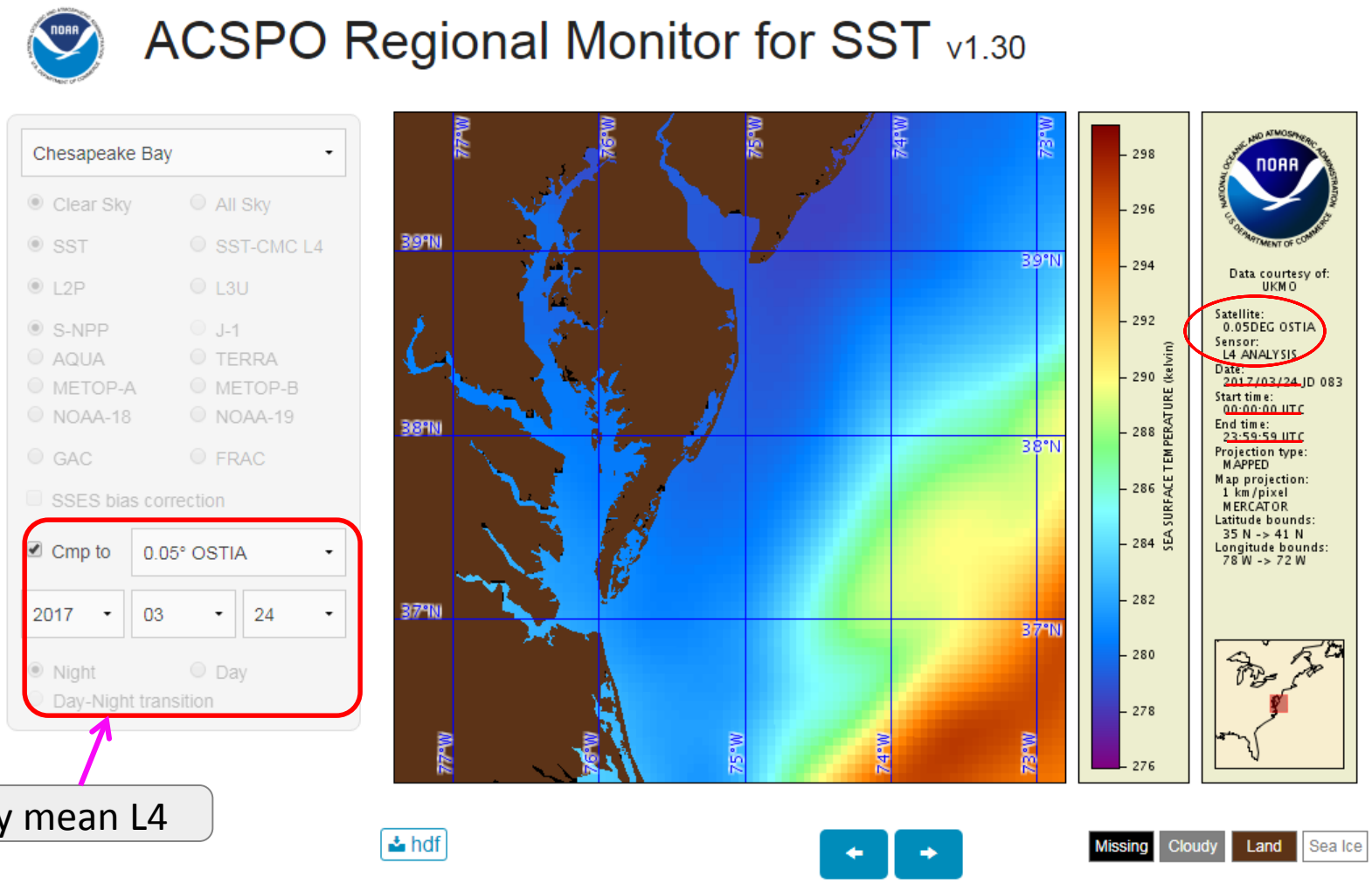
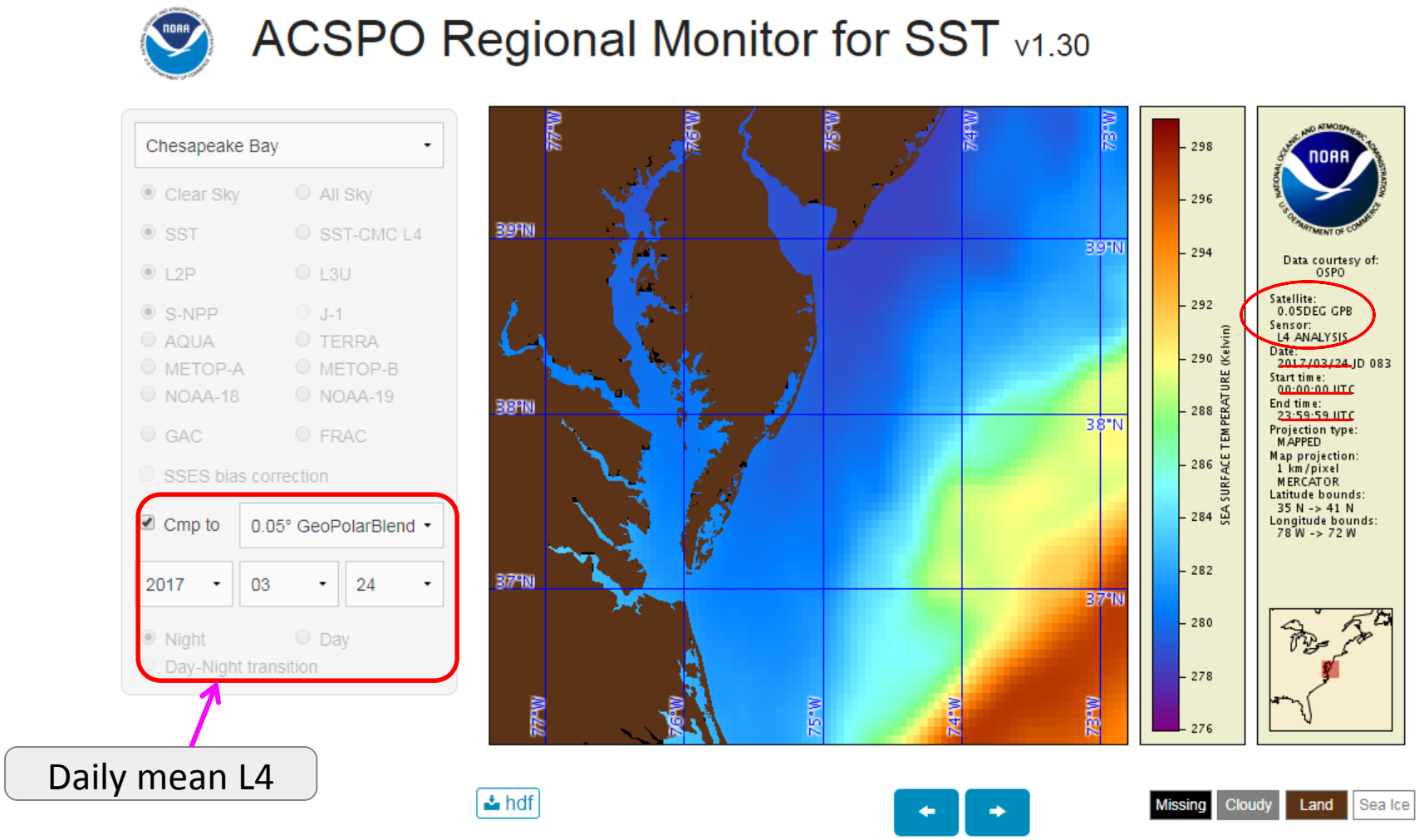


