Microwave SSTs & climatologies

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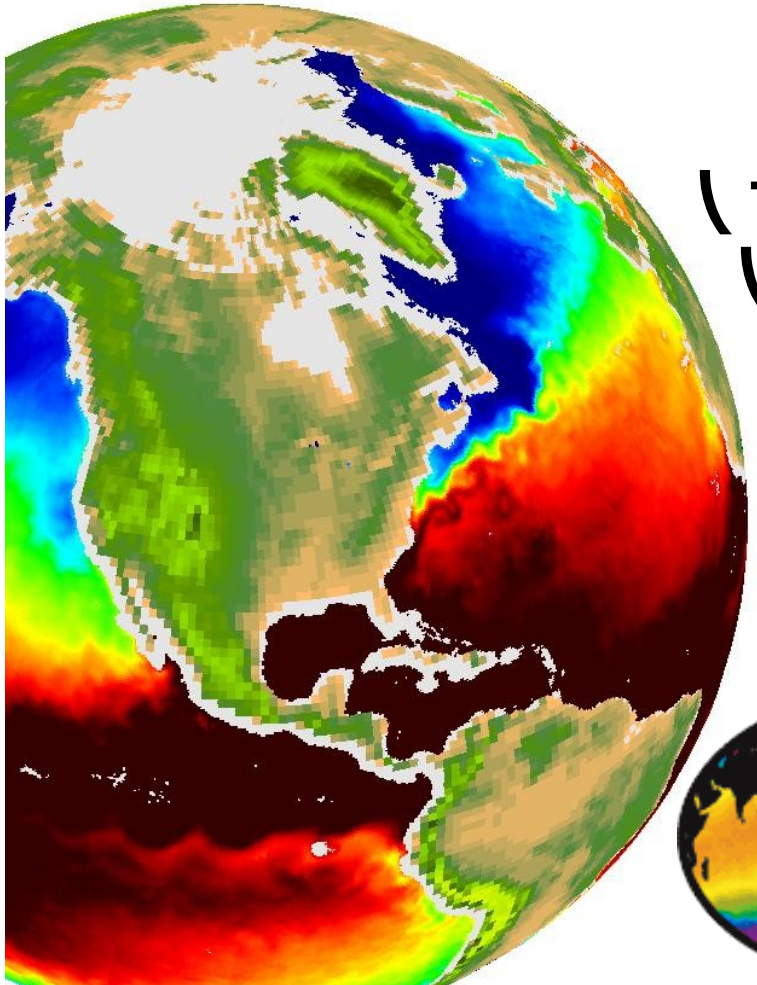
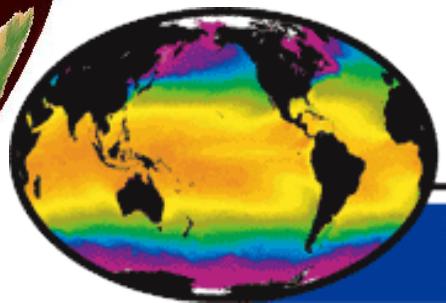


- TMI/AMSR-E
  - MW SST algorithm development
    - Validation Results
      - Sensor Issues
      - Useful for Climate research

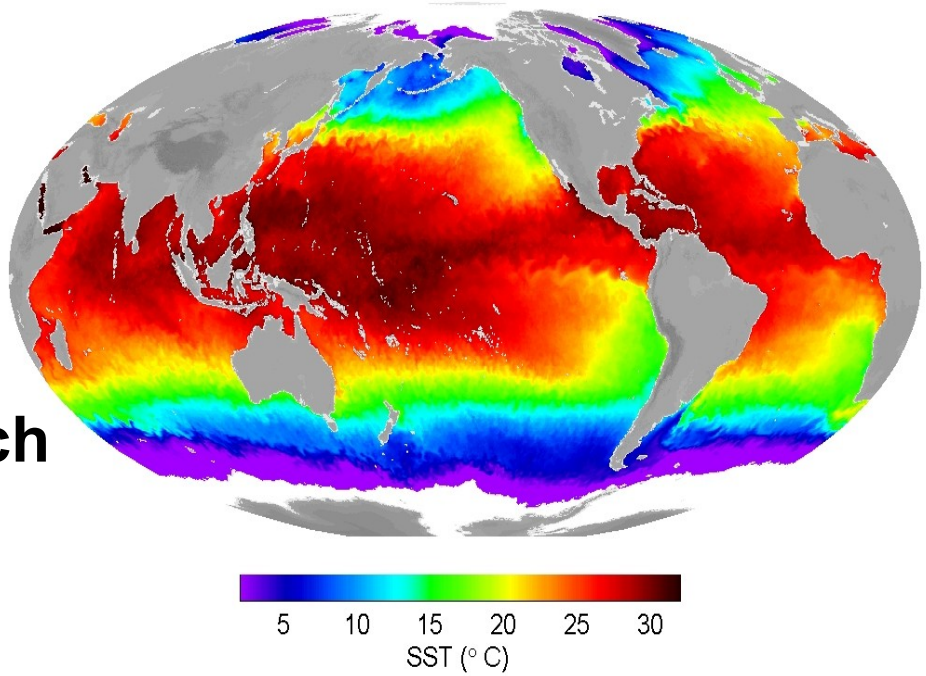


GHRSST-PP

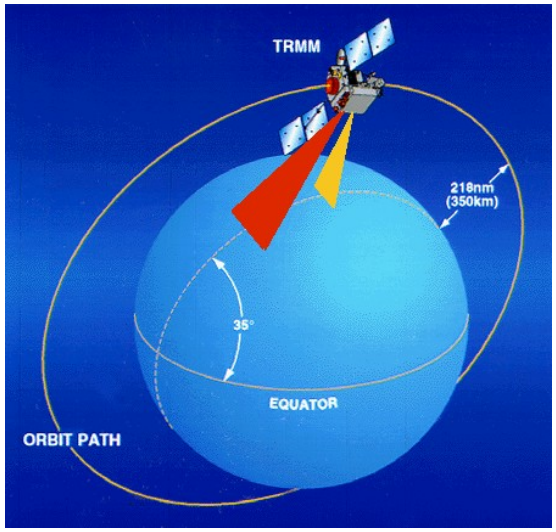
GODAE High Resolution Sea Surface Temperature Pilot Project

Outline of Talk

- ♣Current status of TMI & AMSR-E SSTs
  - Sensor description
  - RSS MW SST algorithm
- ♣Validation Results
- ♣Calibration problems
- ♣Useful for Climate research



