

### Satellite Microwave SST

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### Presentation Outline

#### Introduction to TRMM

Orbital Characteristics, Instrument

#### **Microwave SST Algorithm**

Physically based

#### Validation of Microwave SSTs

In Situ Comparisons

Satellite Inter-comparison Studies

#### **Diurnal Variability**

TMI & Pathfinder

#### The Next 20 Years

Future of Microwave Instruments





### TRMM Orbit



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

TRMM SST, November 23, 2000

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





#### **Derivation of Regression Coefficients** Remote Sensing Systems www.remss.com



ATSR and TMI coefficients calculated by regression to RTM generated Tbs.

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





## TRMM SST 3 Day Average August 26, 1998



Virtually complete coverage in 2 daysAll weather (except rain) retrievals



### Increased accuracy: Long-term Stability



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### Better Coverage: IR/MW retrievals

#### 1998: 2-day averages, Pathfinder retrievals





### Removal of cross-talk







#### **Comparison between TMI and IR SSTs**



Mean Differences, 1998



# **SST Validation**



### with Ocean Buoys



		Orbital Collocations TMI – Buov SST	
	collocations	Mean Dif.	STD
ΤΑΟ	28176	-0.08	0.57
PIRATA	4913	0.03	0.55
NDBC	19493	0.28	0.92



### SST Validation with Ocean Buoys







# Timeseries of Buoy, Reynolds, Pathfinder, and TMI SSTs





## TMI Drifter bias



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Reynolds - In Situ SSTs, 1998





### TMI and Reynolds: Mean



Mean SST: TMI





# Diurnal PF/buoy & TMI/buoy









#### **Diurnal warming of SST**

At wind speeds less than 5 m/s (occur 20%), diurnal warming of up to 1.8°C, peaking at 2-3pm.

Cooling of skin during night at wind speeds less than 2 m/s (occur 3%).

At wind speeds greater than 10 m/s (occur 30%), TMI has a cool bias of -0.20 °C.







## TMI SST ERRORS



Systematic errors have been detected in the TMI SST and, to a lesser degree, wind speed products. Analysis shows the errors are due to wobbling of the TRMM spacecraft. This spacecraft attitude problem began after the orbit-raising maneuver. Retrievals after August 16, 2001 may be erroneous. The time periods Aug 25 - Sept 2 and after Sept 24 are particularly bad.





### The Next 20 Years

Mission/Sensor	Dates	Comments
ADEOS-2 AMSR + SeaWinds	2002-2005	Radiometer and Scatterometer
AQUA AMSR-E/MODIS	2002-2005	Complements ADEOS-2 Coverage
WindSat (Navy)	2002-2005	Two-Look Polarimetric Radiometer
GCOM B-1 AMSR/α-SCAT/SGLI	2007-2011 (?)	Radiometer and Scatterometer
NPOESS CMIS/VIIRS	2009 -2020	Single-Look Polarimetric Radiometer (?)

Improved Performance 6.9, 10.7, 19, 23, 37, 90 GHz 2 meter antenna 50 km resolution, 1600 km swath Better Pre-launch Calibration Supplementary information on wind SST Accuracy 0.2 C for 3-day averages at 50-km resolution





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