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
ACSP0 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

- 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

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

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

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Summer (Jul.-Sep.) salinity [PSS] at the surface (one-degree grid)
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