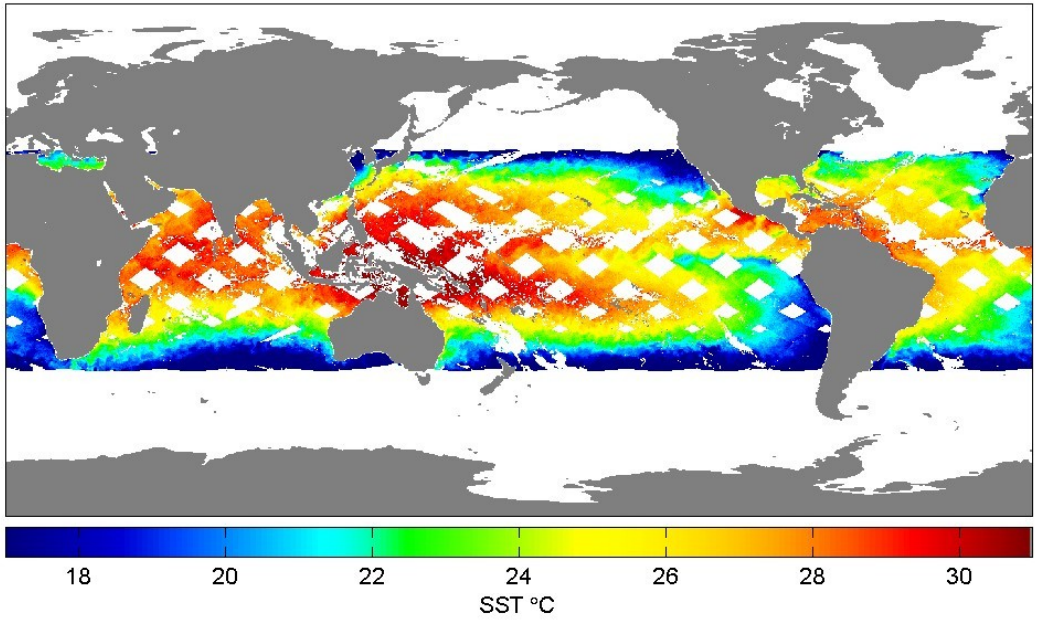
TRMM Orbit



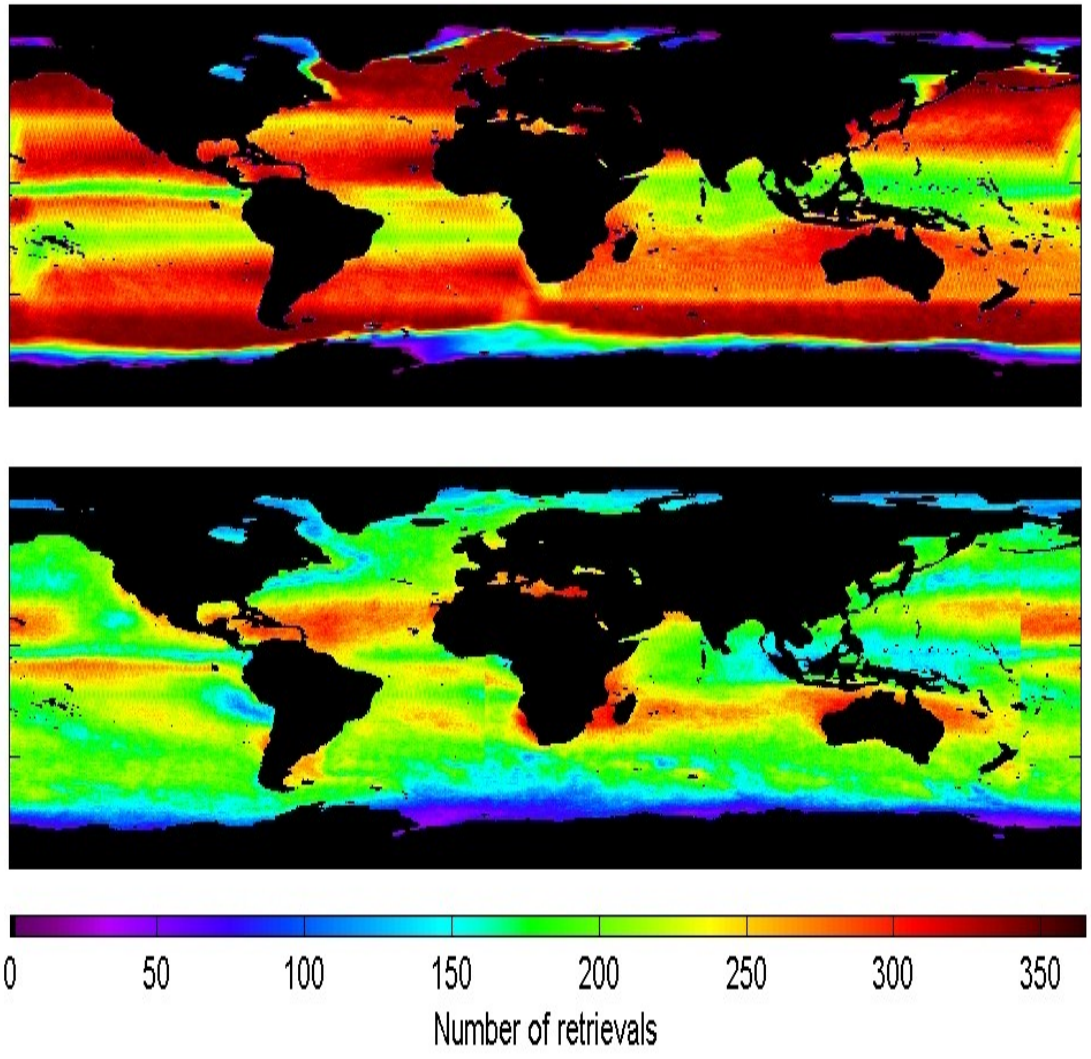
- 50 km footprint
- Swath width: 760 km
- 5 channels:
  10.7, 19.4, 21.3, 37, 85.5 GHz

- 35° inclination.
- Altitude of 350km.
- Full coverage in
  ~2 days.

TRMM SST, November 23, 2000



Better Coverage: IR/MW retrievals



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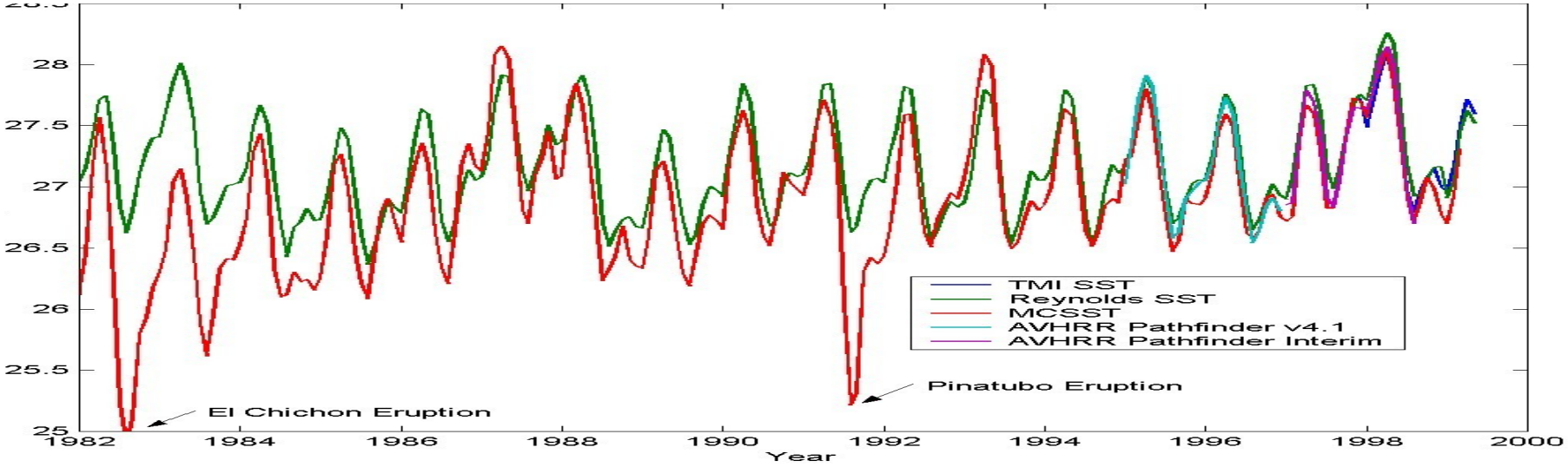
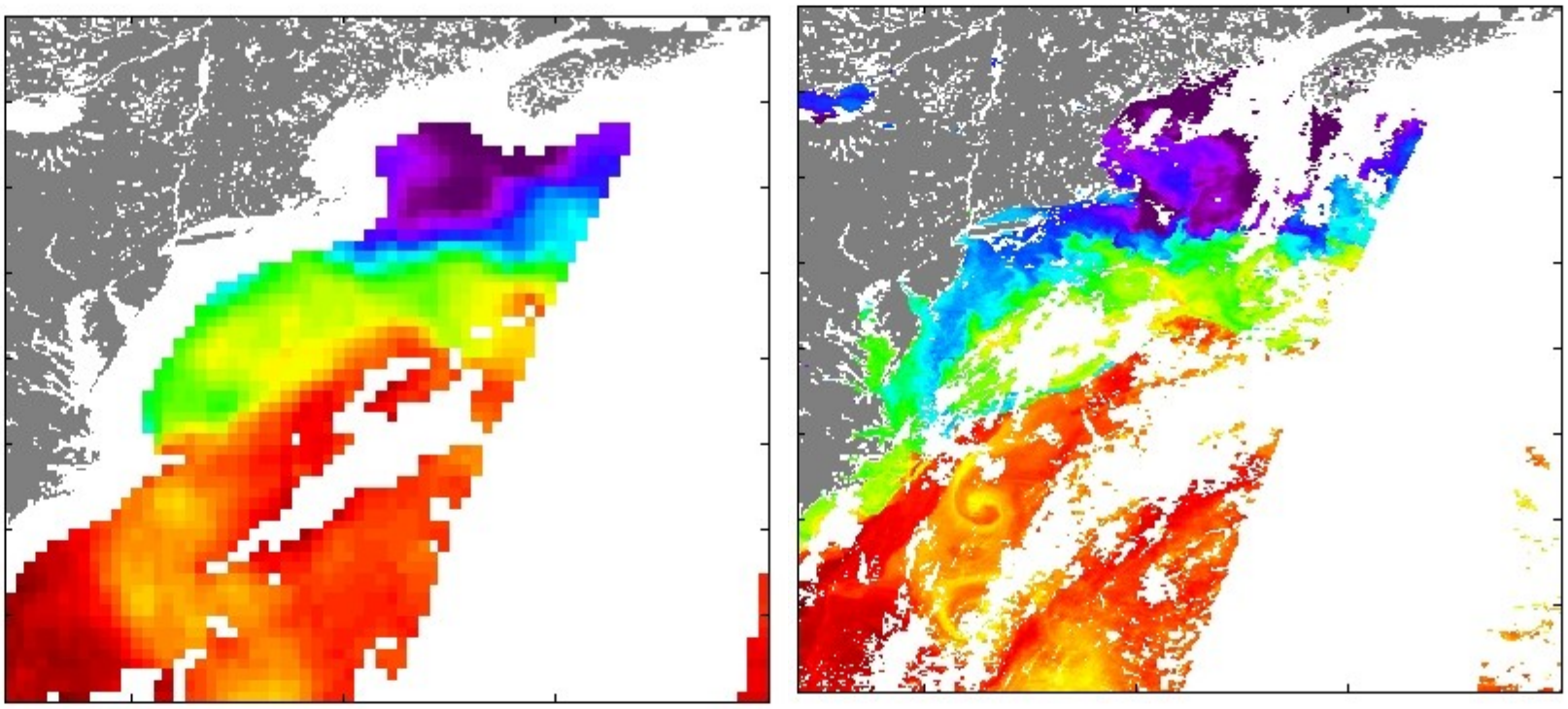
Climate Stability

- Water Vapor is a greenhouse gas – IR SST are susceptible to biases due to water vapor
- Volcanic aerosols, Saharan Dust, & Asian Dust events result in cool biases (minimized in more advanced instruments)



