NOAA's Optimum Interpolation SST and Updates Needed

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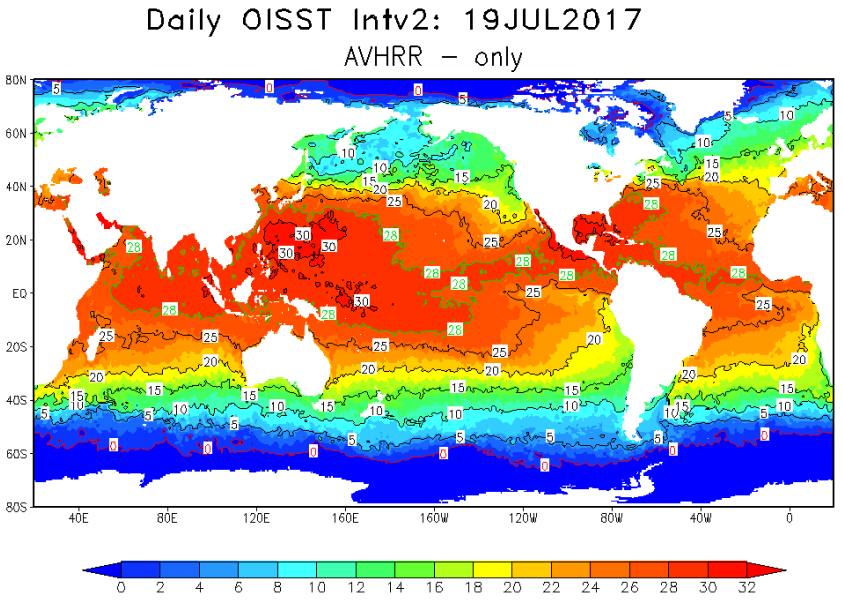
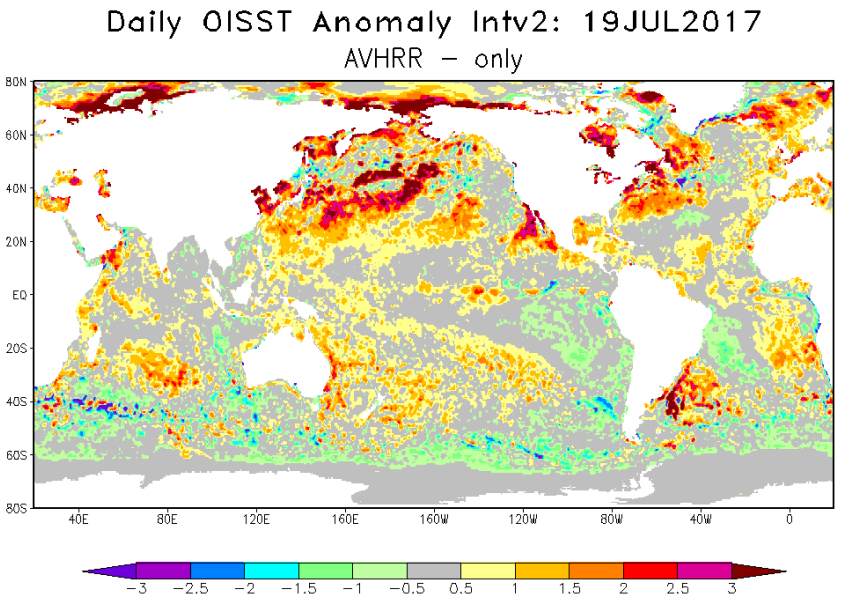
Outline

- OISST: stable analysis, widely used for multi-decade study and monitoring
- Updates needed:
  - VIIRS data need to be incorporated, requiring testing
  - Processing updates needed
- Without attention the analysis could become less reliable

The OI 0.25° Daily Analysis

- Example mean and anomaly for 1 day, using Navy AVHRR data
- Bias adjustments for cloud & aerosol contamination
- Large to mid scale features resolved and error estimates available
- Long record (since late 1981)
- Widely used for long-term monitoring and study





