VIIRS SST at the Naval Oceanographic Office analyses at NAVO/USM

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NAVOCEANO Milestones

- Operational with NPP VIIRS SST: March 2013
- Official Distribution in GDS 2.0 format: September 2013 (first GDS 2.0 SST product on JPL/GDAC)
- Monitoring NAVO SST statistics for over 2 years

NAVOCEANO SST Evaluation

- Statistics for April based on match-up buoys (count)
- NAVO VIIRS SST (Best quality):

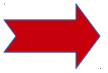
	Count	Bias	RMS error
day	19780	-0.06	0.41
night	32470	-0.02	0.37

- NAVO VIIRS SST Statistics have remained stable and within requirements.
- Similar or better than NAVO AVHRR SST

NAVOCEANO SST EDR Evaluation

- For comparison, IDPS SST EDR (Best quality):

	Count	Bias	RMS error
day	8199	0.06	0.50
night	9476	-0.08	0.29

- Much smaller domain because of satellite zenith angle limit  can be relaxed with new equations
- Daytime RMS error varies 0.45-0.50°C due to missed aerosol and cloud contamination

Evaluation of Clear Sky determination on SST accuracy

- Accuracy of the VIIRS Cloud Mask (VCM) “cloud-free” SST retrievals
- Comparison with NAVOCEANO Cloud Mask (NCM)

NCM is a good comparison standard as it produces very clean SST for assimilation by oceanographic models.

VCM only handles the detection of clouds and not other contaminants ➡ needs extra tests for a valid comparison.

Evaluation of Clear Sky determination on SST accuracy

- Added contamination tests: Simple tests to be considered as proof of concept
  - Daytime:
    - Reflectance test contingent on field test
  - Nighttime:
    - NCM aerosol test
    - Adjacency to cloud test contingent on field test

Evaluation of Clear Sky determination on SST accuracy

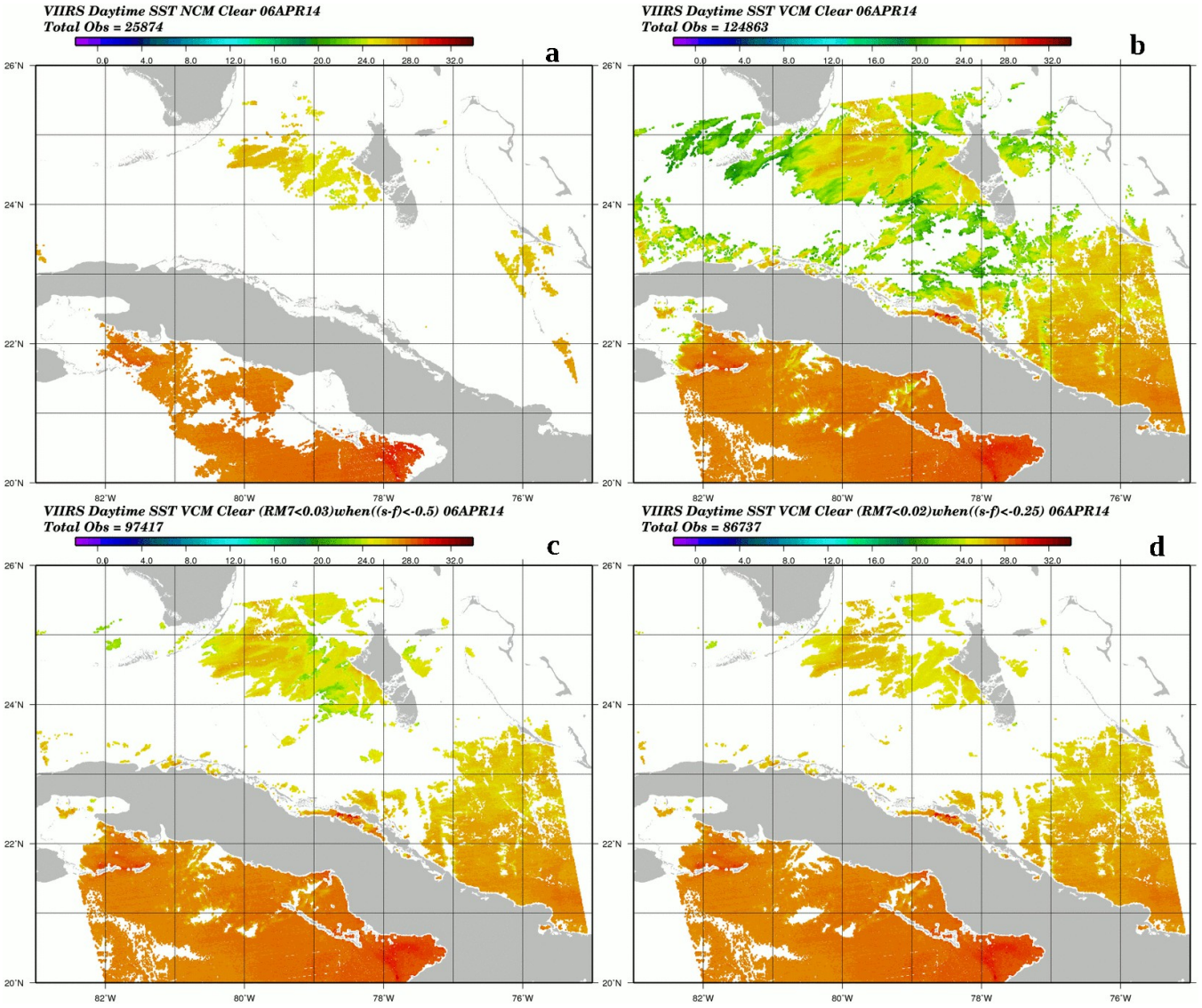
Daytime / February	Buoy matches	RMS error °C
NCM / NCM + test	4967 / 4901	0.51 / 050
VCM / VCM + test	16844 / 14863	0.70 / 0.51