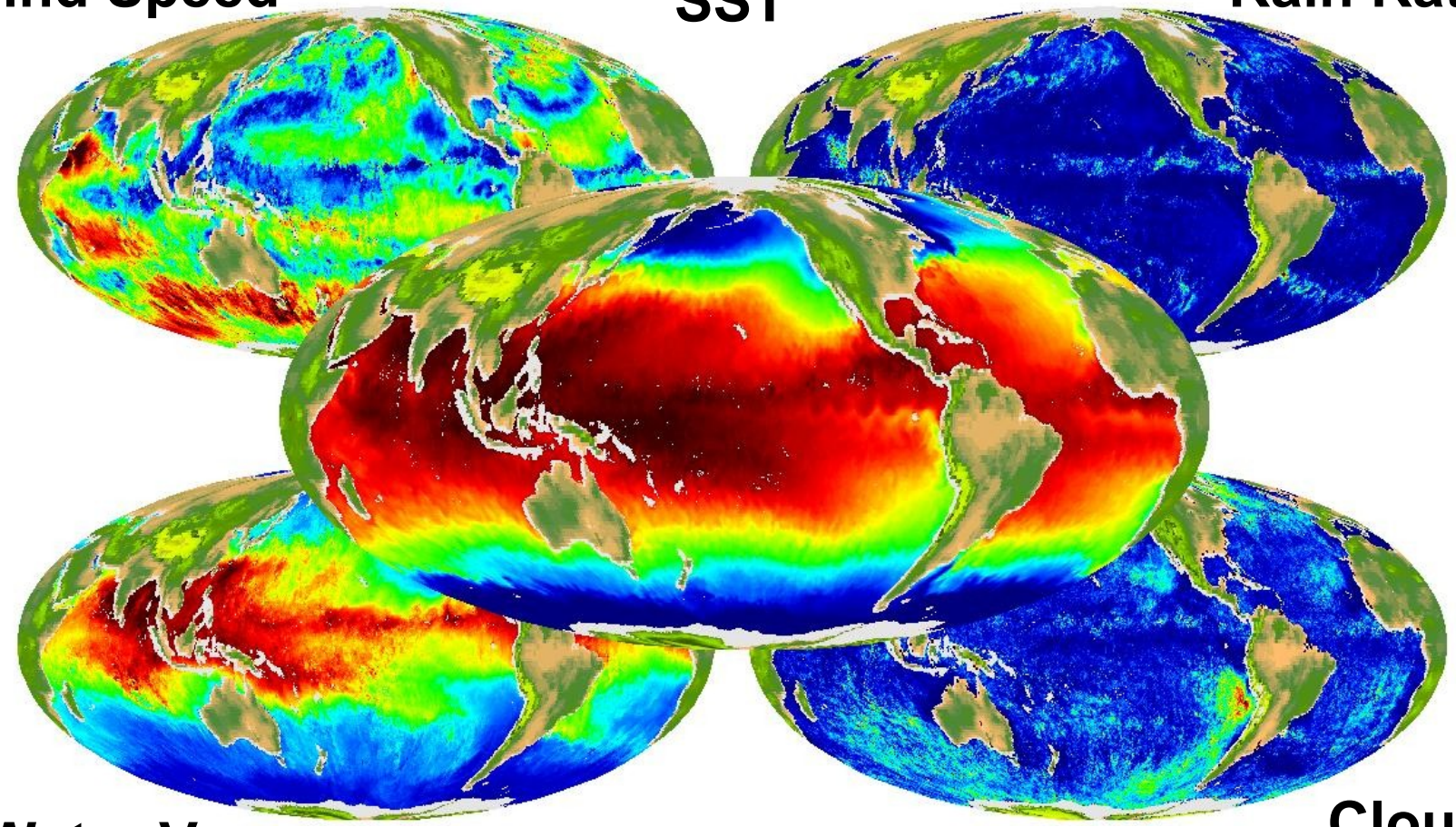
Spatial Resolution

AMSRE MODIS



www.misst.org

TMI/AMSR-E
Suite of Ocean Products



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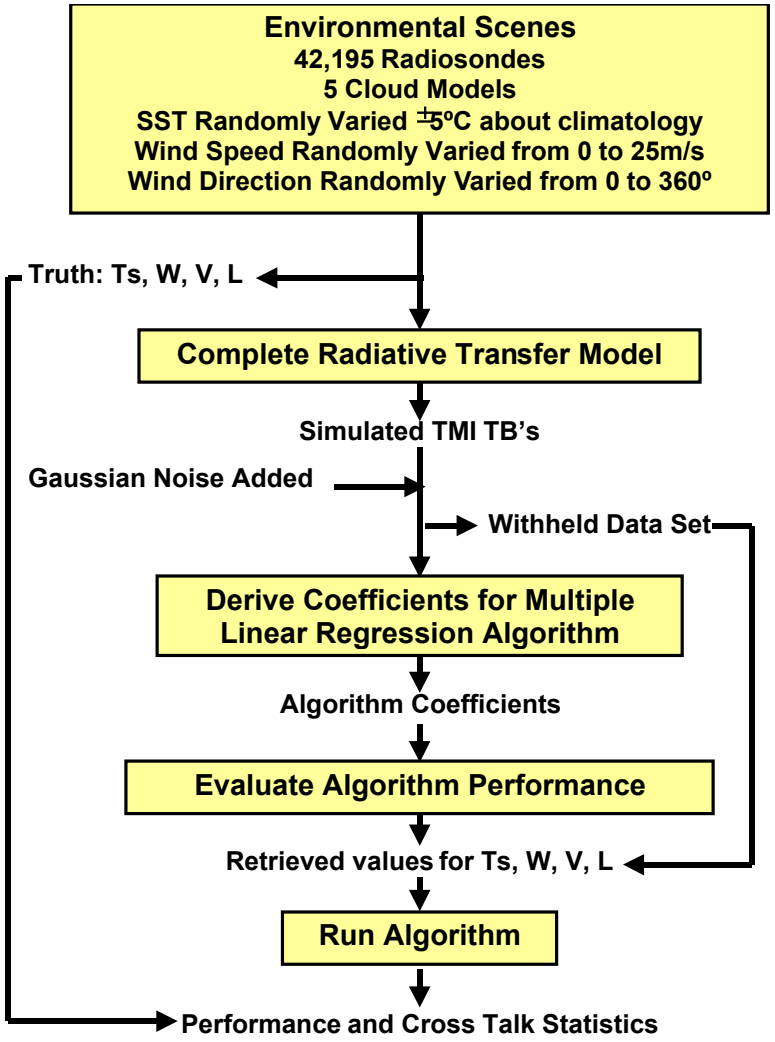
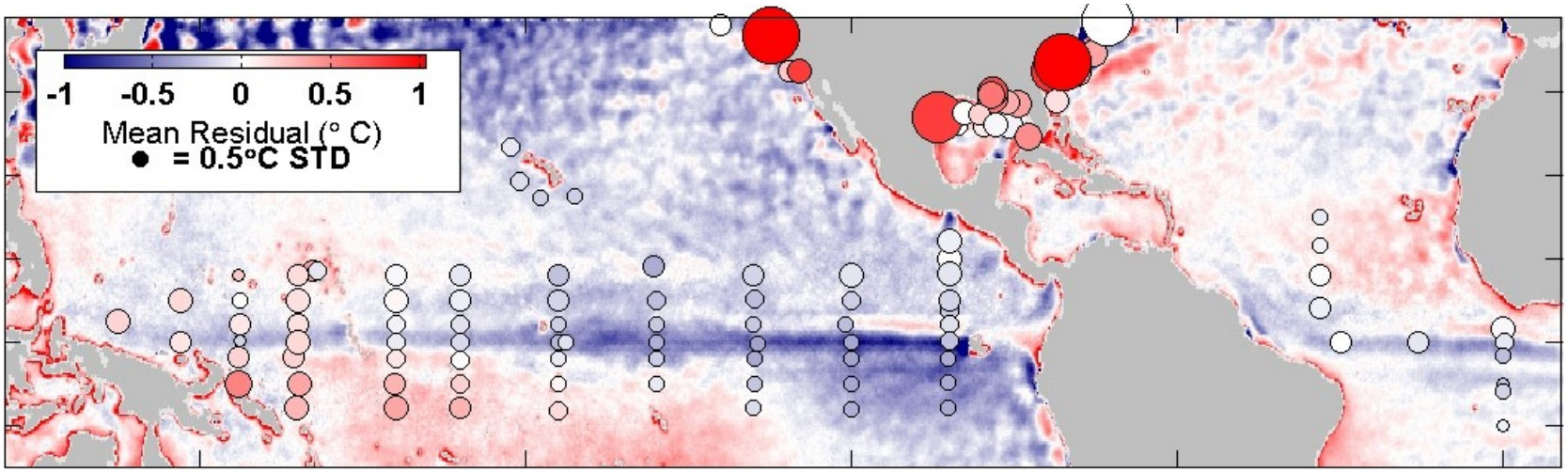
Algorithm Derivation



TMI, AMSR-E, AATSR coefficients calculated by regression to RTM generated TBs.

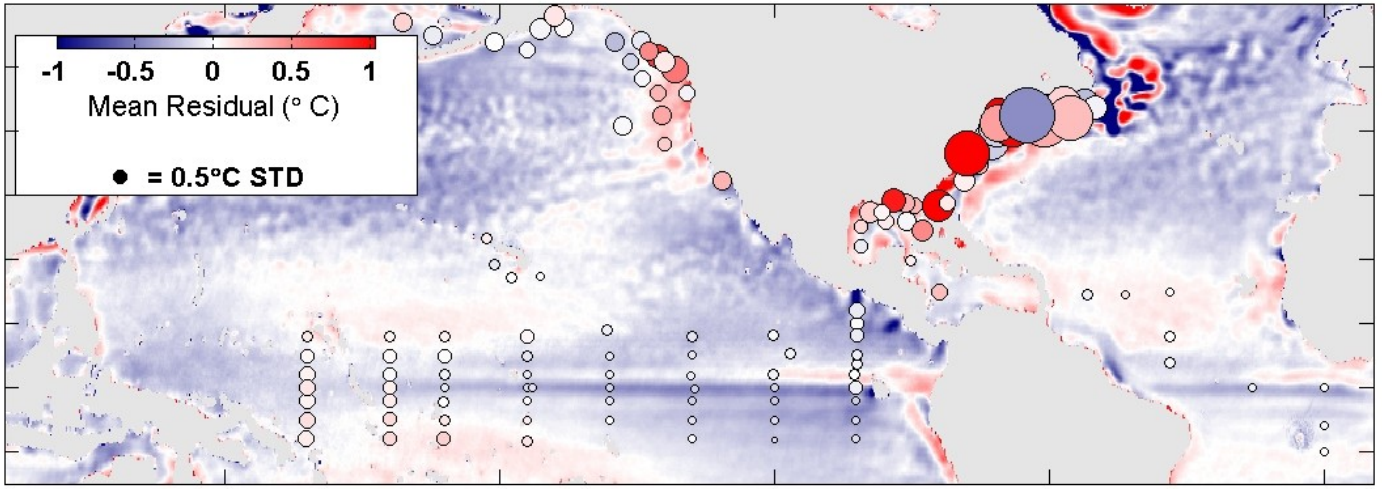
AVHRR SST monthly coefficients calculated by blind regressions to in-situ (drifters/buoys/ship) measurements.