Satellite SSTs and Testing Needed

- SSTs estimated from radiation
  - Atmospheric corrections for clouds and aerosols
  - Compared to older algorithms, ACSPO SSTs have greater sampling: need to evaluate changes from using ACSPO SSTs
  - First: compare ACSPO AVHRR-based analysis to current AVHRR-based analysis
  - Next: compare ACSPO AVHRR-based OISST to ACSPO VIIRS-based OISST

ACSPO Data Improvements

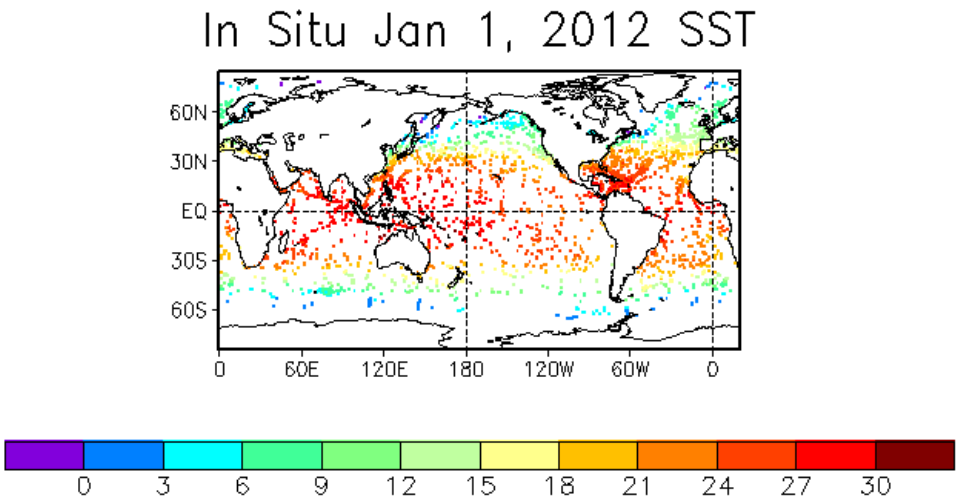
- Current status:
  - AVHRR Navy SST used after 2005
  - AVHRR Pathfinder SST used for historical period (1981-2005)

- New ACSPO operational AVHRR-based SST
  - More advanced algorithm, better coverage, less resolution loss
  - Becoming easier to use for operations

- ACSPO VIIRS data
  - continues infrared time series after AVHRR era ends
  - need to be tested for 0.25° long-period analysis and for a higher-resolution analysis