Nighttime / February	Buoy matches	RMS error °C
NCM	6785	0.36
VCM / VCM + tests	21052 / 17171	0.56 / 0.34

- Additional tests mostly flagging adjacent retrievals to detected clouds ➡ cloud leakage w/ original VCM
- VCM with additional tests performs as well as NCM, and allows increased coverage

Example of Clear Sky SST

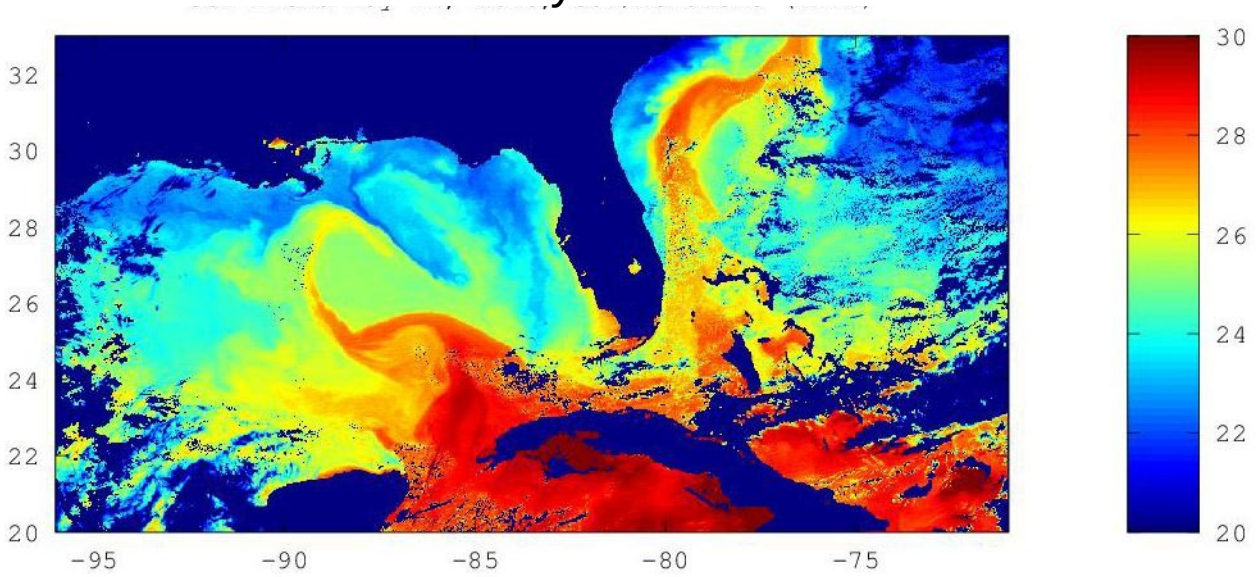
Daytime SST fields on April 6, 2014 a) for NCM clear, b) for VCM clear, c) for VCM clear with additional test, d) with a tightened additional test to remove remaining cloud leakage