TMI SST Validation



		Orbital Collocations TMI – Buoy SST	
	collocations	Mean Dif.	STD
TAO	84072	-0.09	0.67
PIRATA	11669	-0.09	0.60
NDBC	55597	0.31	1.12

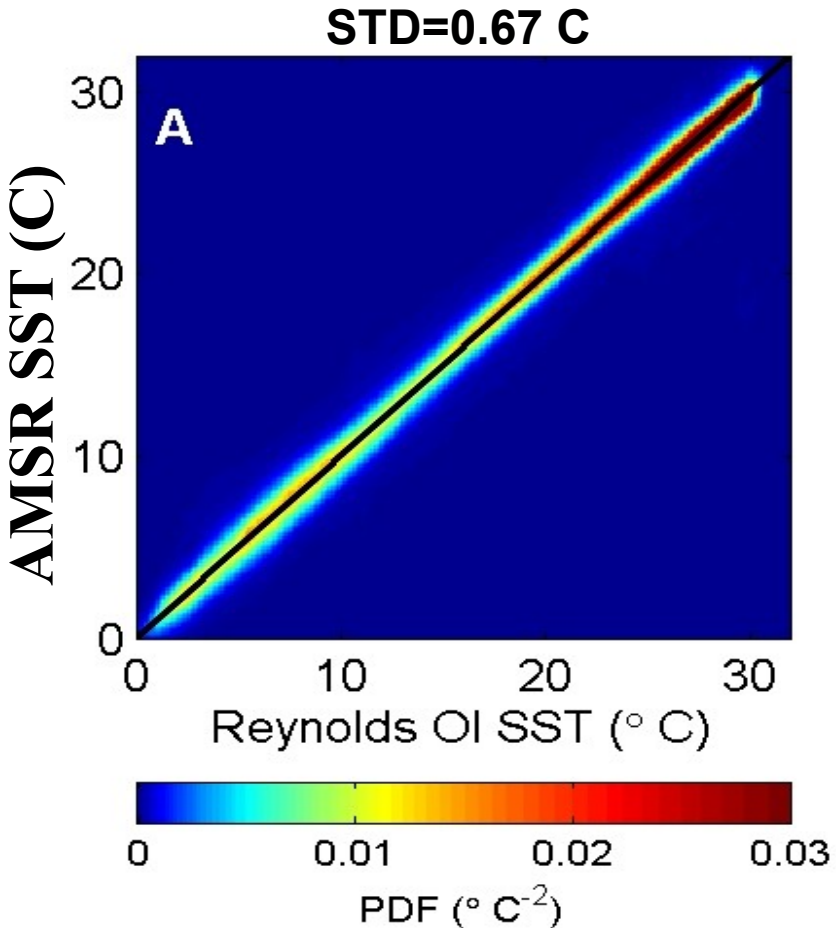
AMSRE SST Validation



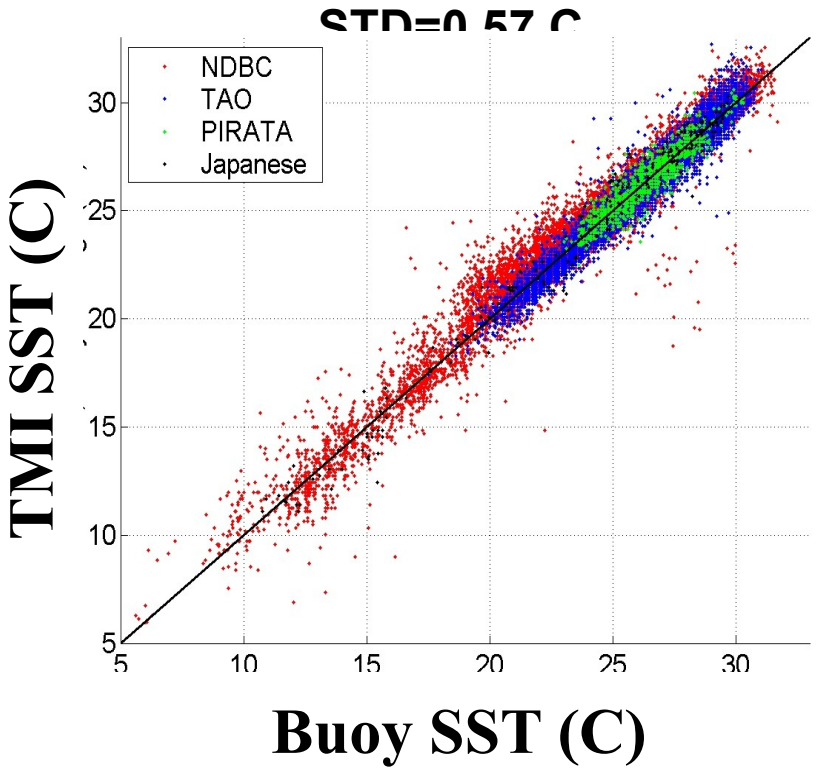
		AMSRE – Buoy SST	
	collocations	Mean Dif.	STD
TAO	21461	-0.03	0.41
PIRATA	2837	-0.00	0.35
NDBC	19817	0.22	1.91
Canada	4844	0.03	1.23

AMSR-E/TMI Validation

AMSR-E vs. Reynolds

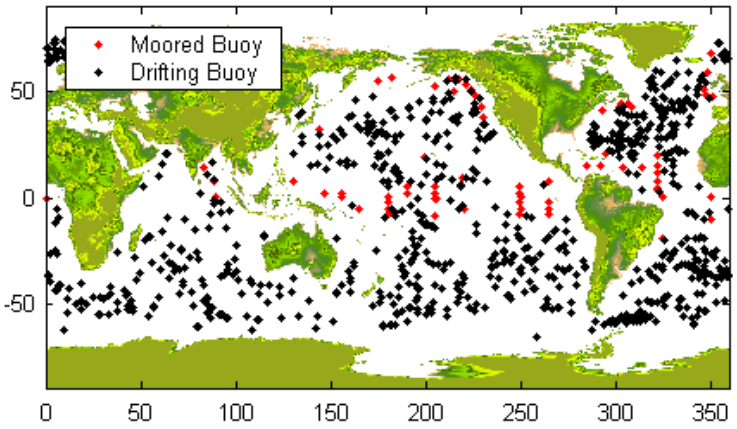


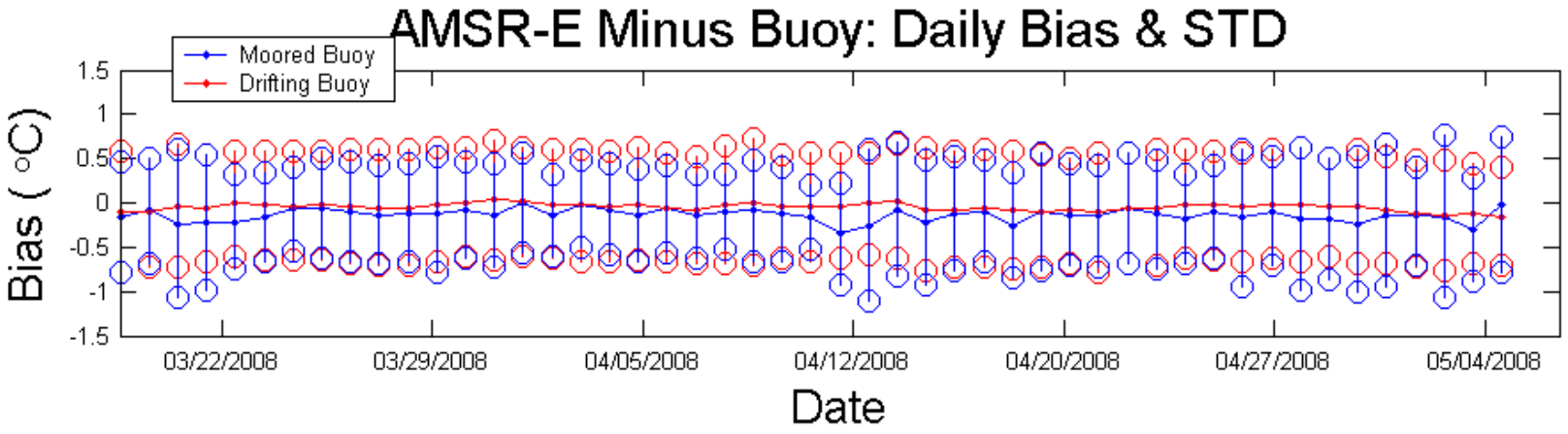
TMI vs. Buoy SSTs



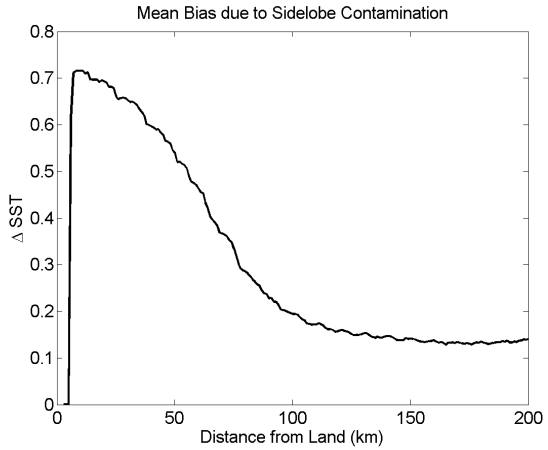
Near real time AMSR-E SST Validation Using Buoys & Ship Measurements from NRL-Monterey