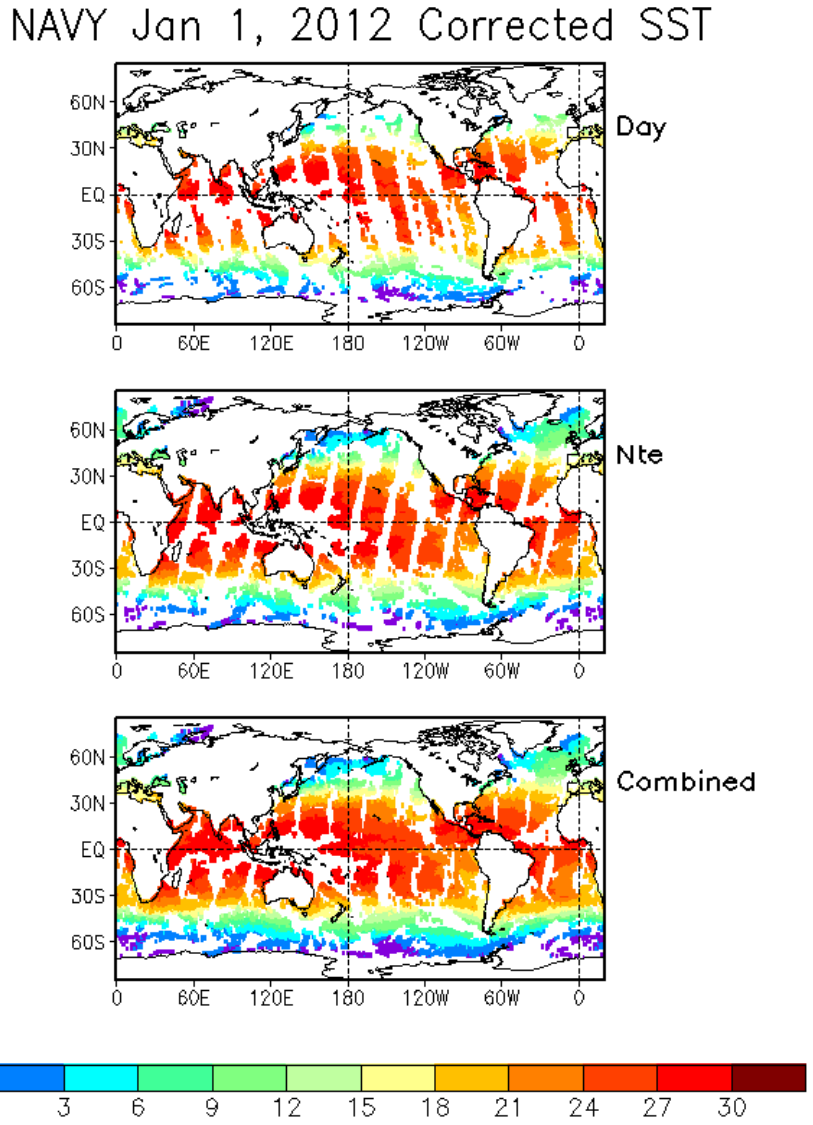
In Situ Data

- One day: 1 Jan 2012
- Ship & Buoy combined sampling typical for the year
- Mostly used for correcting satellite biases
  - Not enough sampling for high-resolution analysis
- Here averaged to 1° grid to more clearly show sampling