Daily mean L4

Comparison to L4 & Geo SSTs

- ✓ 0.05° Geo_Polar_Blended reserves more details than OSTIA



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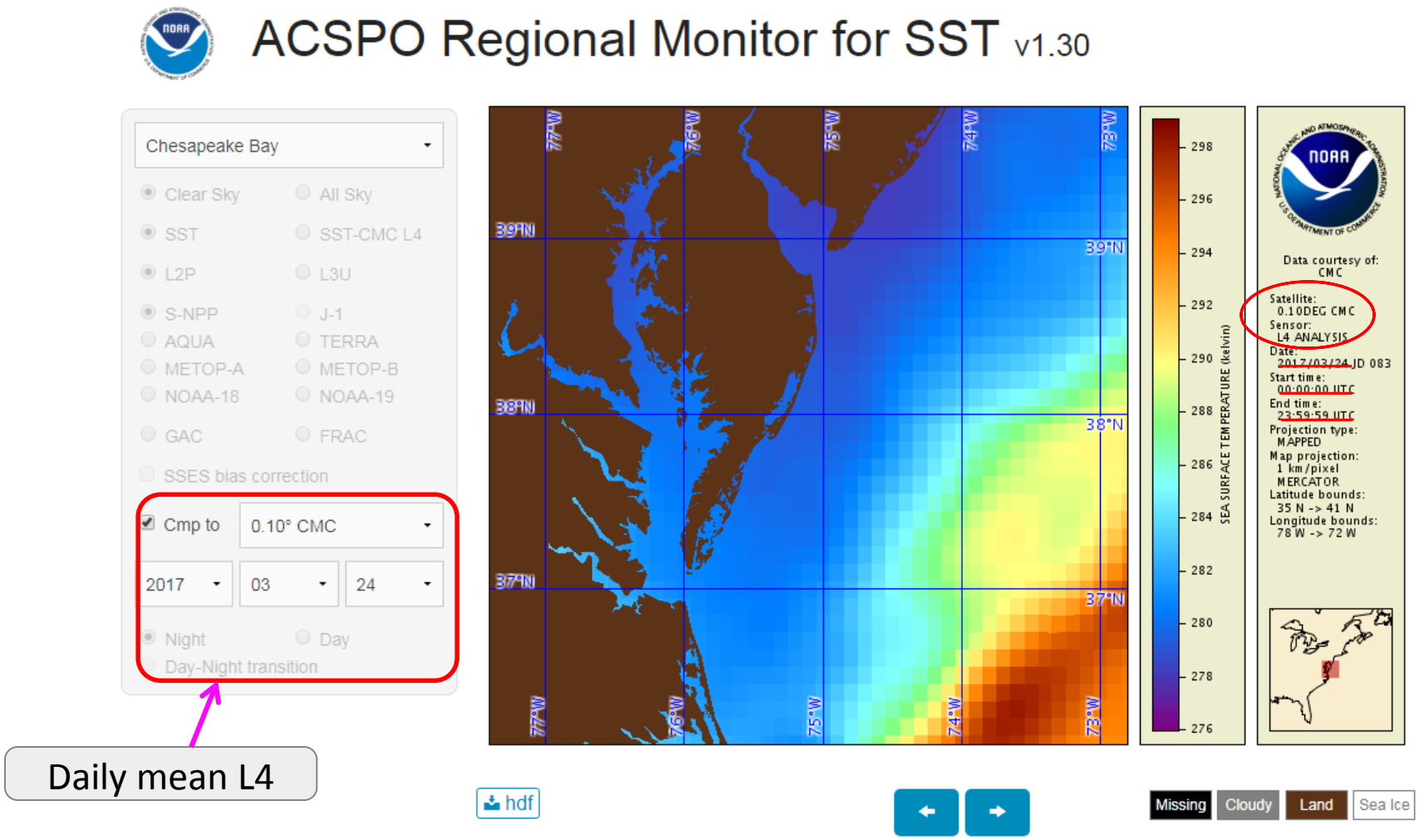
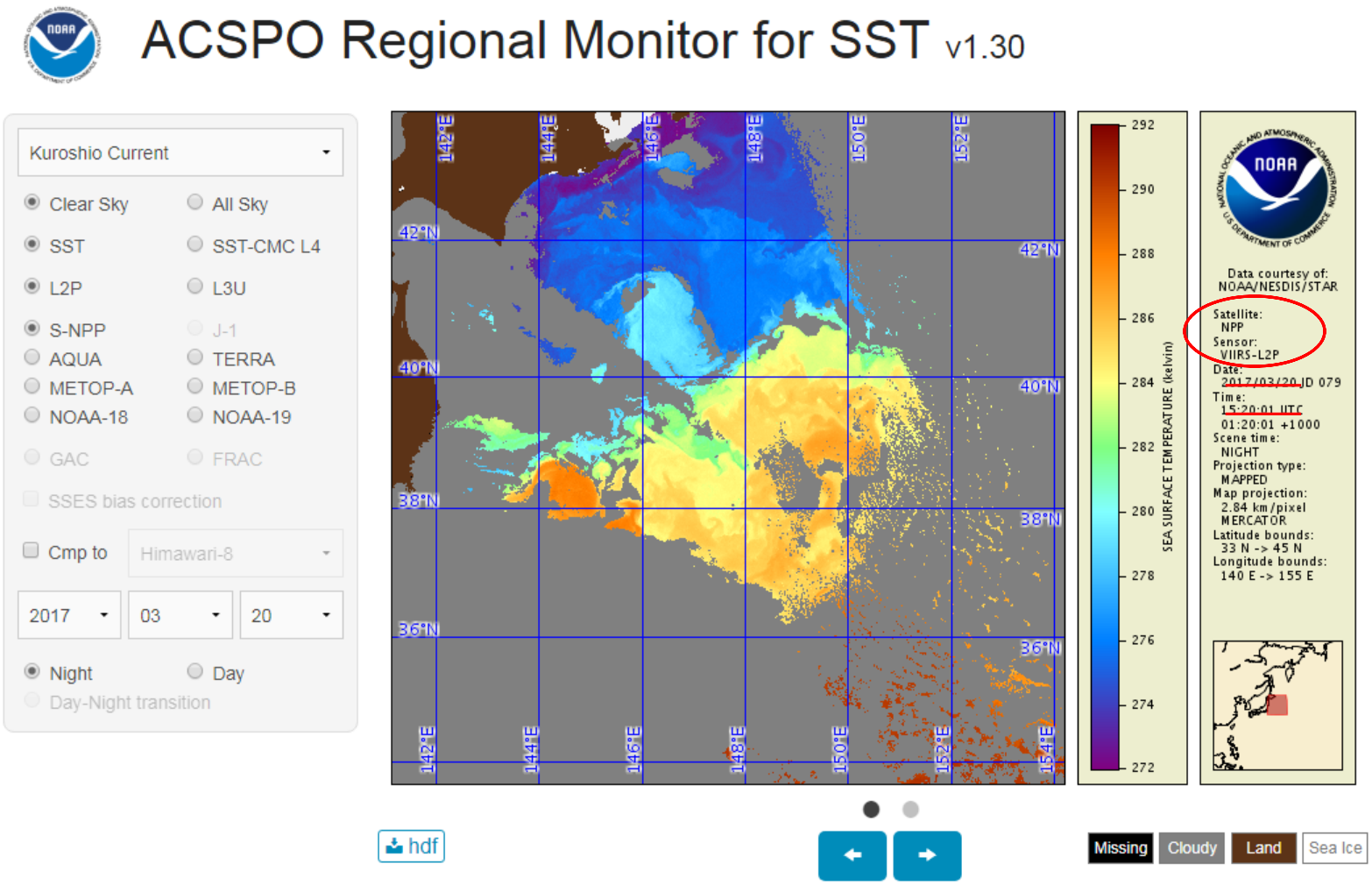


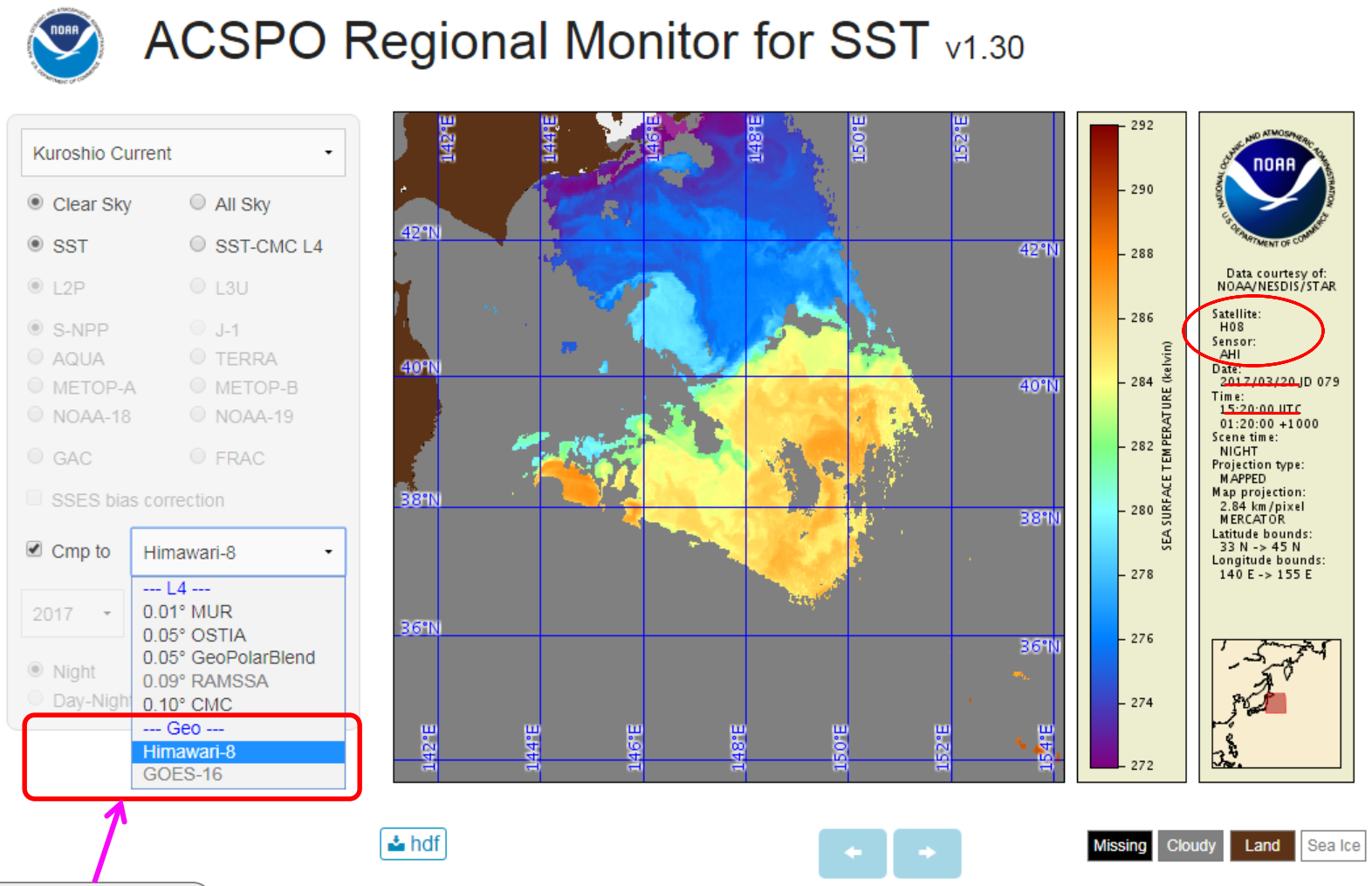
Comparison to Geo SSTs

ARMS Interface: Comparison to Geo SSTs

- ✓ Including geostationary SSTs: AHI onboard Himawari-8, ABI onboard GOES-16 (internal view only)
- ✓ AHI is available for three regions: Kuroshio Current, Korean Strait, and South China Sea