- Updated twice daily
- Figures show last 50 days bias/std & locations of previous day collocations
- Complete collocated dataset available

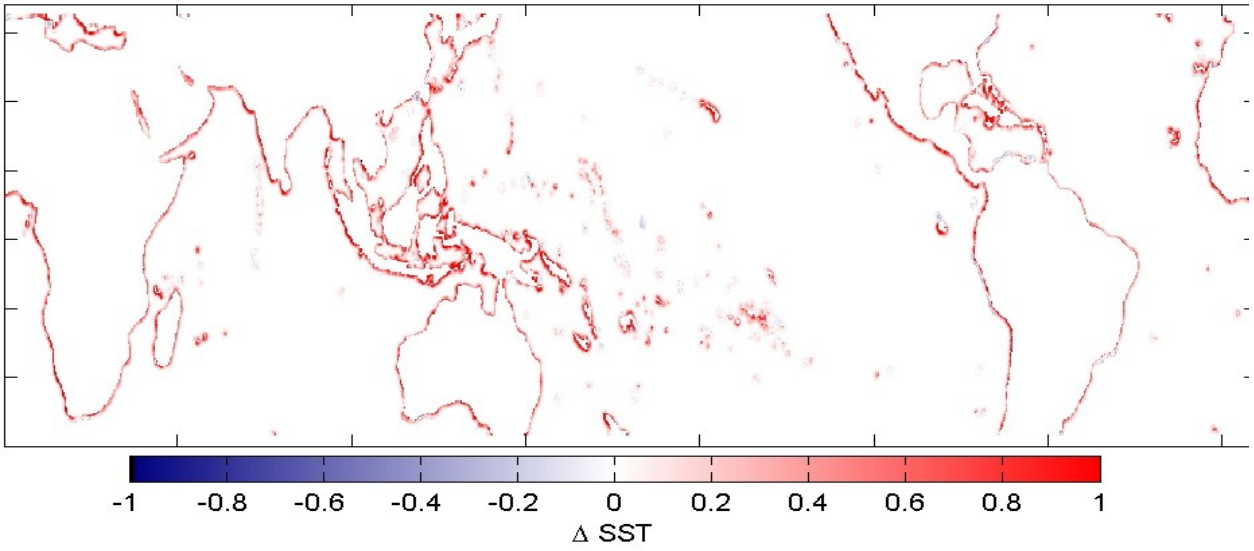




Land contamination in TMI

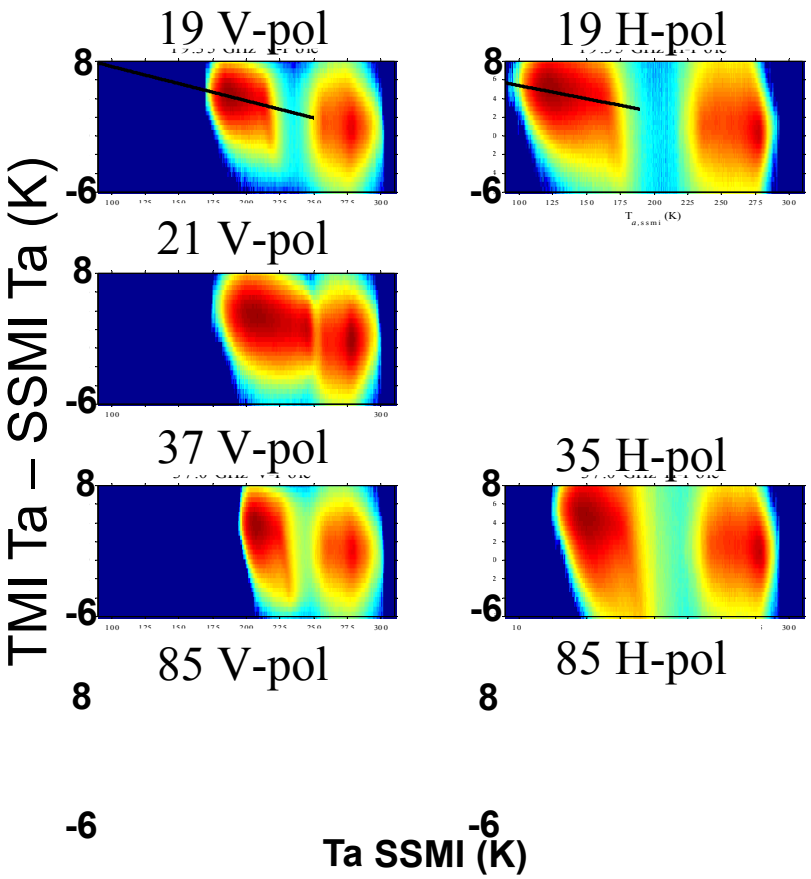


- Microwave observations within 50-100 Km from land affected by warm emission by land
- WARM bias of coastal SSTs

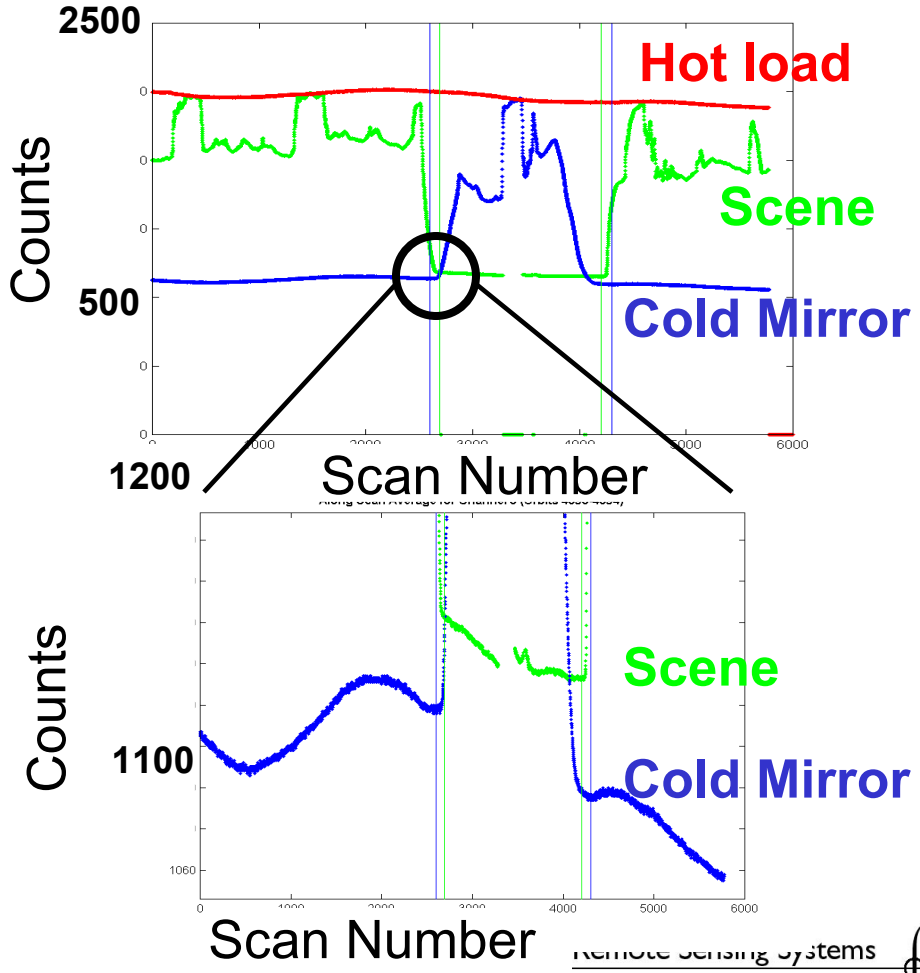


Initial Post-launch TMI inter-calibration

SSM/I Versus TMI Comparisons



TRMM Pitch-Over



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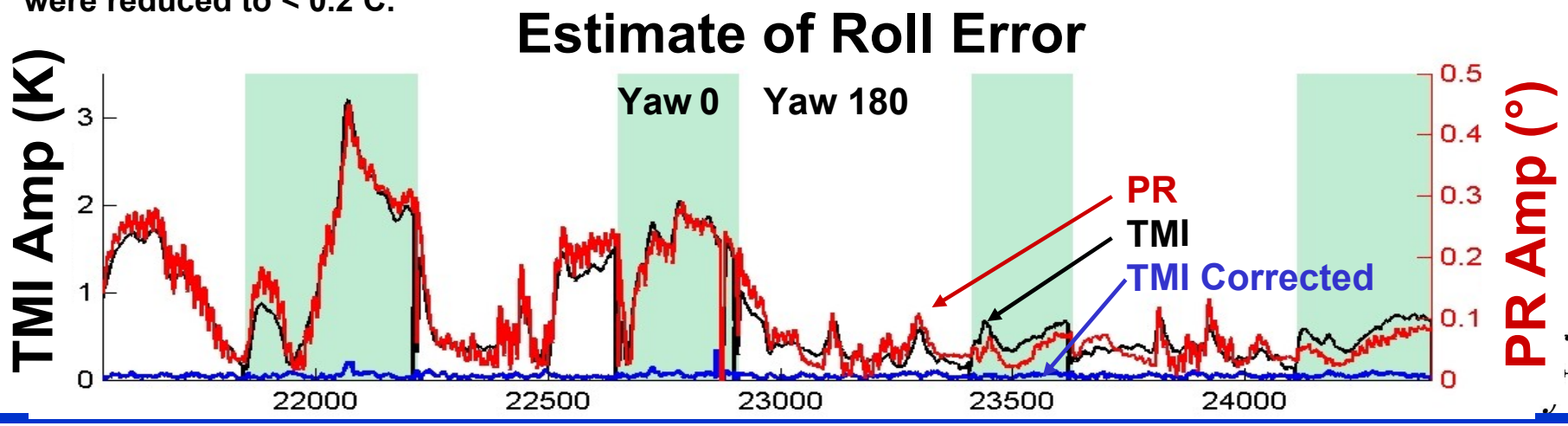
TMI Post-orbital Boost Roll Error