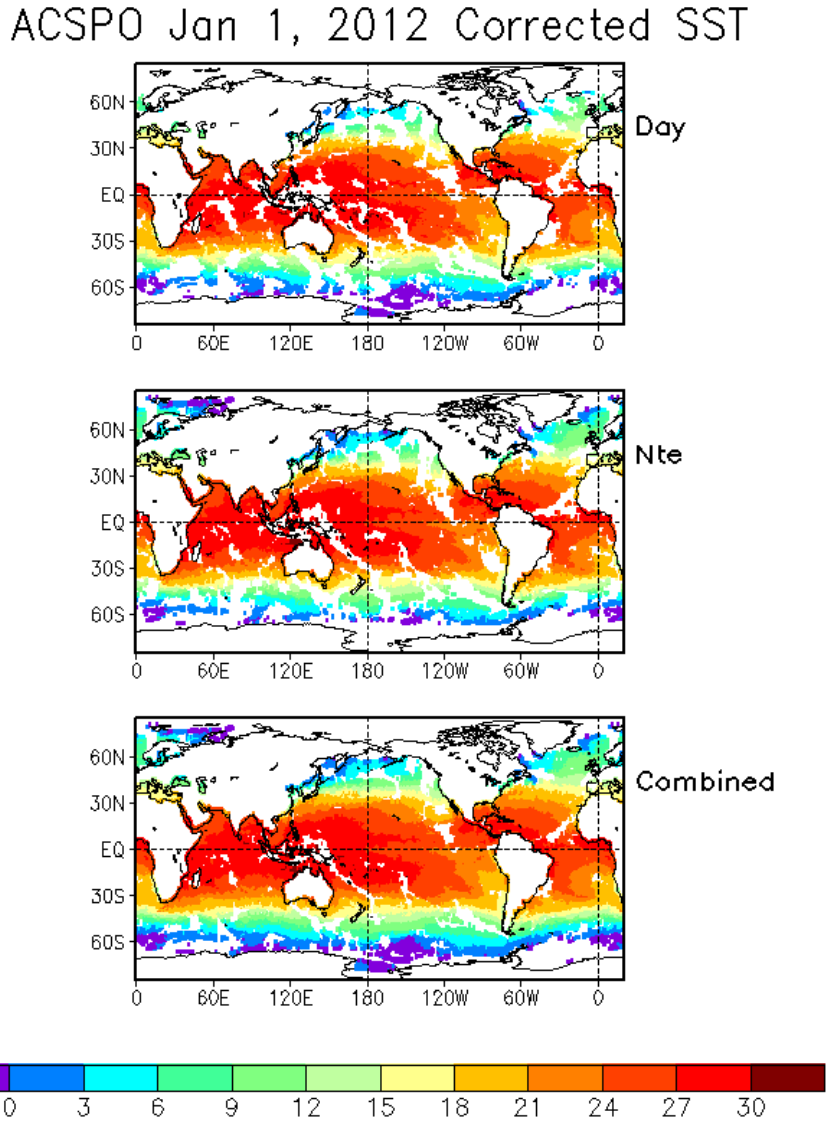
NAVY AVHRR Daily

- One day: 1 Jan 2012
- Day & Night show satellite passes
- Combined sampling for daily analysis



ACSPO AVHRR Daily Data

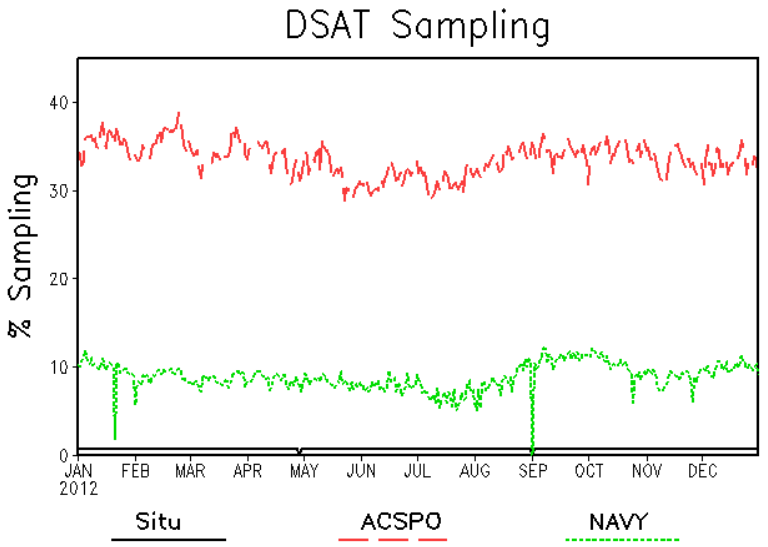
- Same day: more sampling
- Expanded data reduces sampling errors
- Data errors need more evaluation