ARMS Interface: Comparison to Geo SSTs

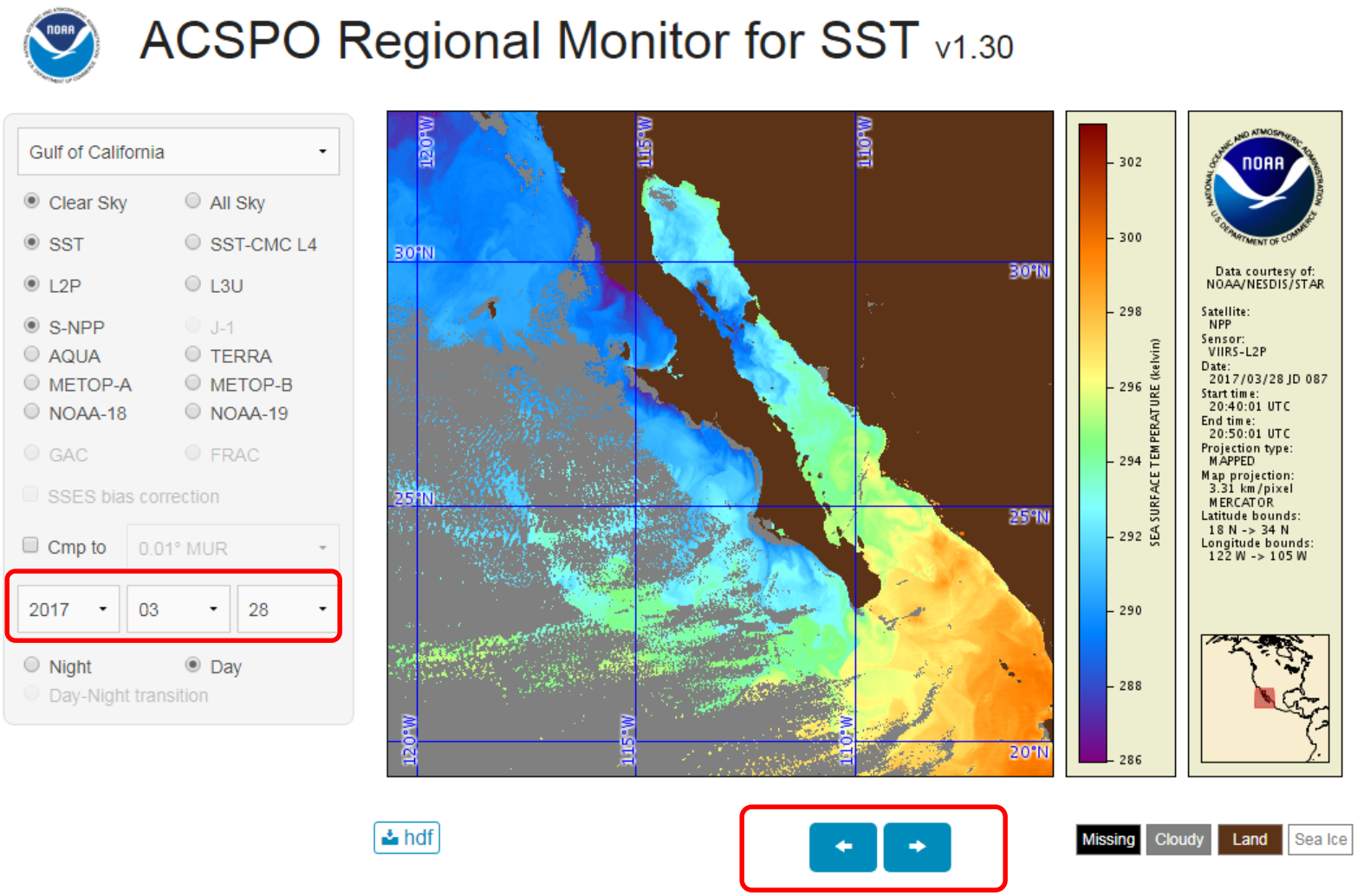


Closest in time geo

Date Selection

ARMS Interface: Date Selection

✓ Starting date: July 18th 2015



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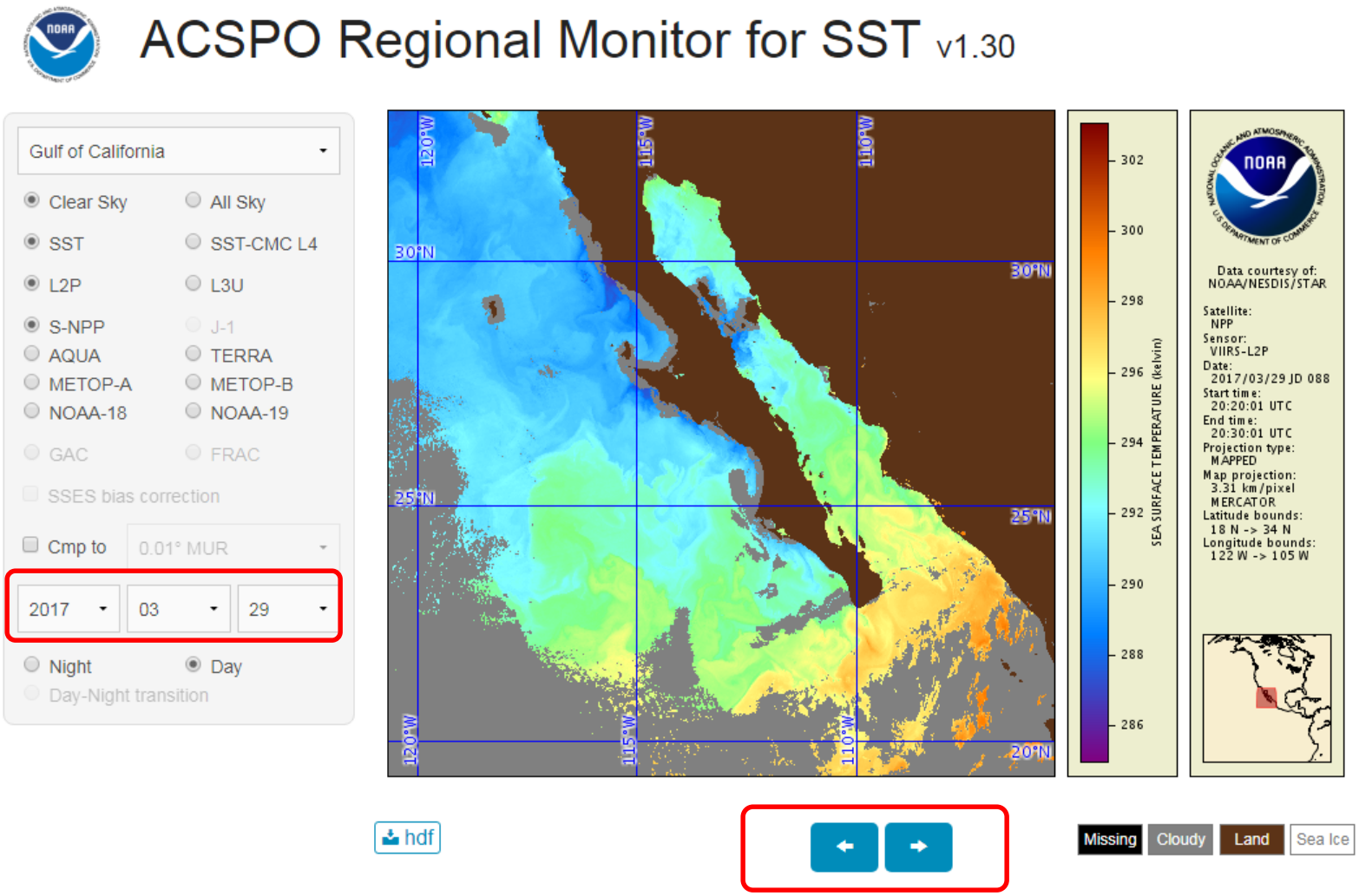

