

# Daily Blended Analysis for Sea Surface Temperature

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11<sup>th</sup> Ocean Observation Panel for Climate  
 Tokyo, Japan | May 16 -20, 2006

## Jan '03: Number of Days with Nighttime Obs on 0.25° grid

Top: AVHRR Pathfinder  
 Bottom: AMSR-E

### For AVHRR:

- Absolute latitudes > 40° have roughly only 5 days of data
- Number of days increases toward the tropics
- Drop offs due to cloud cover

### For AMSR:

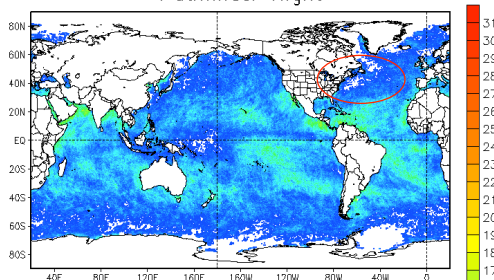
- Absolute latitudes > 40° have more than 20 days of data
- Drop offs due to precipitation in ITCZ and SPCZ



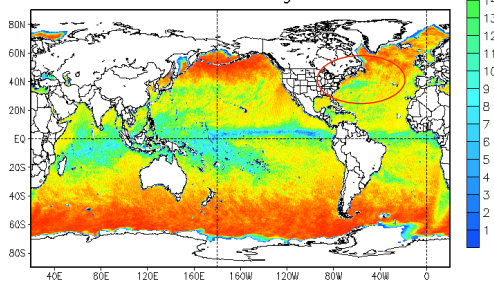
2

## Number of Nights with Obs: JAN2003

Pathfinder Night

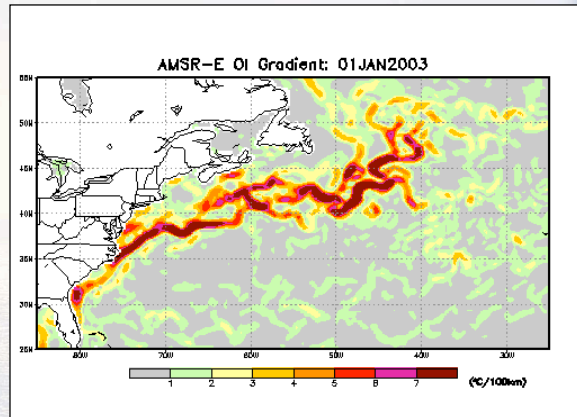


AMSR-E Night



## Magnitude of Gradient: Gulf Stream

- Daily OI using AMSR-E for January - March 2003
- Gradients have a stationary part due to topography
  - Thus, limited AVHRR data are useful



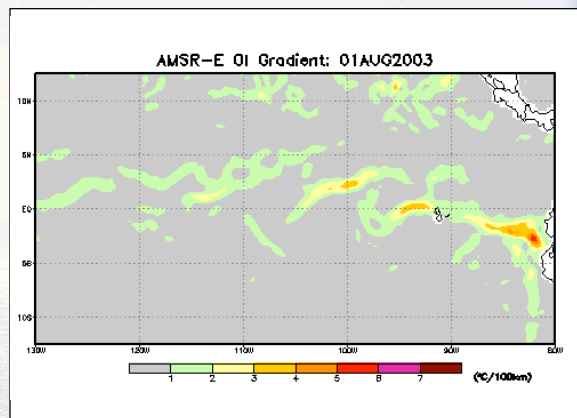
3

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## Magnitude of Gradient: Tropical Eastern Pacific

- Daily OI using AMSR-E for August - October 2003
- Gradients propagate westward
  - Limited coverage not as useful here
  - Monthly averaging smooths out most of gradient signal



4

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# OI SST Analysis

## Weekly (OI.v2)

- Grid: 1°
- Data: Satellite plus in situ (ship and buoy) data
  - Satellite data
    - **Infrared AVHRR**
  - 7-Day large-scale satellite bias correction for each satellite
- Spatial error correlation: ~ 700 km