SST analyses with Swath Overlap

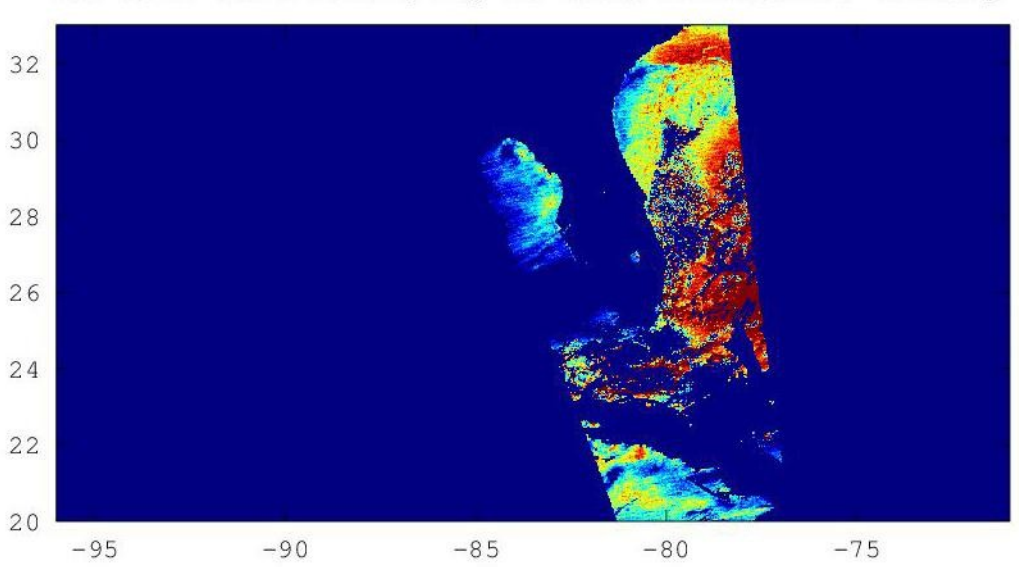
- With full swath processing, significant swath overlap even at low latitudes
- The overlap between swath can help evaluate SST equations at higher satellite zenith angle (SZA).
- Three types of equations:
  - Standard Non Linear SST – NL53deg (designed for SZA < 53°)
  - NLSST equation with additional SZA terms – “Non Linéaire Complet” (NLC) which is OSI/SAF daytime equation
  - Miami Lat-band algorithm v6
- For NLC: coefficients from NAVO, STAR, Météo France.