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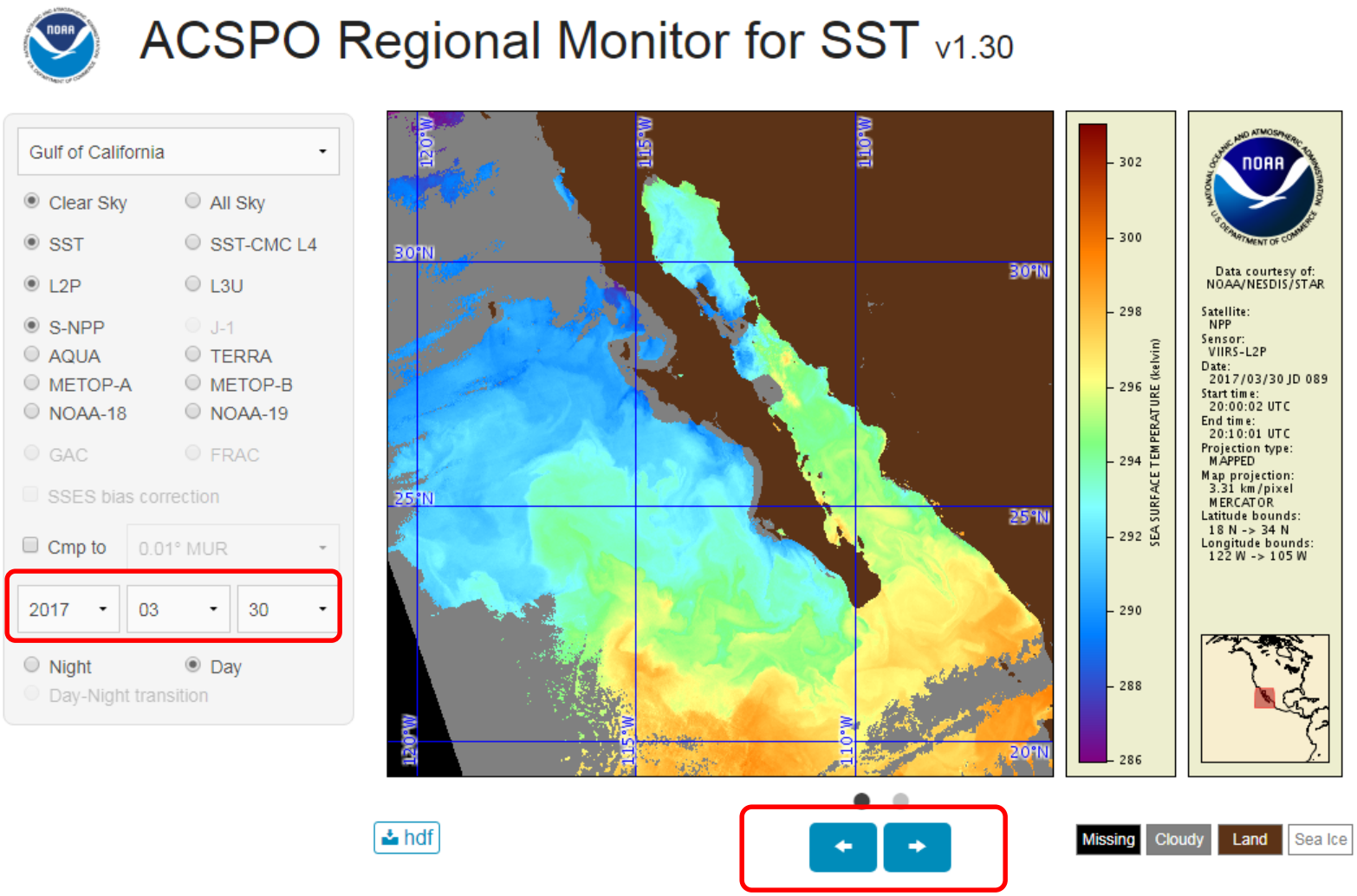
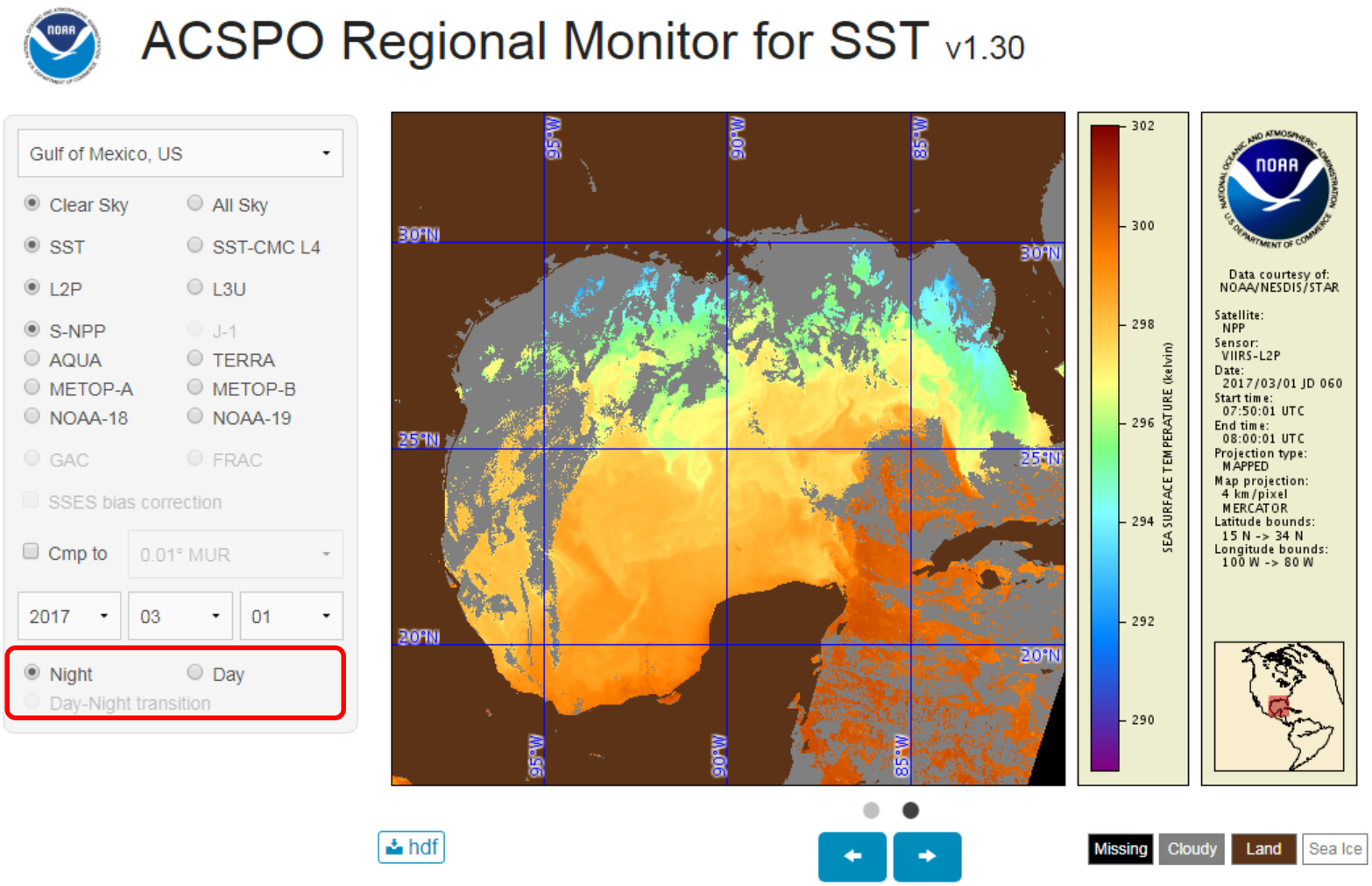


Day/Night Data

ARMS Interface: Day/Night Data

- ✓ Scene time options: nighttime, daytime, region crossing the day-night transition zone (high-lats)



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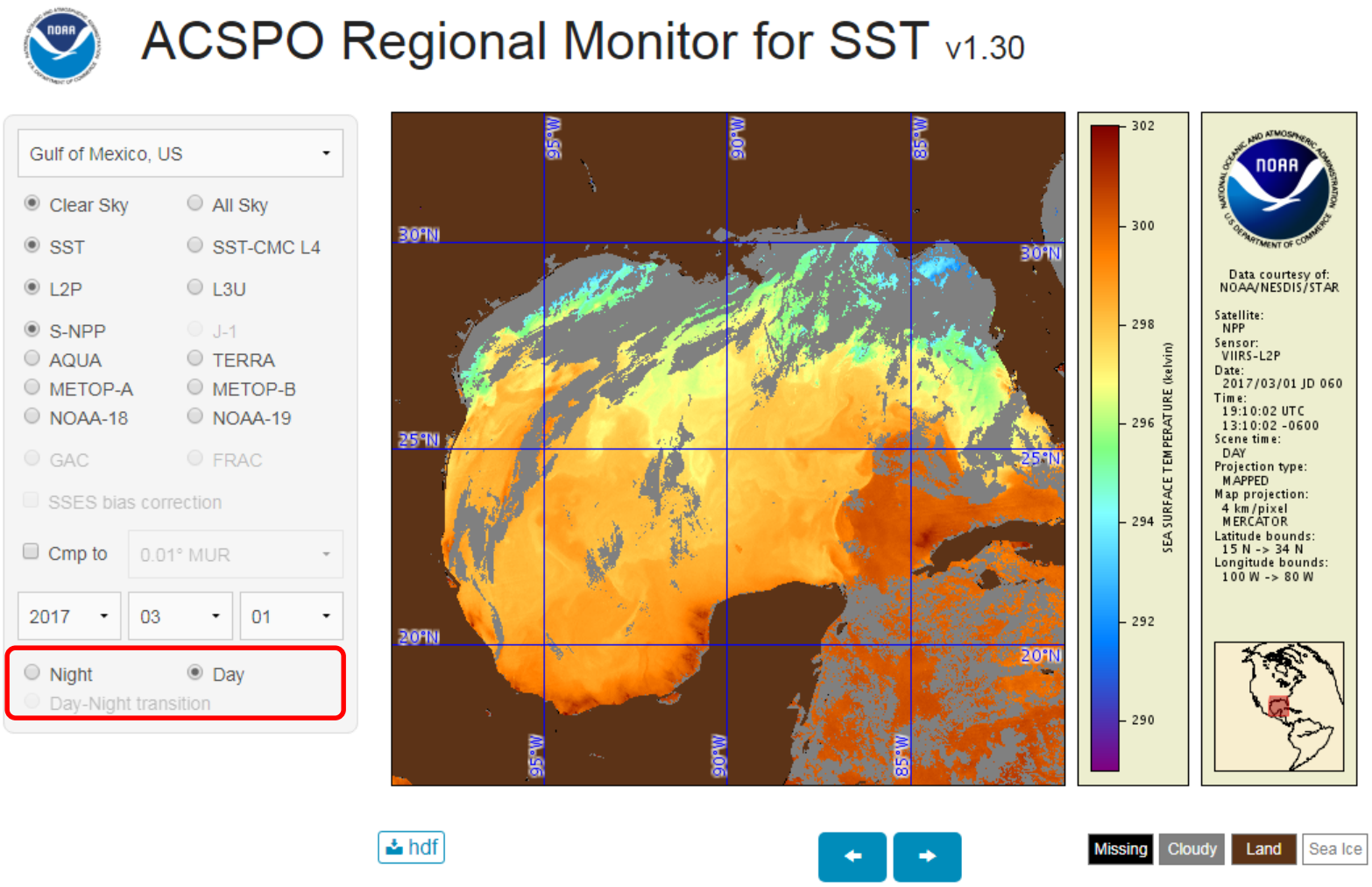