- On August 25, 2001 TRMM finished a maneuver to boost the altitude from 350 to 402 km.
- TRMM's attitude control system (ACS) controls yaw/pitch/roll based on onboard attitude estimates. Pre-boost ACS utilized an Earth horizon sensor for roll and pitch.
- The altitude increase resulted in the loss of the Earth horizon sensor, the ACS backup system uses a 'Kalman filter' with weighted input from the gyros, sun sensor, magnetometer.
- Post-boost errors in the PR rain and TMI SST were immediately apparent. Independent estimates of errors in roll from GSFC PR team (Red) and RSS TMI SST team (Black) are in close agreement.
- **Post-boost roll errors peaked at 0.5 degrees at the end of September -- these errors translate to 3 C errors in SST before correction. Using the RSS calibration developed, SST errors due to roll were reduced to < 0.2 C.**

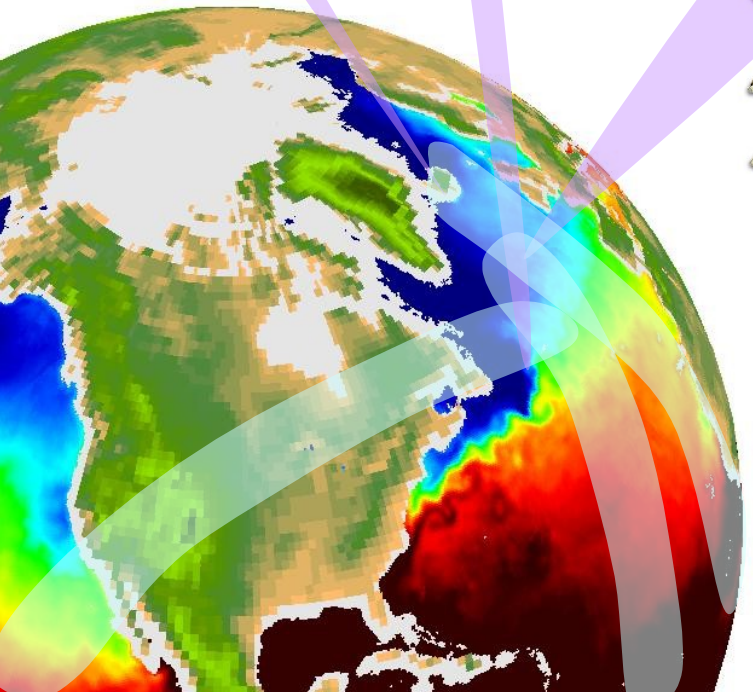


On-Orbit Calibration of AMSR-E Hot Load

SSM/I

TMI

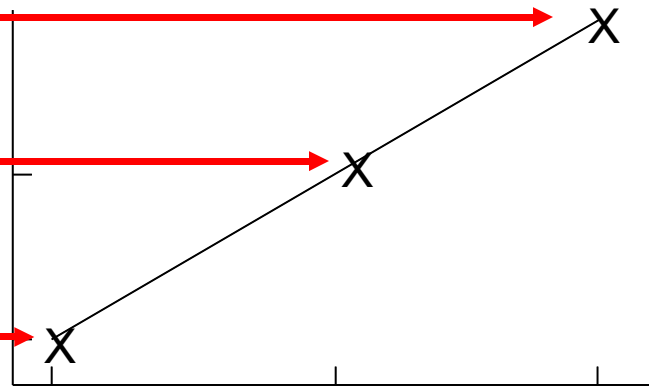
AMSR-E



Solution for Effective Hot Load Temperature

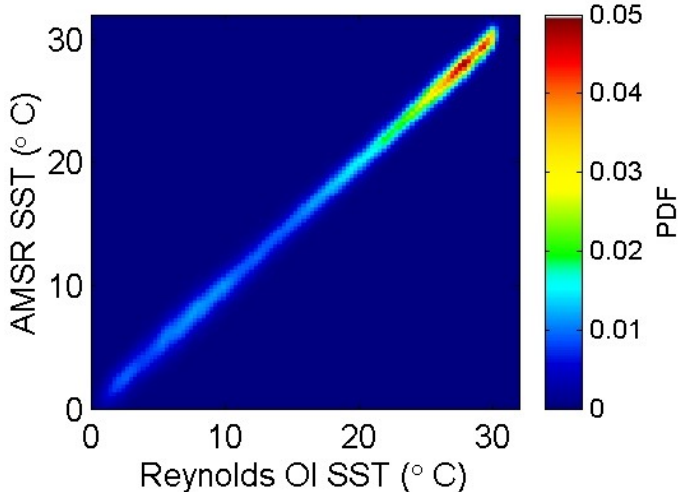
Earth Temperature from Satellite Network

Deep Space Observation = 2.7 K

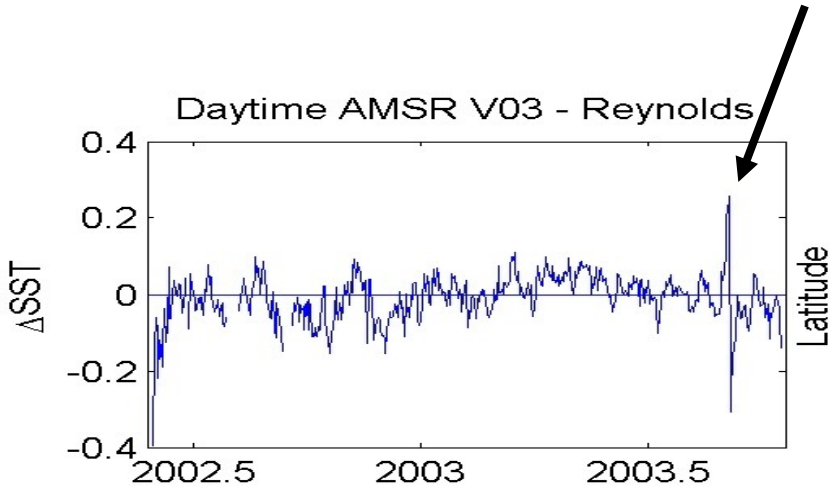


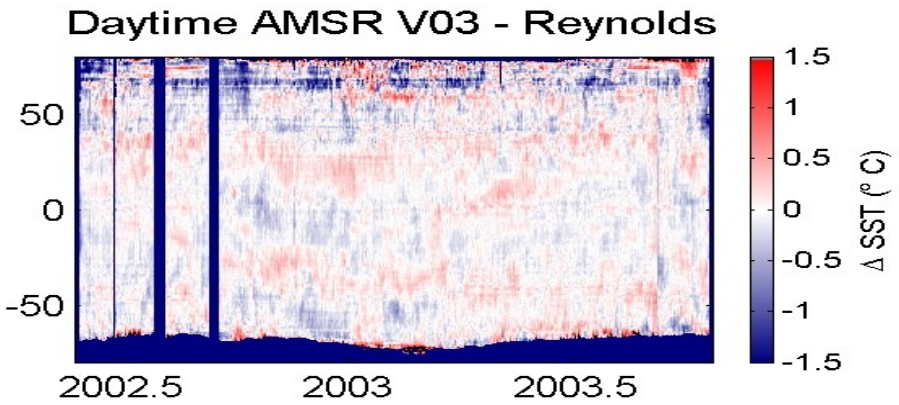
AMSR-E Radiometer Observations (Counts)

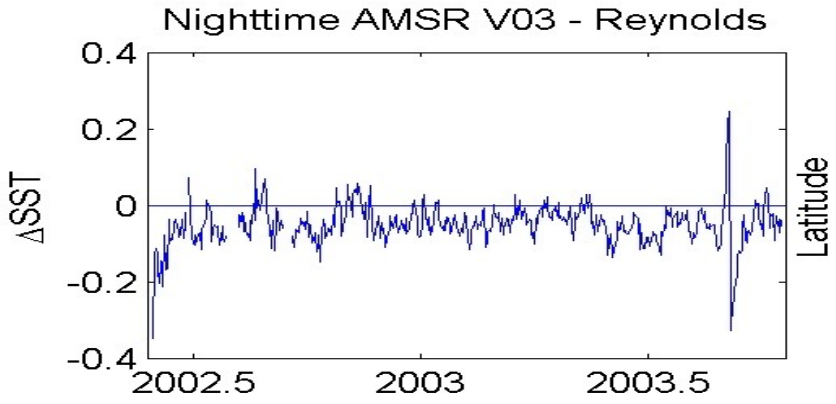
On-Orbit Calibration significantly improves accuracy of AMSR-E retrievals