## Daily

- Grid: 0.25°
- Data: Satellite plus in situ (ship and buoy) data
  - Satellite data to include
    - **Infrared AVHRR**
    - **Microwave AMSR-E**
  - 7-Day large-scale satellite bias correction for each satellite
- Spatial error correlation: ~ 100 km



5

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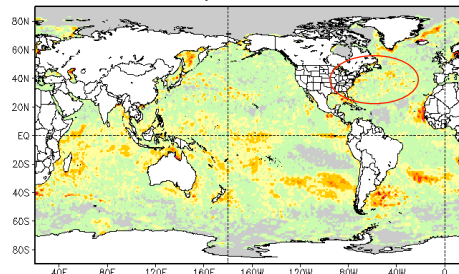
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## Jan 2003: Standard Deviation

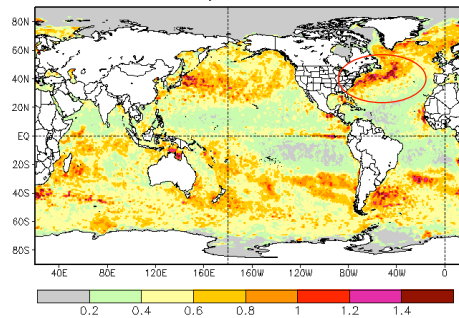
**Top: Pathfinder**  
**Bottom: AMSR-E**

- AMSR-E has stronger standard deviations than Pathfinder
  - Especially in mid-latitude winter
  - Clouds reduce Pathfinder sampling
- These differences plus gradient differences suggest that **separate** Pathfinder OI and Pathfinder + AMSR OI needed

Monthly Stand Dev: JAN2003  
Path Daily OI: NO Bias Cor



AMSR Daily OI: NO Bias Cor



6

## Jan 2003: Mean SST Gradient

### From the figure note:

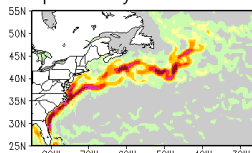
- Sparse AVHRR data
- AMSR data missing near coast otherwise almost complete
- OI.v2 gradients very weak
- Daily OI and RTG gradients are similar
- AMSR OI has strongest gradients due to better data coverage than AVHRR



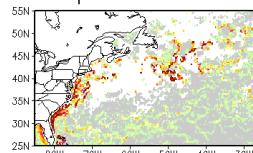
7

### Monthly Average Gradient: JAN2003

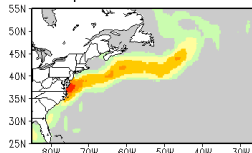
Oper Daily OI: 100km



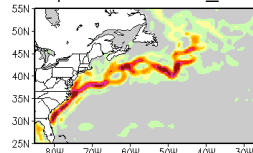
Operational Data



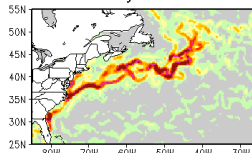
Operational OI.v2



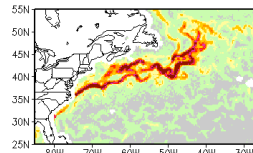
Operational RTG\_SST



AMSR Daily OI: 100km



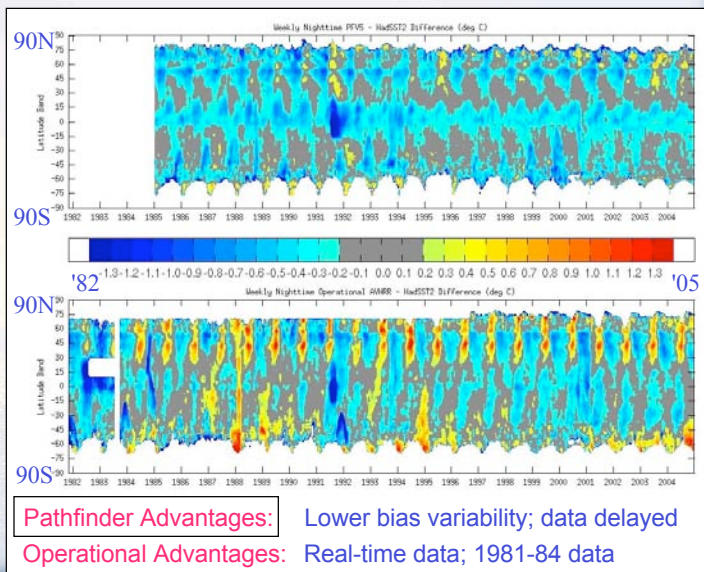
AMSR Data



## Nighttime Zonal Bias: AVHRR - In Situ

AVHRR  
Pathfinder  
- In Situ

AVHRR  
Operational  
- In Situ



8

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## Weekly & Daily OI December 1991