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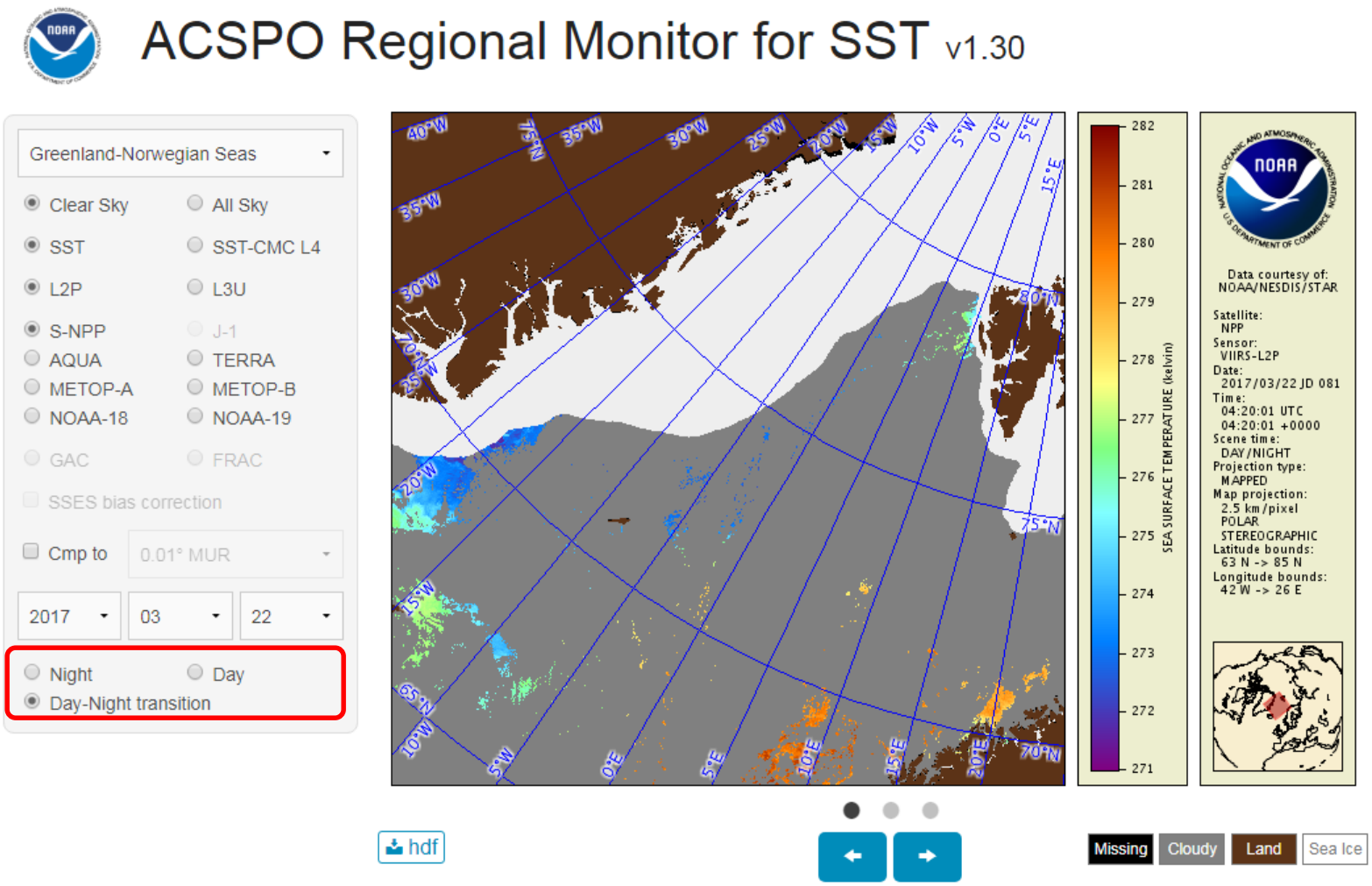
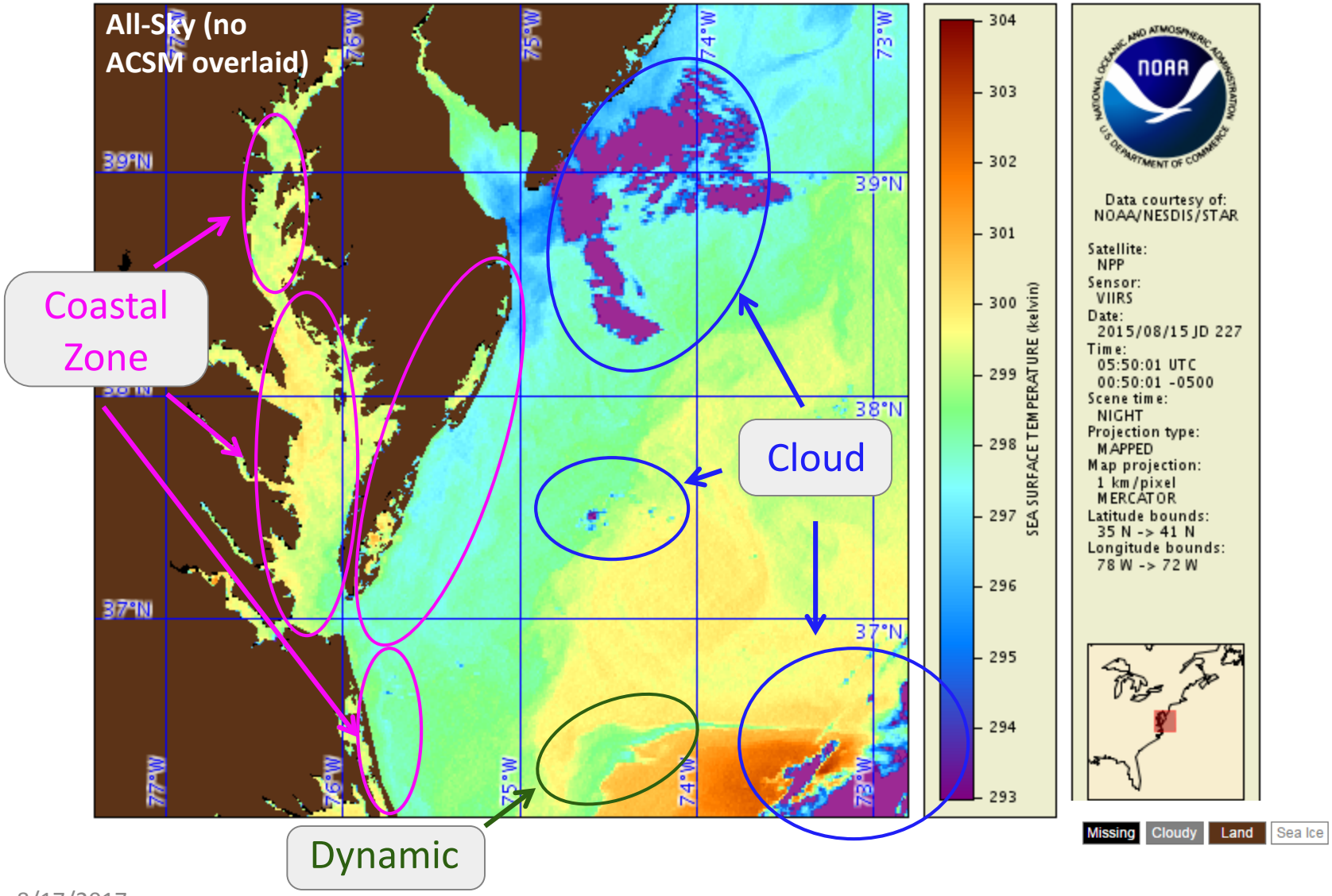


Examples of Using ARMS for ACSPO Diagnostics

- ✓ Validate Clear-Sky Domain
- ✓ Validate Clear-Sky Mask and SST for day/night consistency
- ✓ Check the sea-ice mask in ACSPO (currently taken from CMC)