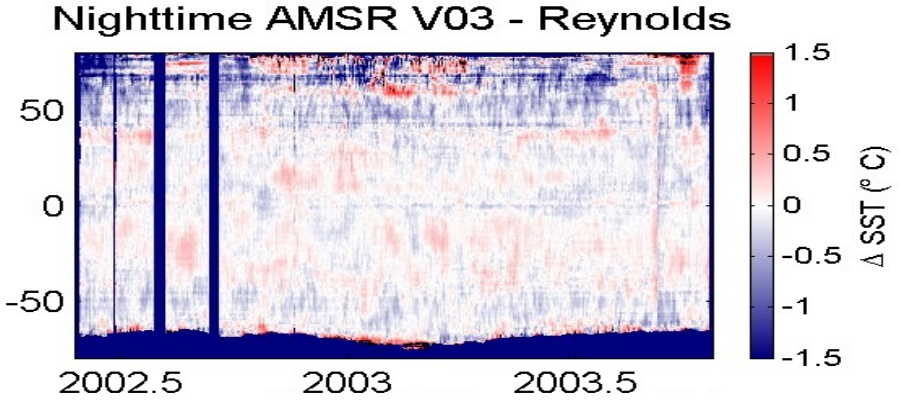


Aqua Pitch Error





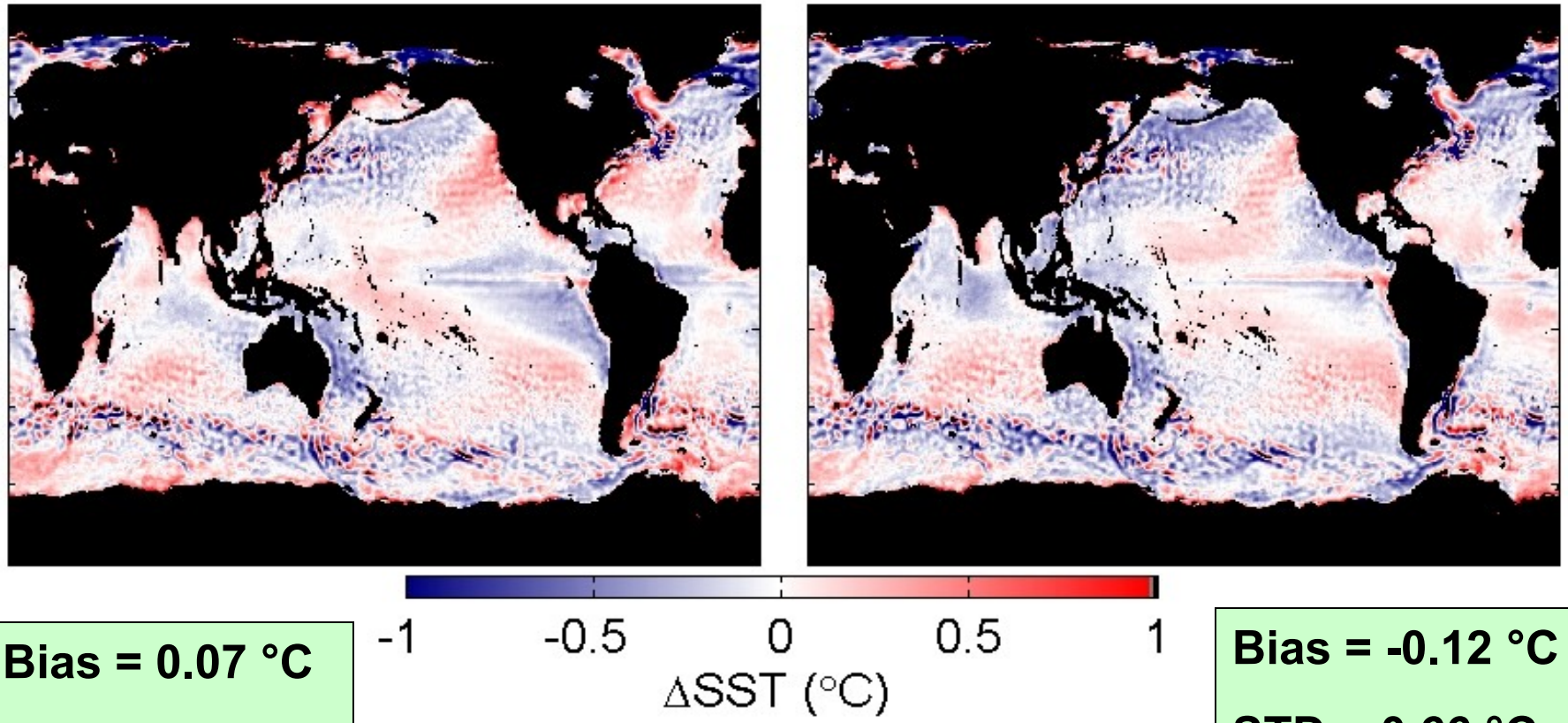




Global Difference : June 2001 – October 2003

AMSR-E Day - Reynolds

AMSR-E Night - Reynolds



Bias = 0.07 °C

STD = 0.67 °C

Bias = -0.12 °C

STD = 0.66 °C

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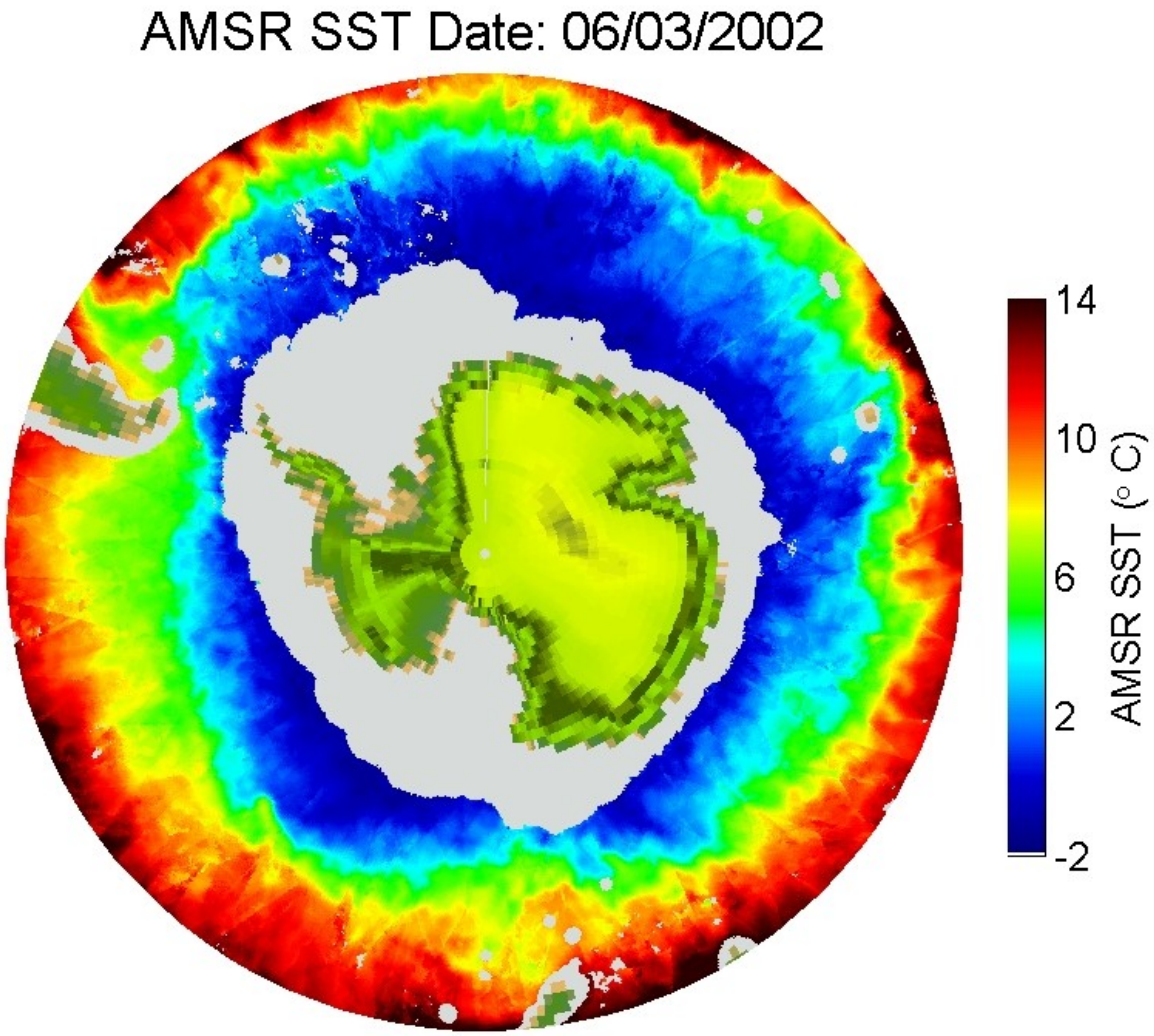
3-day average: Polar SST



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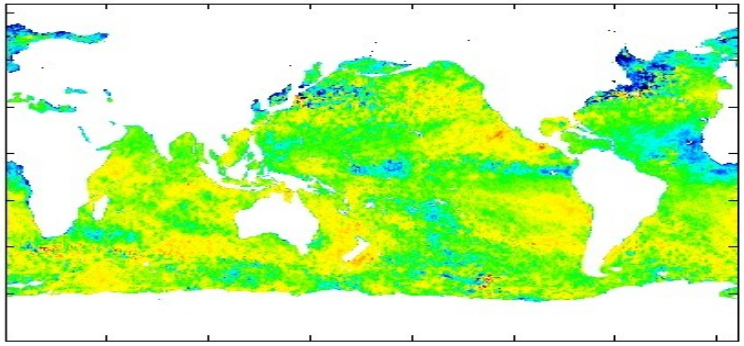
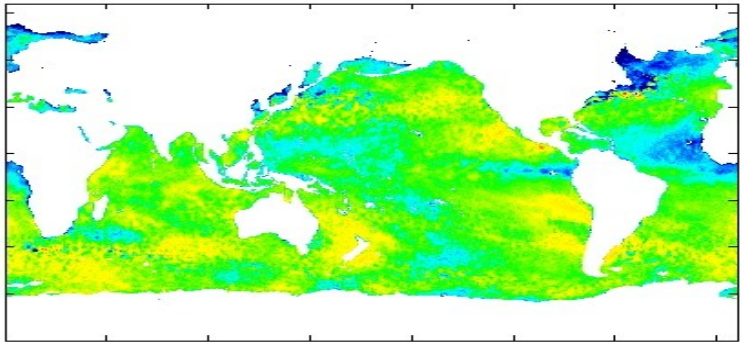
Climatologies