- Both OIs have bias correction for AVHRR data
- Daily OI uses Pathfinder
- Weekly OI uses Operational

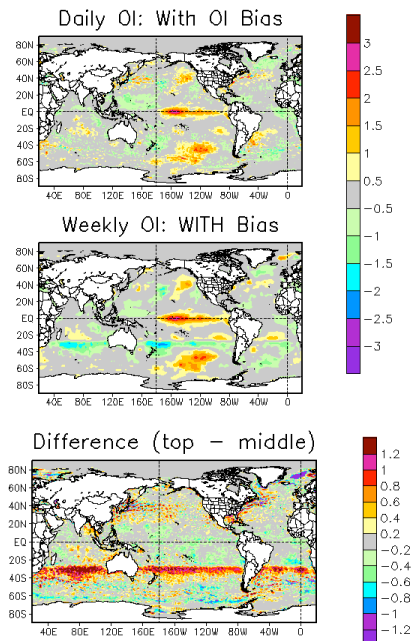
### From the figure note:

- Operational data problem along 35°S
  - Delayed mode processing allows data correction
- Daily scales reduced in high gradient areas



9

### Monthly Average: DEC1991



## Weekly & Daily OI January 1998

- Both OIs have bias correction for AVHRR data
- Daily OI uses Pathfinder
- Weekly OI uses Operational

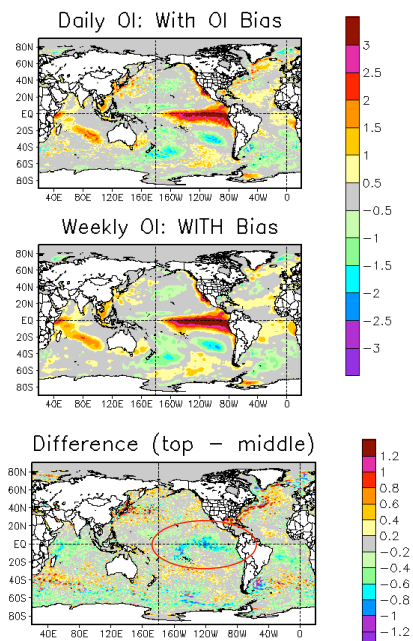
### From the figure note:

- Pathfinder problem near equator in Eastern Pacific
  - Zonal bias in Pathfinder worse than Operational
  - Number of AVHRR retrievals lower than normal due to ENSO cloud cover



10

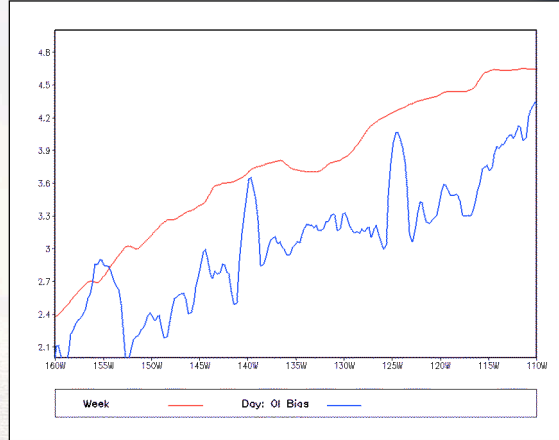
### Monthly Average: JAN1998



## OI Anomalies with Bias Correction January 1988: Along equator

**From the figure note:**

- Operational AVHRR did not have strong biases in this region
- Negative biases in daily OI except at TAO mooring sites near: 155°W, 140°W & 125°W
- OI bias correction fails to correct AVHRR Pathfinder satellite biases