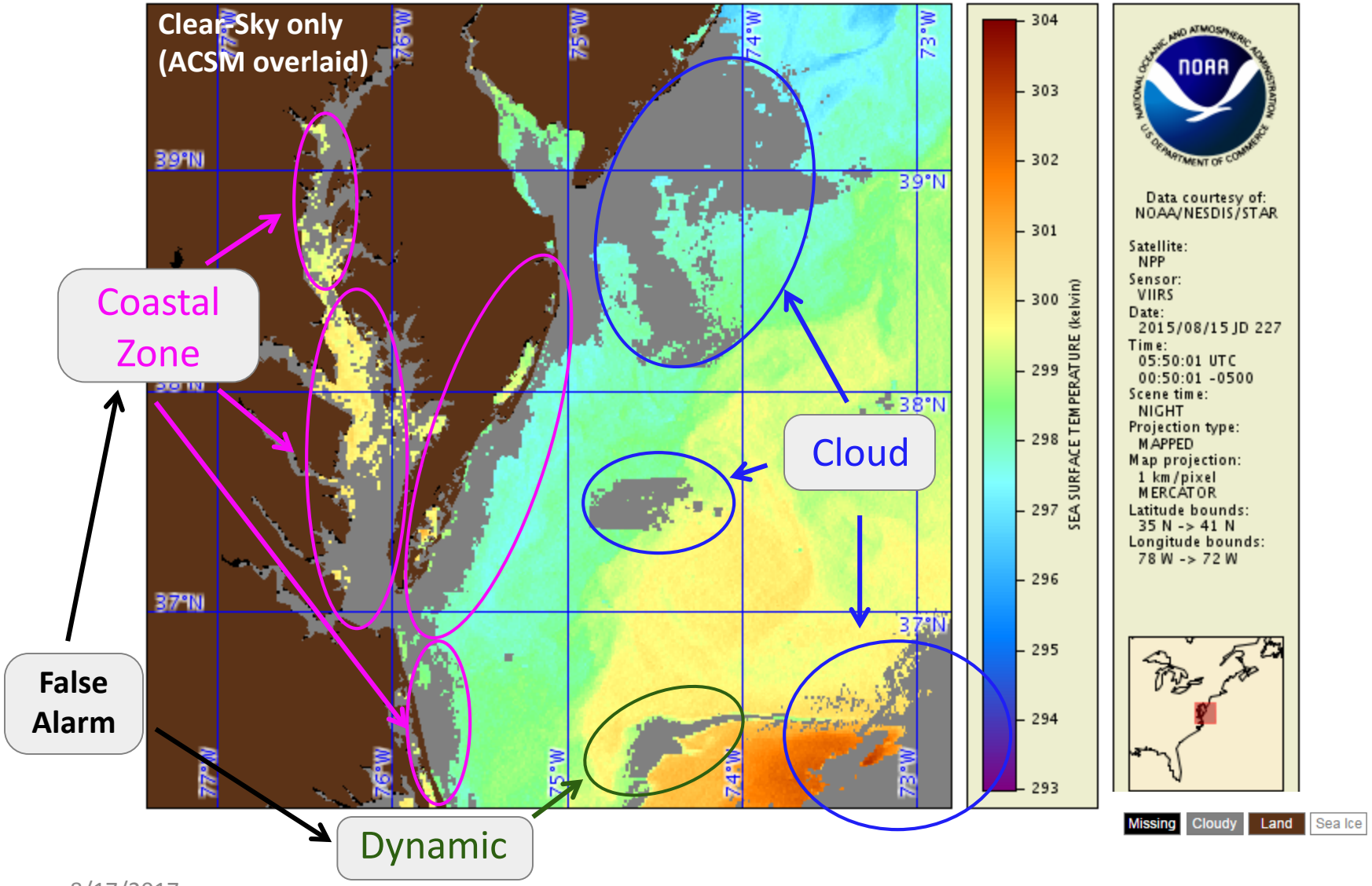
Identify areas of improvement

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

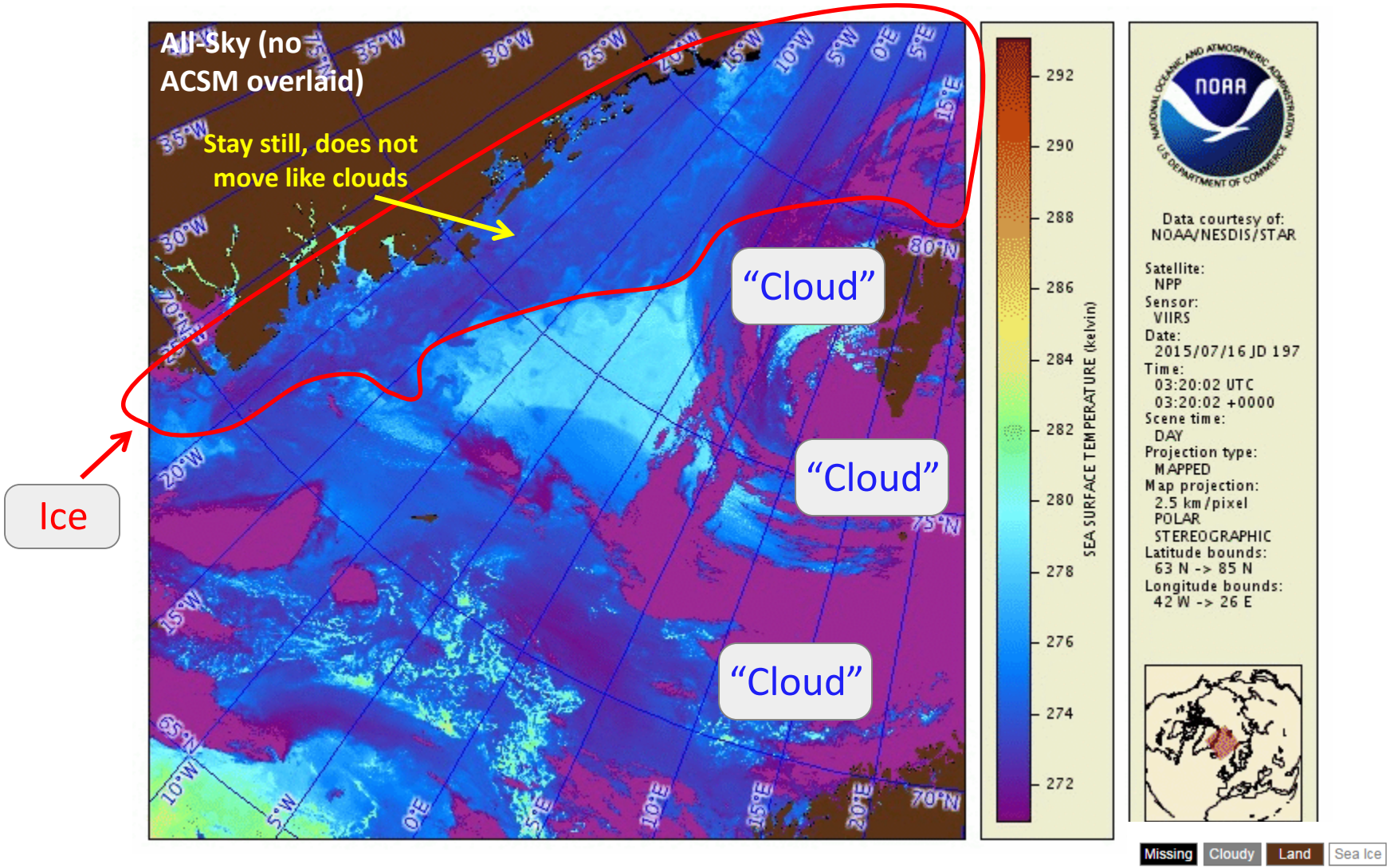


ACSPO Clear-Sky Mask Overly Conservative In Coastal / Dynamic areas