SST field May 14 2013



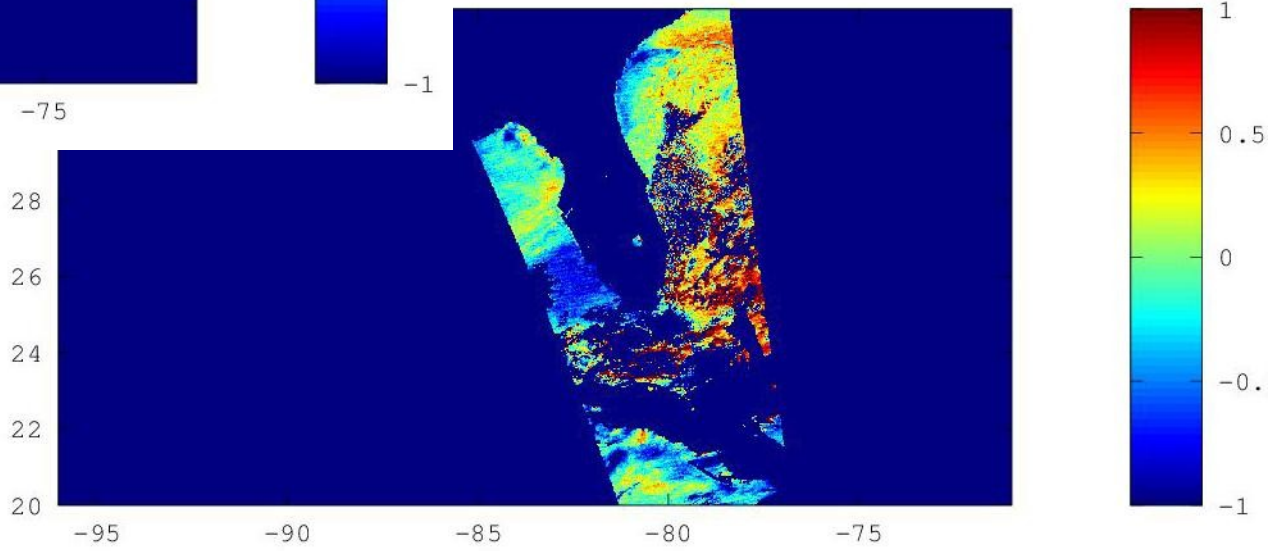
SST analyses with Swath Overlap

- SST field of later orbit is subtracted from that of earlier orbit
- Uncorrected limb darkening effect appears as a cold bias on west side of the overlap region and a warmer bias on the east side



NL53deg

NLC



SST analyses with Swath Overlap

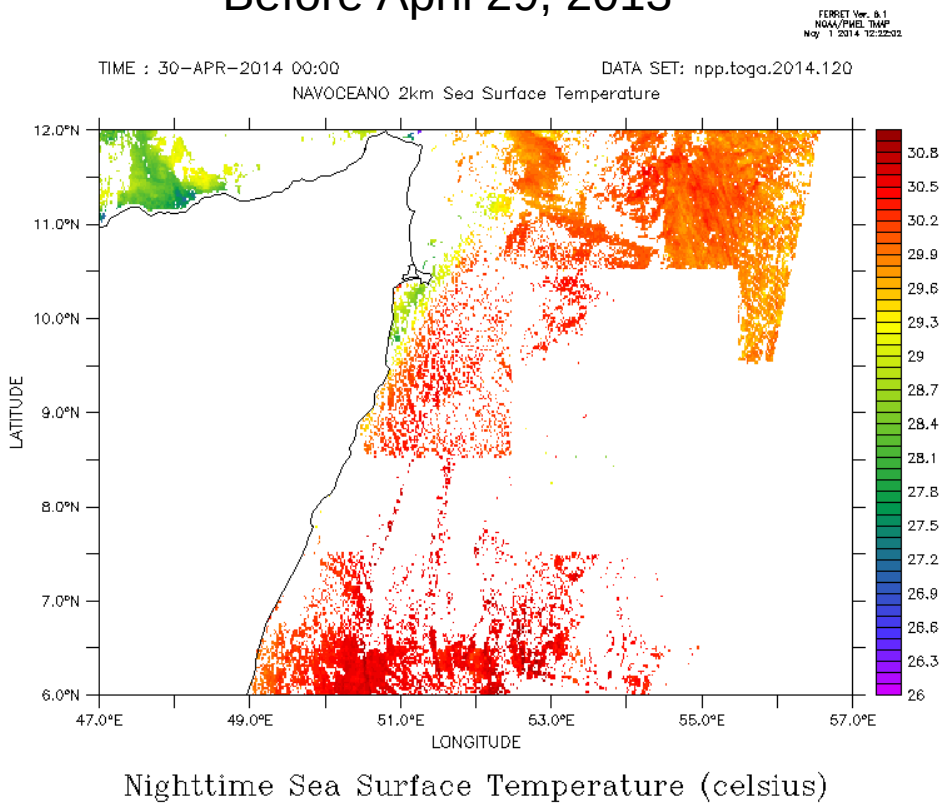
- Numerical results for domain shown in previous two slides
- As expected at high satellite zenith angle NL53deg performs significantly worse than NLC.