11

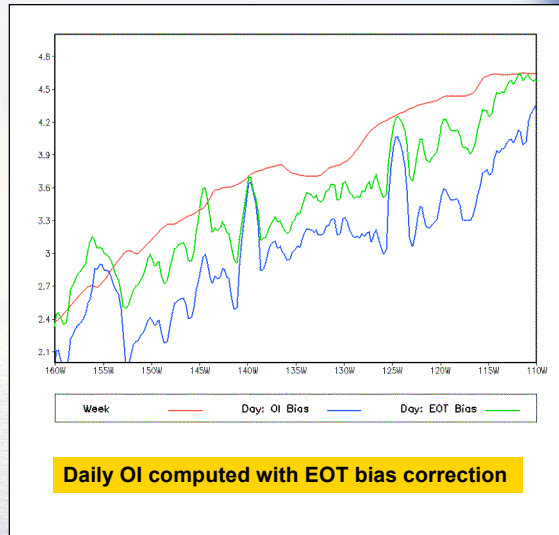
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- OI bias correction fails to correct AVHRR Pathfinder satellite biases
- **Empirical Orthogonal Teleconnections (EOT) bias correction better at correcting biases**



**Daily OI computed with EOT bias correction**



12

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## Daily OI: Plans

- Add error estimate field to OI
  - Bias, Sampling & Random errors
- Improve sea ice concentrations and generation of SSTs from sea ice
- Put output files in **NetCDF**
- Make OI operational



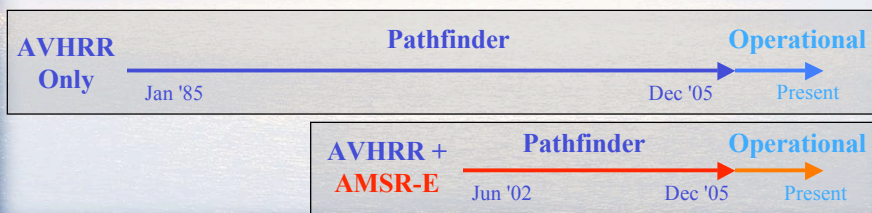
13

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## Daily FTP OI Products

- **AVHRR only**
  - Pathfinder (Jan '85 - Dec '05)
  - Operational (Jan '06 - present)
- **AVHRR + AMSR-E**
  - Pathfinder (Jun '02 - Dec '05)
  - Operational (Jan '06 - present)
  - AMSR-E (Jun '02 - present)
- **Test other data: TMI, ATSR, MODIS...**



14

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## Daily OI: Ship Biases

- Satellite biases are corrected with respect to in situ data (ships & buoys)
- Ships have larger random and bias errors than buoys
  - Ship observations using buckets tend to be biased cold due to evaporation
  - Ship observations using engine intake tend to be biased warm due to engine room heating
  - Ship metadata needs improvement
- Try to correct ship bias using buoy data
  - Preliminary tests indicate EOT procedures over a 30 day time period would work



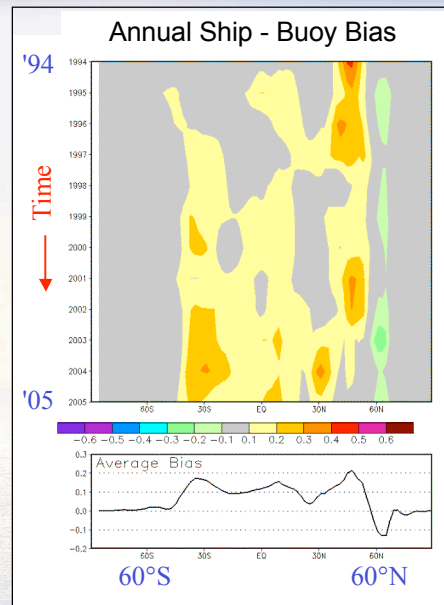
15

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## Ship-Buoy SST Zonal Biases

- EOT monthly ship & buoy analyses
- Buoy SST obs increase with time
  - Significant buoy obs 1994 to present
- First correct in situ biases than correct satellite biases
- What is the in situ "Truth"?
  - Buoys more accurate
    - K. Trenberth
  - Ships fit historic record
    - T. Karl



16

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