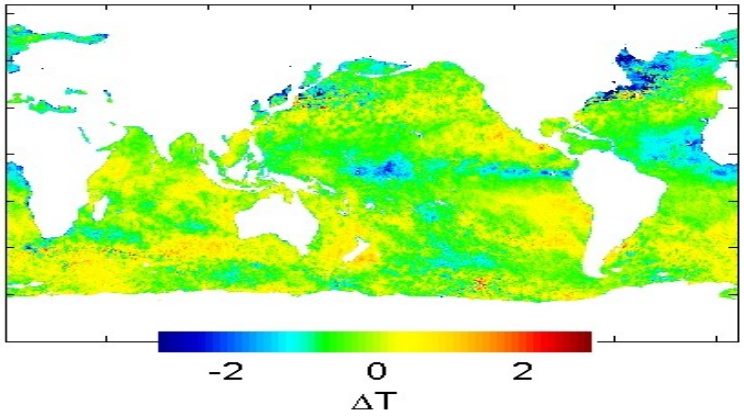
Reynolds

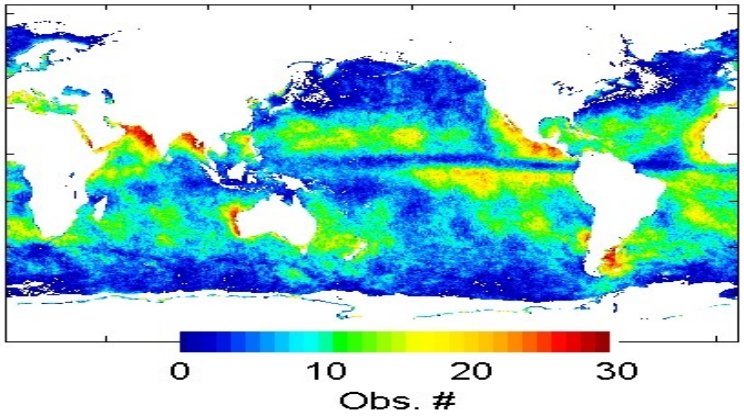


JPL Pentad

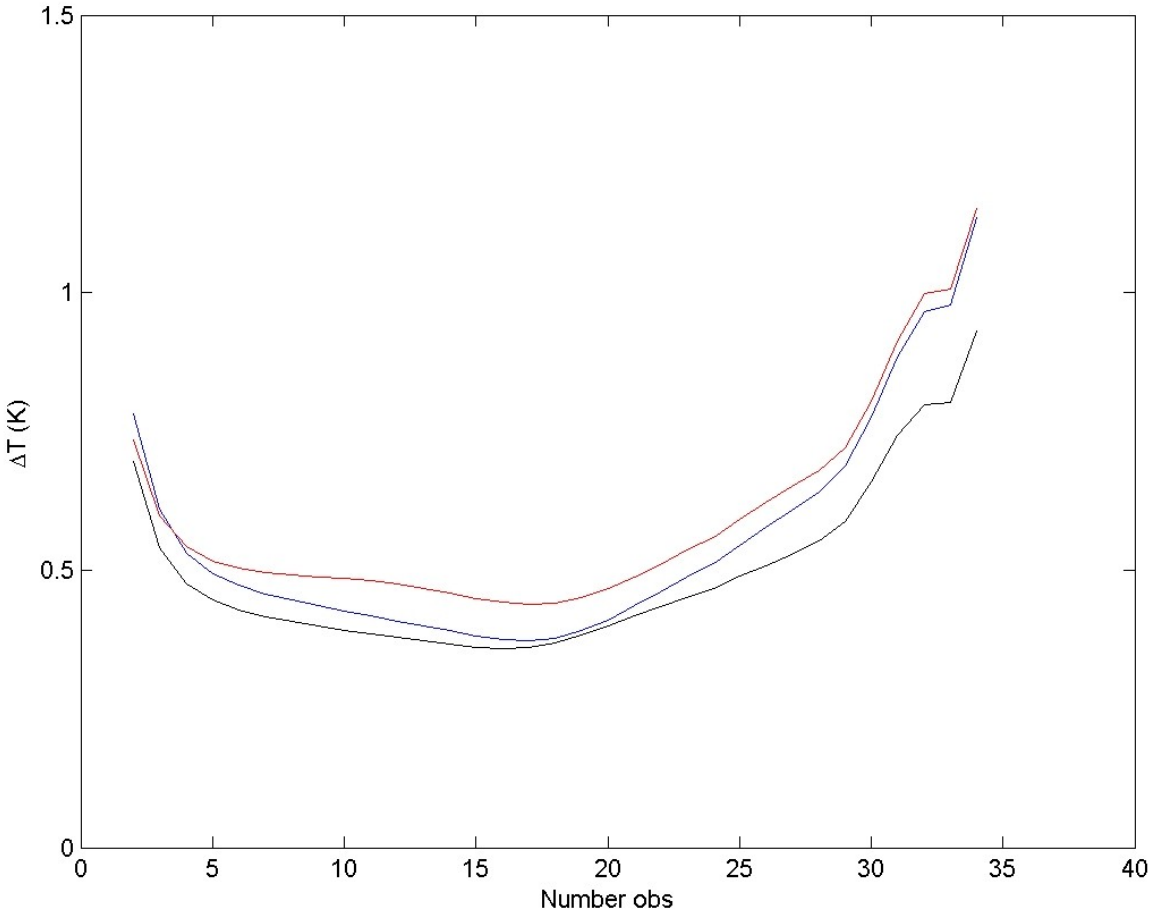


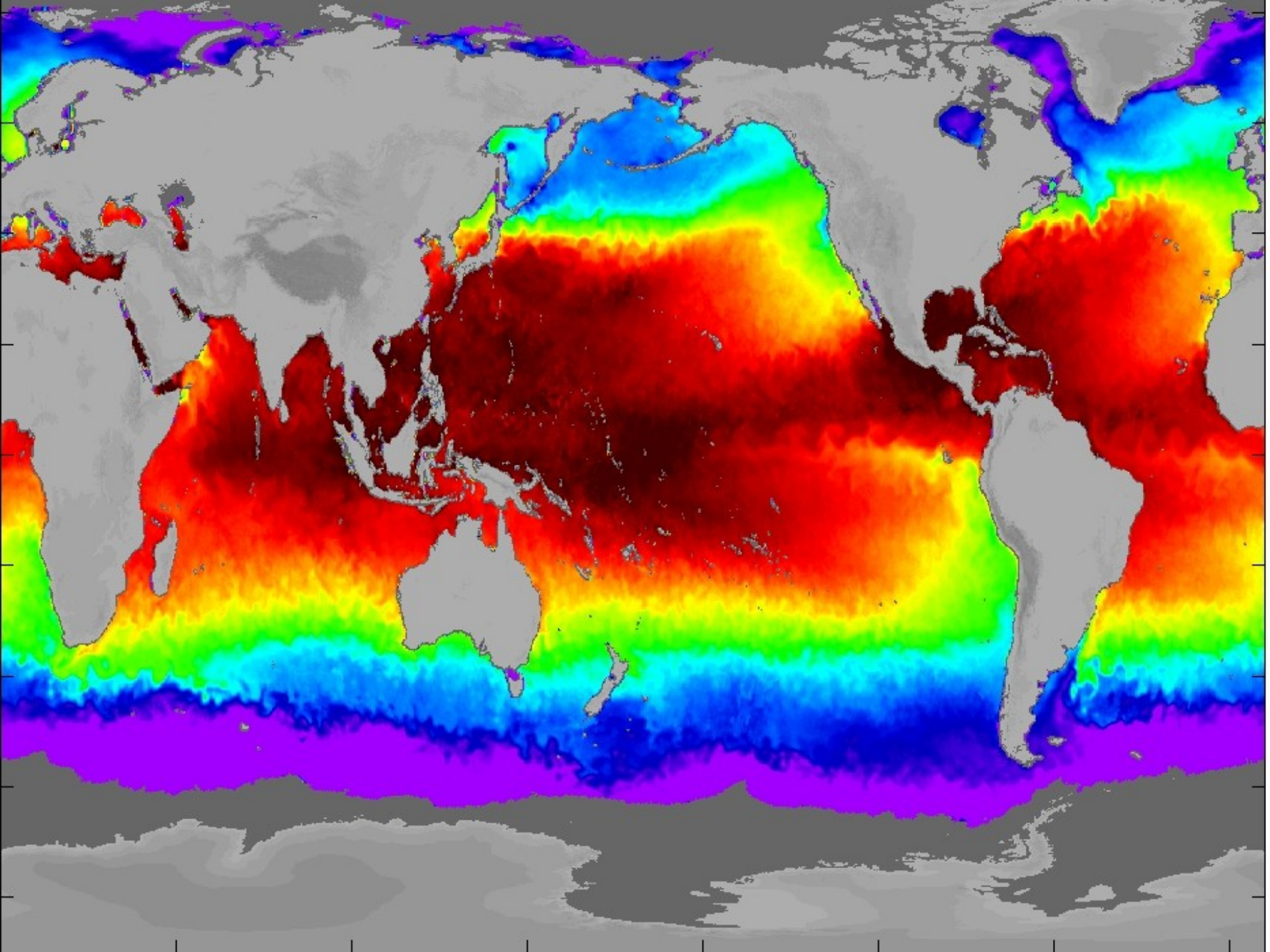
PF clim





Climatologies:





Conclusions

- Satellite SSTs provide data in in situ data sparse regions
- GHRSST data provide bias/std for each retrieval
- ICOADS useful for satellite validation and calibration. Satellites useful for ICOADS validation and calibration.
- www.ghrsst-pp.org