May 14, 2013	bias °C	mean absolute bias °C
NL53deg	-0.23	0.51
IDPS (old equations)	-0.23	0.52
Miami	-0.15	0.39
NLC (NOAA coefs 10/2013)	-0.12	0.41
NLC (Météo France coefs)	-0.13	0.38
NLC (NAVO coefs)	-0.09	0.27

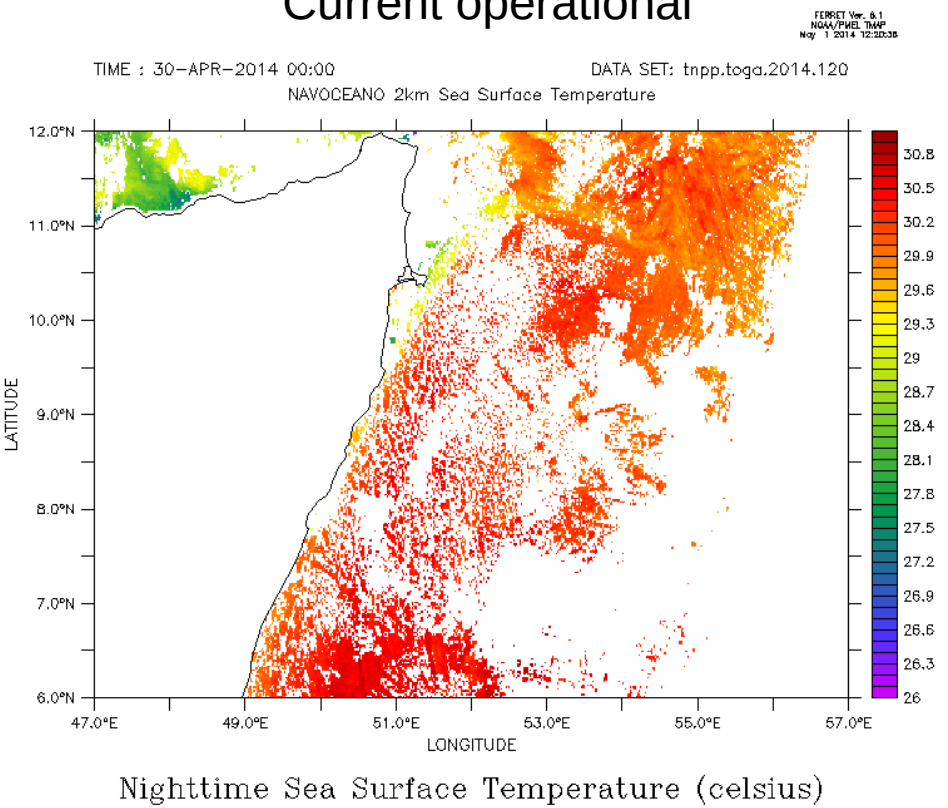
NAVOCEANO improvements

- NAVOCEANO is investigating the use of VCM or improvements to NCM for SST production
- Example: Recent improvements address coverage and cloud detection artifact issues in nighttime SST