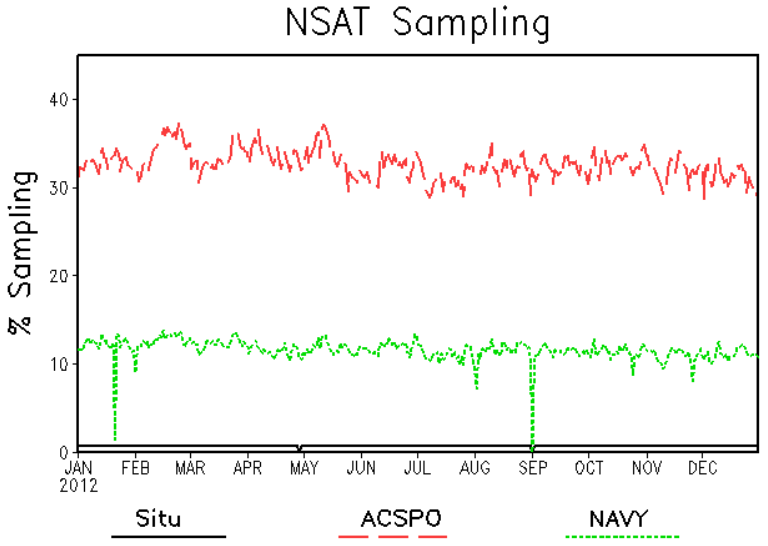


Sampling Comparisons

- ACSPO sampling about 3 times NAVY sampling of 0.25° grid squares

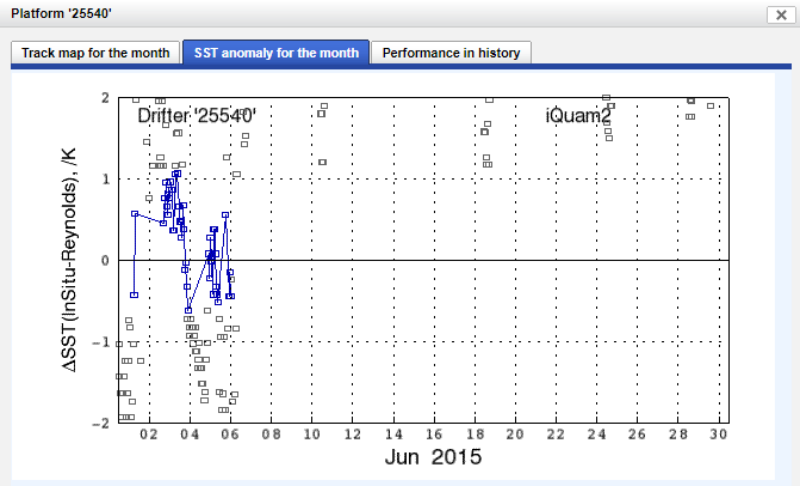
Averages	ASCPO	NAVY	In Situ
DSAT	33.5	8.9	0.7
NSAT	32.6	11.6	0.7





Arctic Problem: 1 Buoys

Buoys can get trapped in melt pond or on top of ice: careful QC needed



Plot of single buoy over time (lat=84.4, lon=-21.2) shows acceptable values in blue, questionable in gray

From https://www.star.nesdis.noaa.gov/sod/sst/iquam/v2/index.html

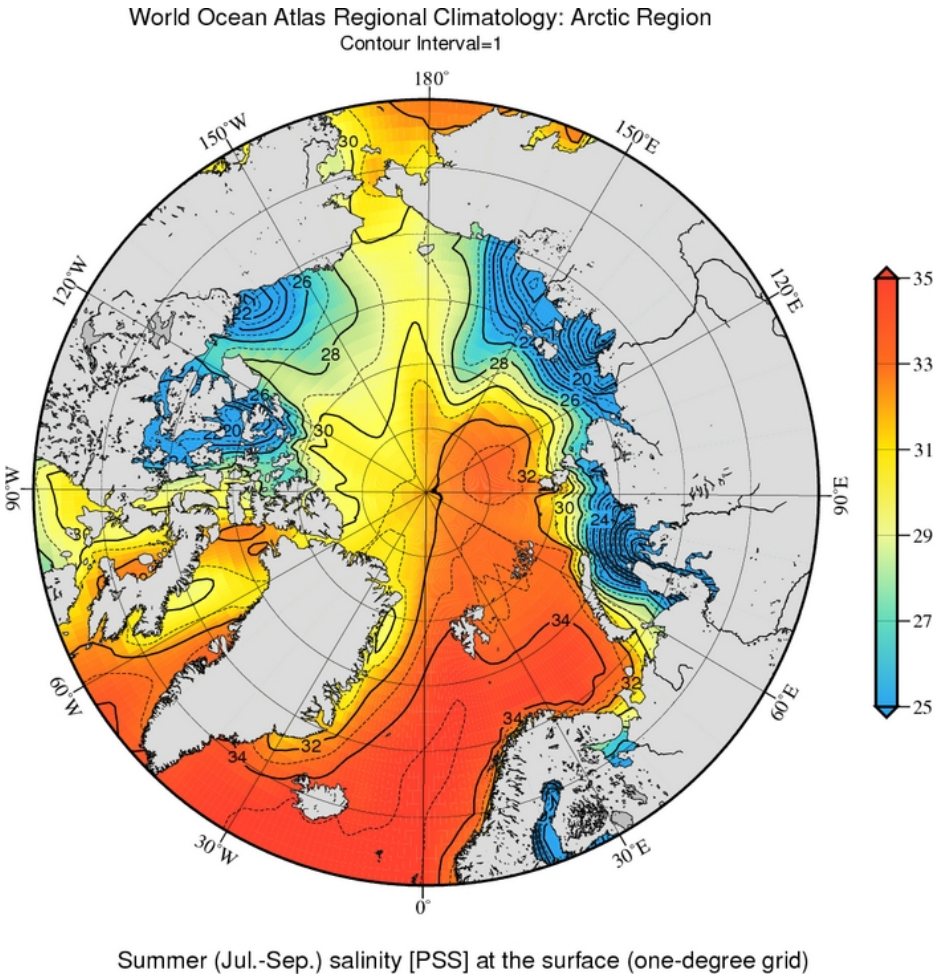
- Ice-mass balance buoy (front): SLP, SAT, SST, ice T, snow depth, ice thickness
- Balls (background) SVP-B common drifters
- Arctic buoys began after 2010, QC delayed so not used in current OISST
- Could use iQuam (STAR) criteria for screening