- ✓ 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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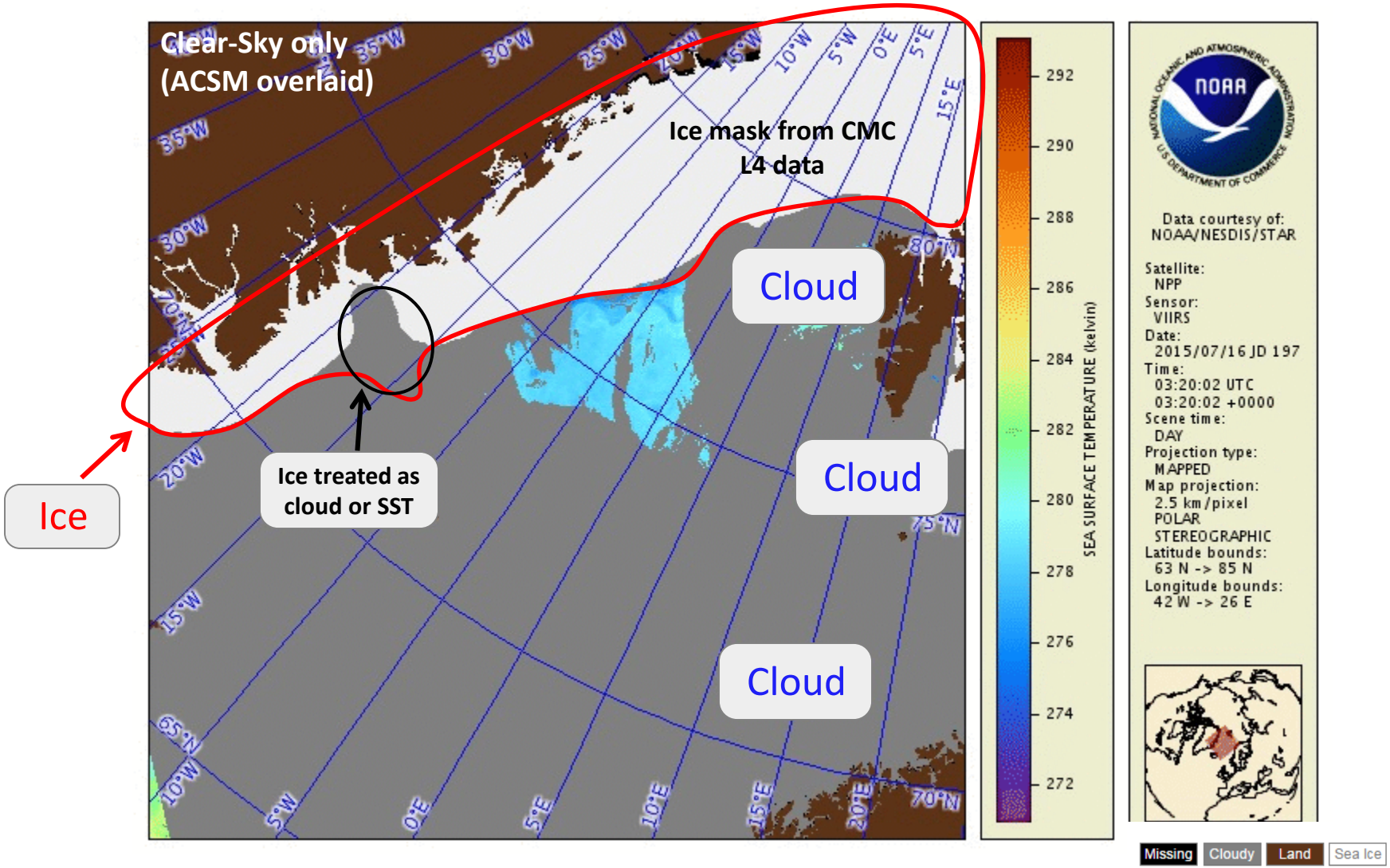
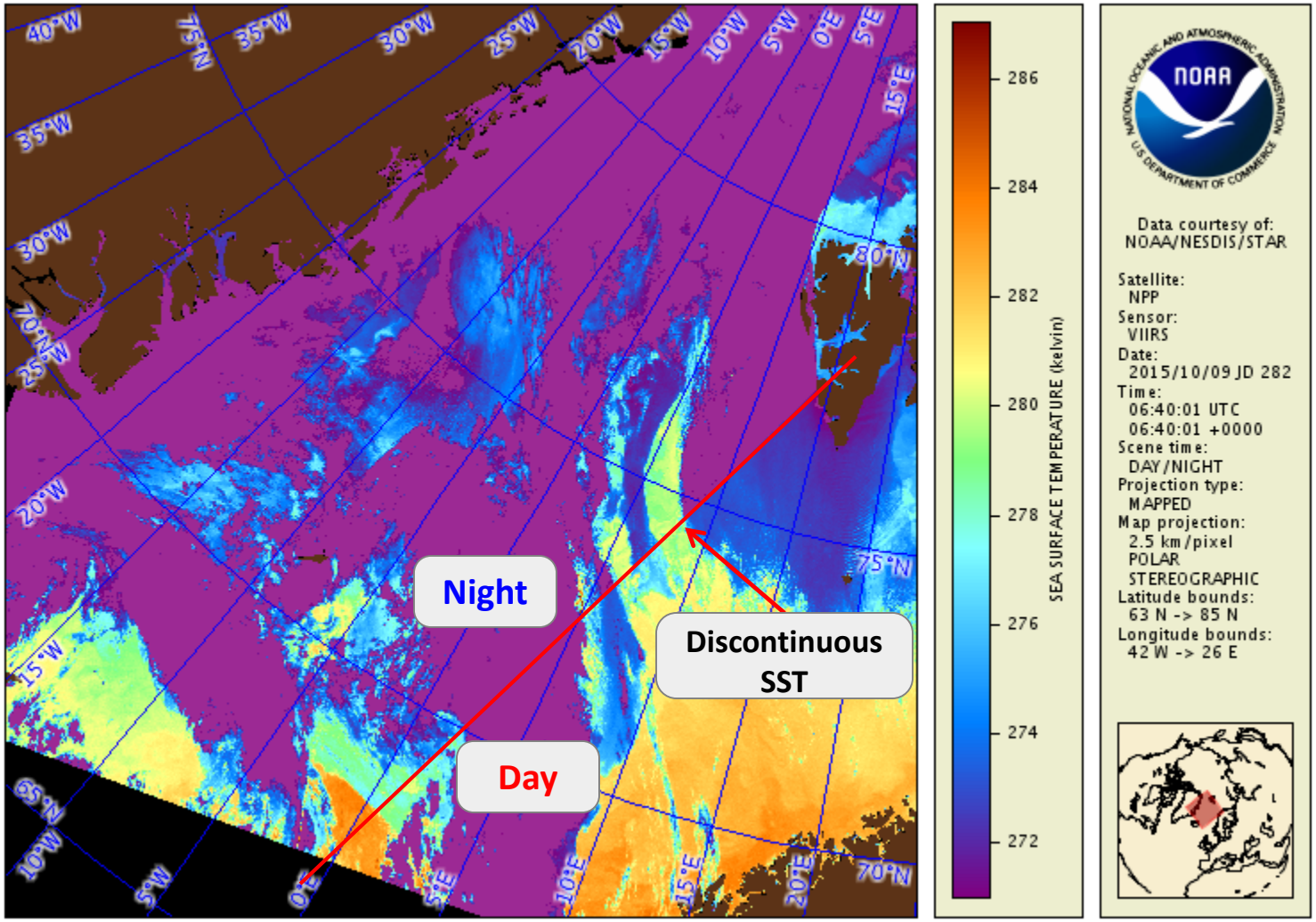


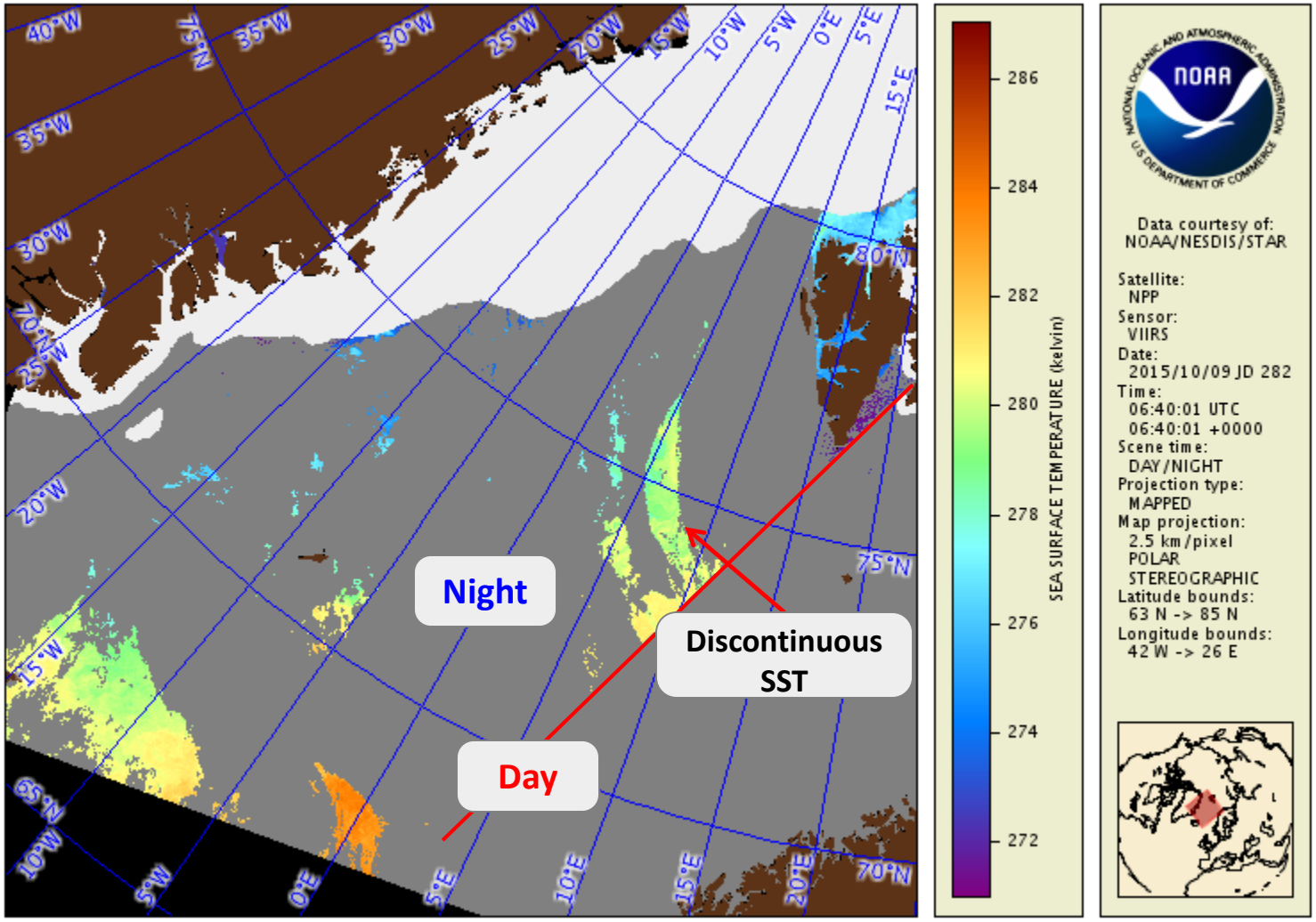
Sea ice and cold water may be identified as “cloud” by the ACSM