Before April 29, 2013



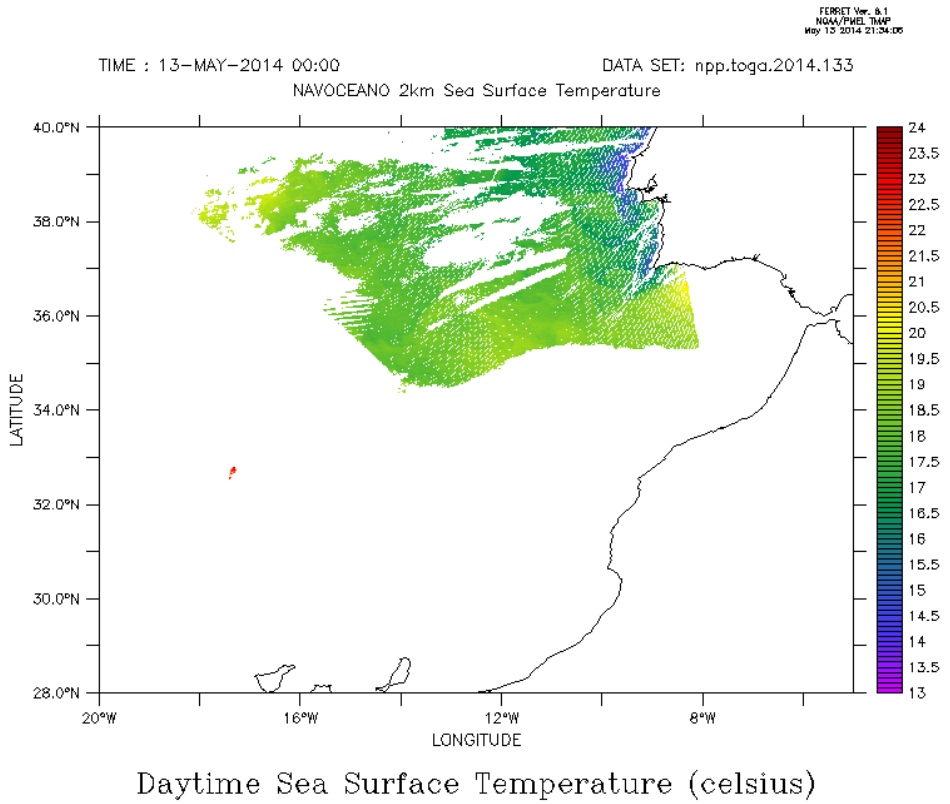
Current operational



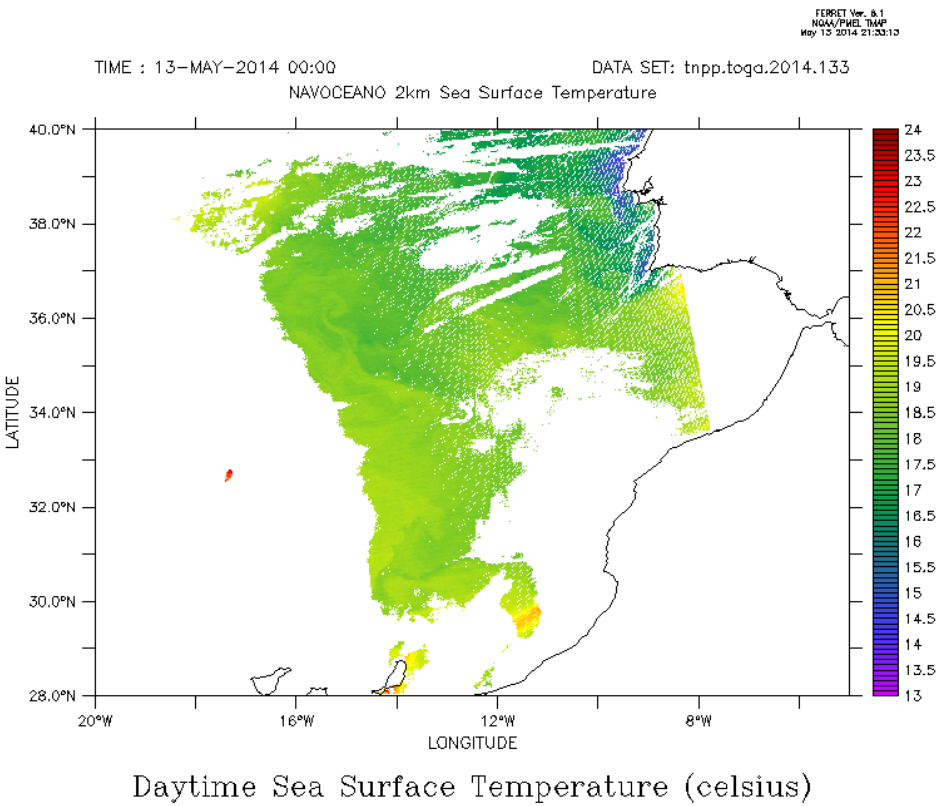
NAVOCEANO improvements

- Example: Proposed modification to address coverage and cloud detection artifact issues in daytime SST

Current operational



In testing



Conclusion

- VIIRS is an excellent sensor which allows the production of quality SST retrievals.
- VCM with additional tests performs well for SST production. VCM would benefit from access to computed SST retrievals and a good previous day SST field.
- Full swath processing allows overlap analyses even at low latitudes but requires the switch to an NLC (NL with extra SZA terms) type equation.