Picture courtesy of Ignatius Rigor, U. Washington, and US Interagency Arctic Buoy Program and International Arctic Buoy Program

Arctic Problem: 2 Salinity Variations

- OISST assumes constant ocean freeze temperature -1.8C (S about 33)
- Actual freeze temperature changes due to salinity
- OI smoothing spreads errors in the sparse-data Arctic

S	Tf (°C)
20	-1.08
25	-1.36
30	-1.64
35	-1.92



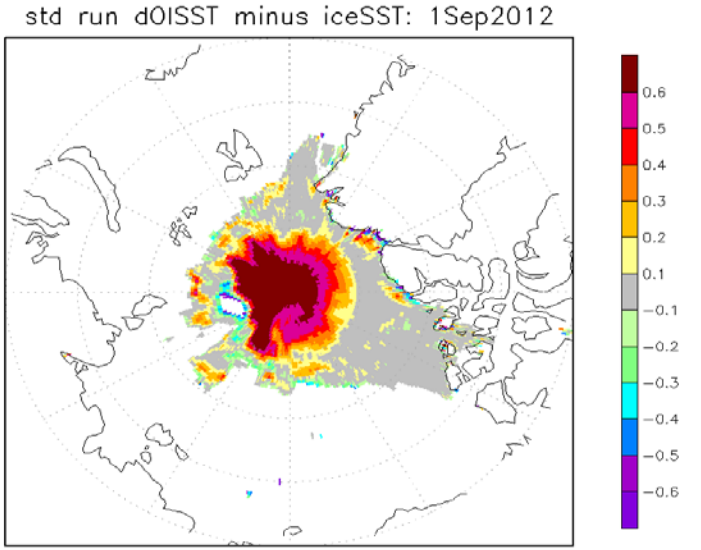
Arctic Problem: 3 Analysis

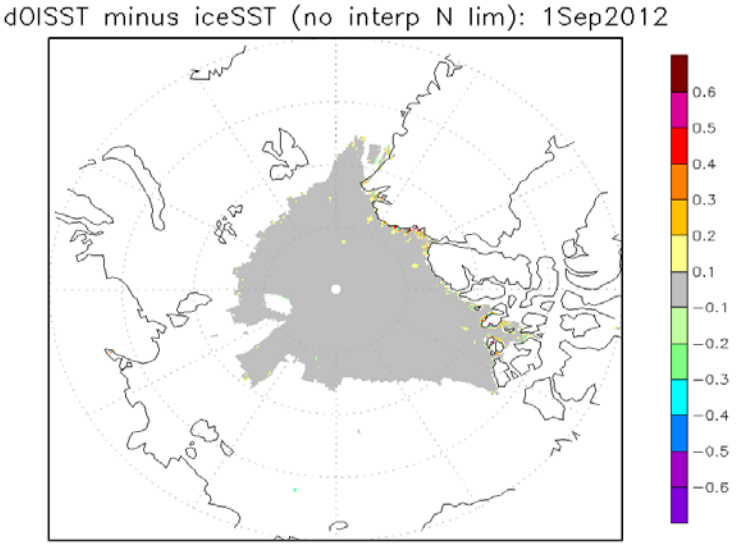
Too much smoothing & extrapolation to the pole in Arctic, spreading sparse warmer temperatures