Example #3: Discontinuity problem in day/night transition zone



SST algorithm is different in daytime and nighttime, which causes discontinuity

Example #3: Discontinuity problem in day/night transition zone



Use of gross filter **RGCT** instead of ratio filter **RRCT** causes cloud mask discontinuity

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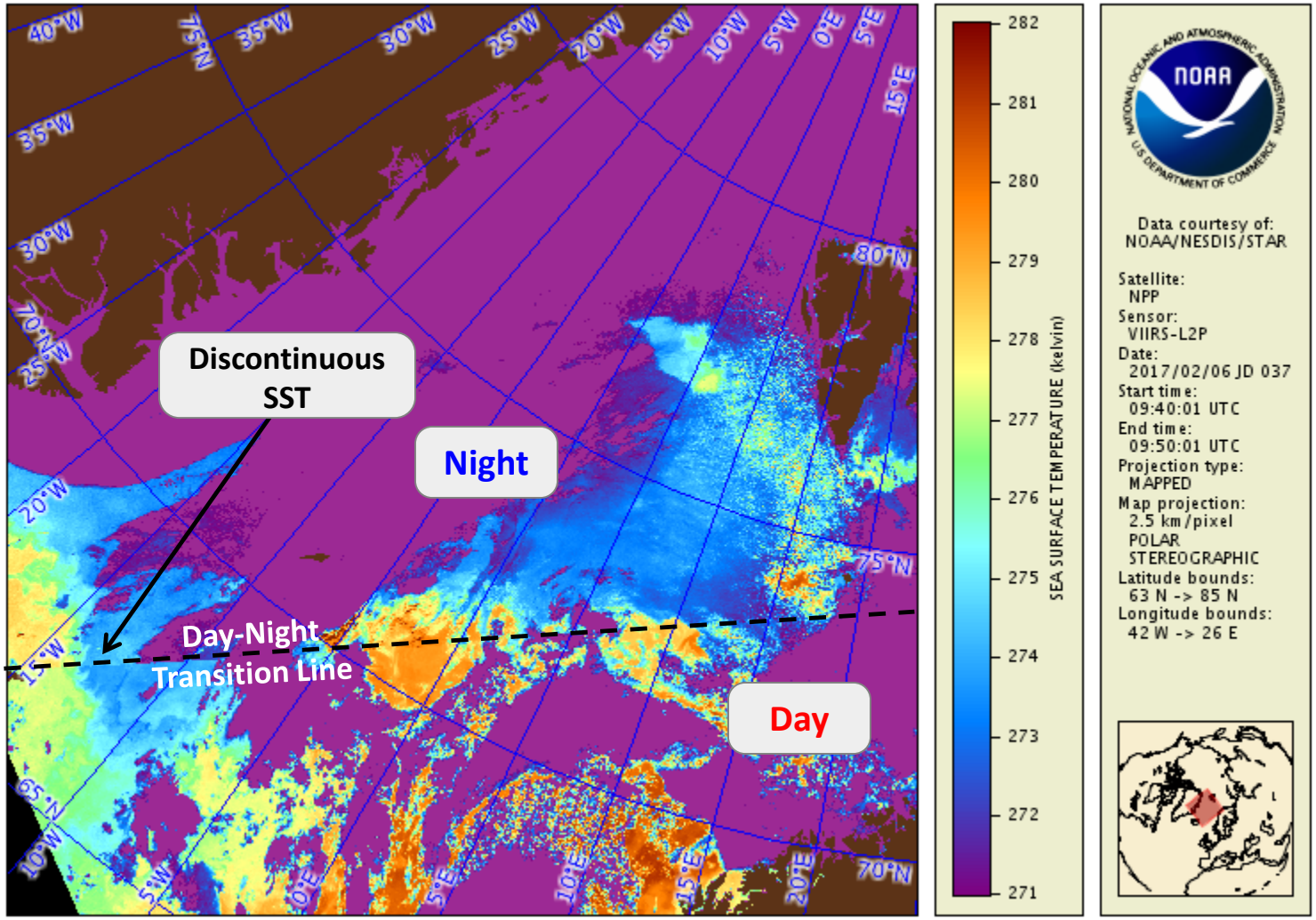

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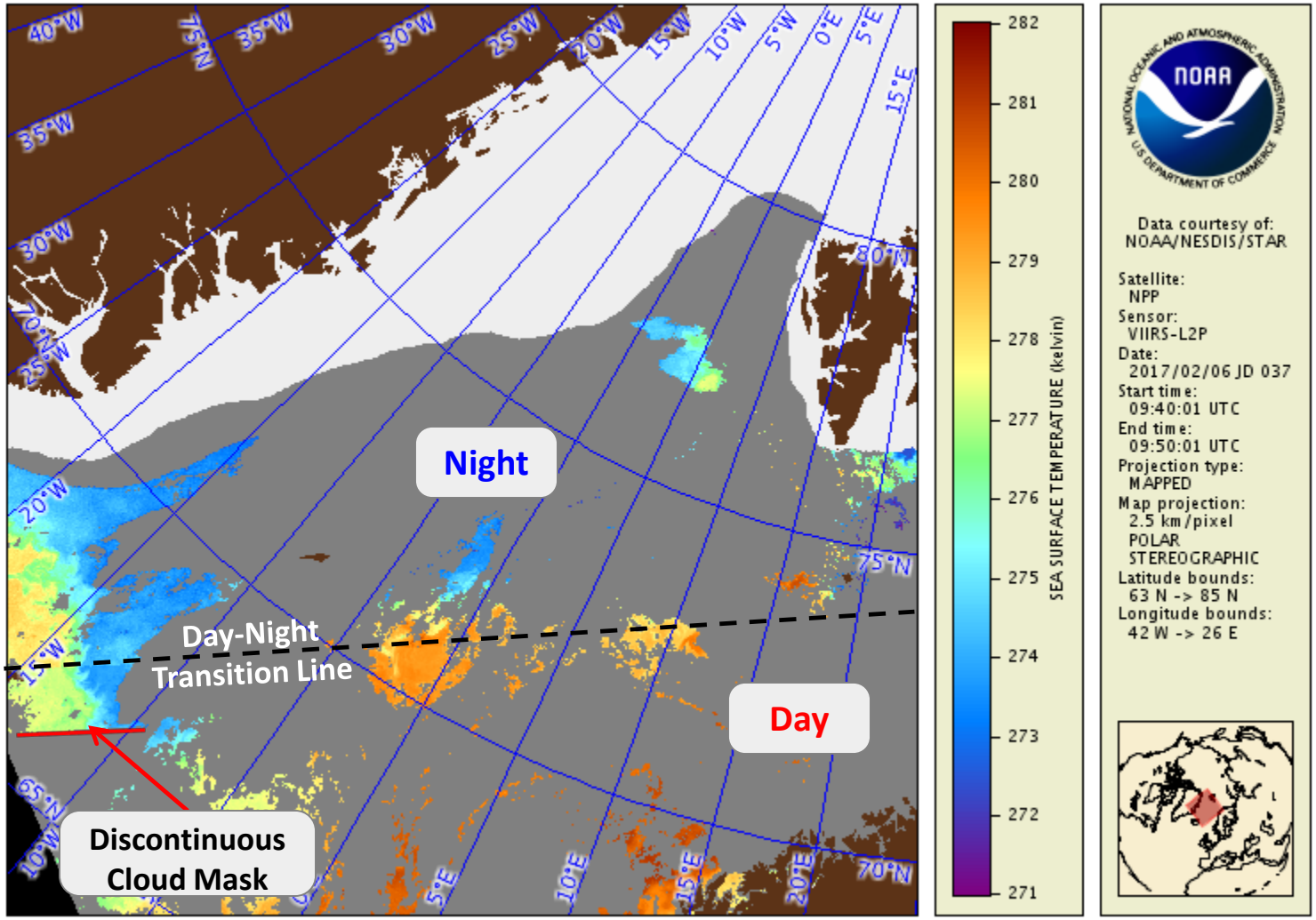

The use of gross filter **RGCT** instead of ratio filter **RRCT** may cause cloud mask discontinuity

Conclusion

Potential improvements of ACSPO using ARMS

- The current “in-pixel” ACSPO Clear-Sky Mask may be overly conservative in coastal, dynamic , and hi-lat areas – work on pattern recognition improvements is underway (Irina’s talk)
- The current ice mask used in ACSPO comes from 0.1º CMC L4 and has room for improvement – have not looked into that yet
- Discontinuity in both SST and mask seen in day/night “twilight” zone in earlier versions of ACSPO – improved in recent ACSPO
- ARMS is a first step towards data fusion
  - ✓ Data of different overpasses from the same platform cane “collated” to generate an L3C
  - ✓ Data from multiple platforms can be “super-collated” to generate an L3S

Potential improvements in ARMS

- SSES effectively reduce global consistency of satellite SST with in situ SST. We plan to add SSES “on-off” button in ARMS, to see its effect on local imagery
- Improve web speed efficiency
- Listen to users what else might be needed