Analysis with Smoothing – IceSST (upper)

Analysis without smoothing difference (lower)

More testing and validation needed





Improved Analysis Statistics

Weekly 1° OI Average Scales

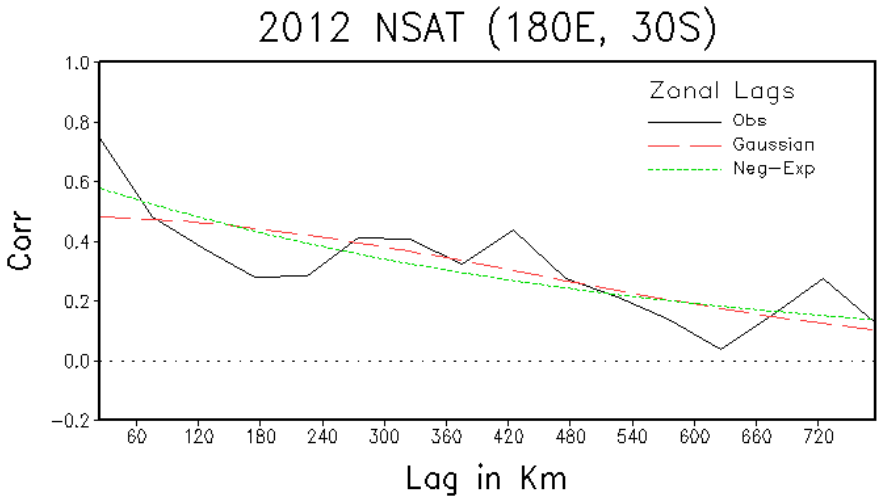
Zonal	859 km
Meridional	608 km
Noise/Signal Variance	0.77-2.13

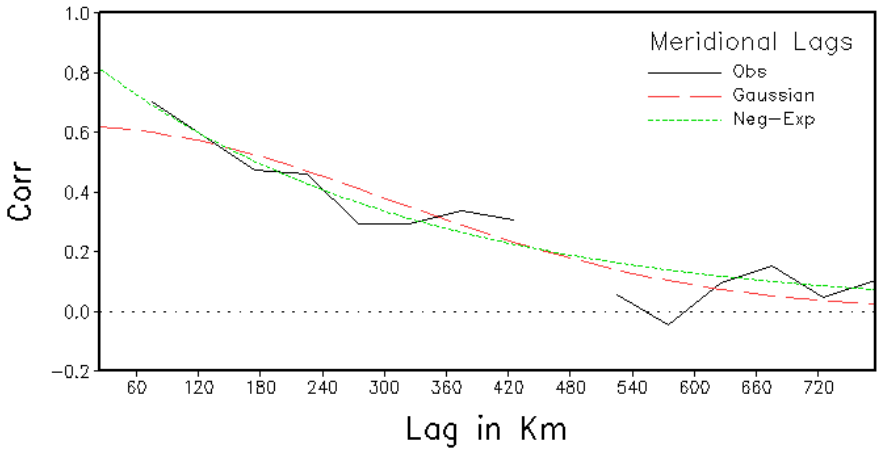
Daily 0.25° OI Average Scales

Zonal	151 km
Meridional	155 km
Noise/Signal Variance	0.25

ACSPO Daily 0.25° Preliminary Estimates

Zonal	270 km
Meridional	240 km
Noise/Signal Variance	0.15-0.29





Resolution Improvements

- VIIRS Available for about 6 years, allows better resolution
- ACSPO SSTS also available for AVHRR from 2002
- Higher spatial resolution possible for the VIIRS period
  - Separate HR analysis to continue into future
  - Longer record 0.25° analysis still needed
- Due to greater sampling from ACSPO processing, may be possible to use it to estimate daily cycle for longer record

Summary

- Long-record OISST is needed: AVHRR era is ending
- Analysis needs updating for continued high-quality operations
- New data needs testing: ACSPO AVHRR, ACSPO VIIRS, updates of Pathfinder and ICOADS
- New higher-resolution analyses are possible for a shorter period
- Without additional resources testing and updates are likely to be delayed