

# The generation of SST climate data records using shipboard radiometers

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# ISSI Team

Scientists who have attended the ISSI International Teams in Space Science on the “Generation of Climate Data Records of Sea-Surface Temperature from current and future satellite radiometers” include:

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Dr Theo Theocharous, National Physical Laboratory, UK

Dr Gary Wick, NOAA ESRL, USA

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Dr Chris Wilson, NASA Jet Propulsion Laboratory, USA



# Introduction

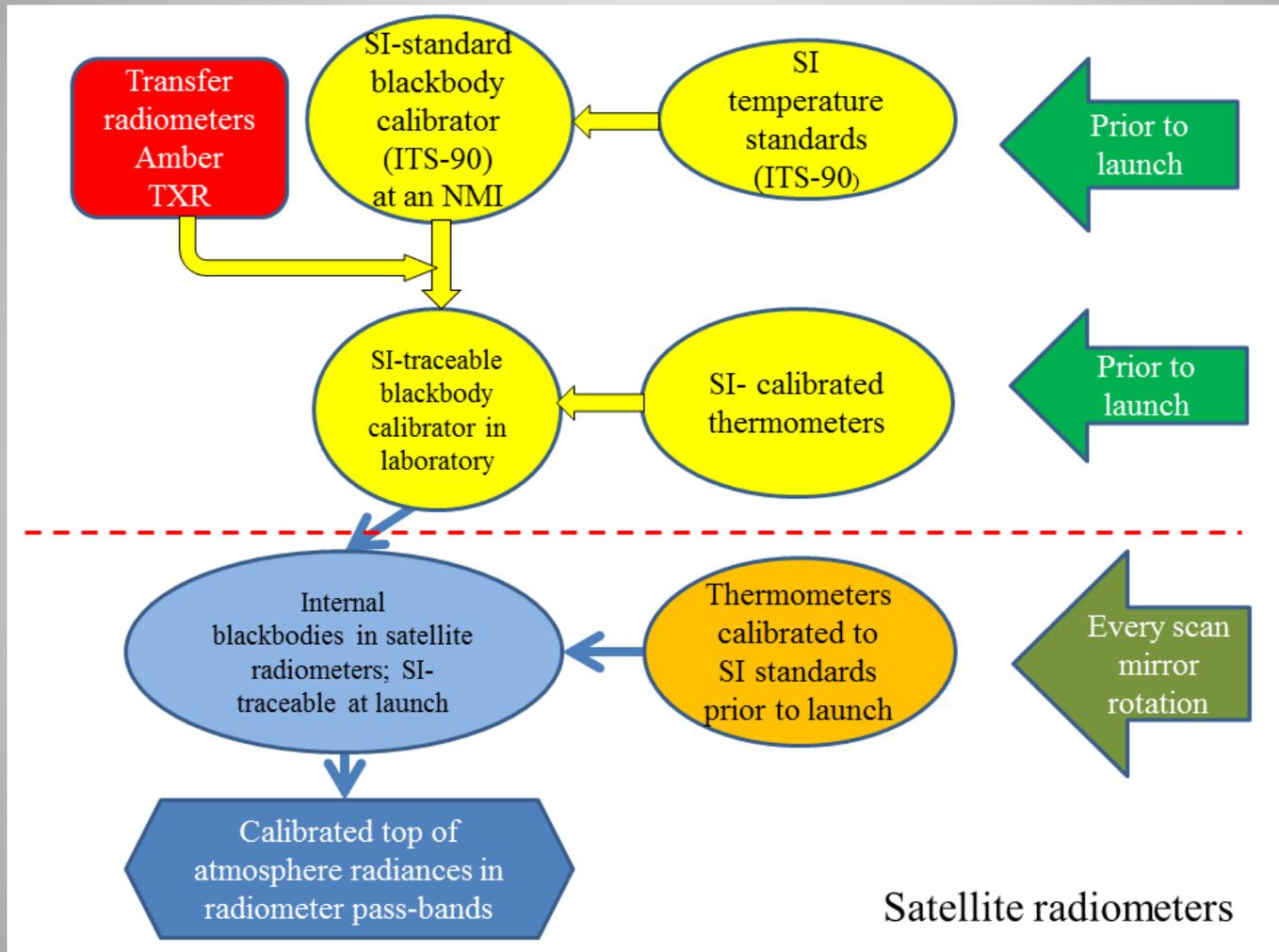
Ship-board radiometers are repeatedly calibrated using SI-traceable facilities. Requires and “unbroken chain” of comparisons from at-sea measurements to SI-standards in National Metrology Institutes.

This is an important prerequisite for generating a Climate Data Record of Sea Surface Temperature.

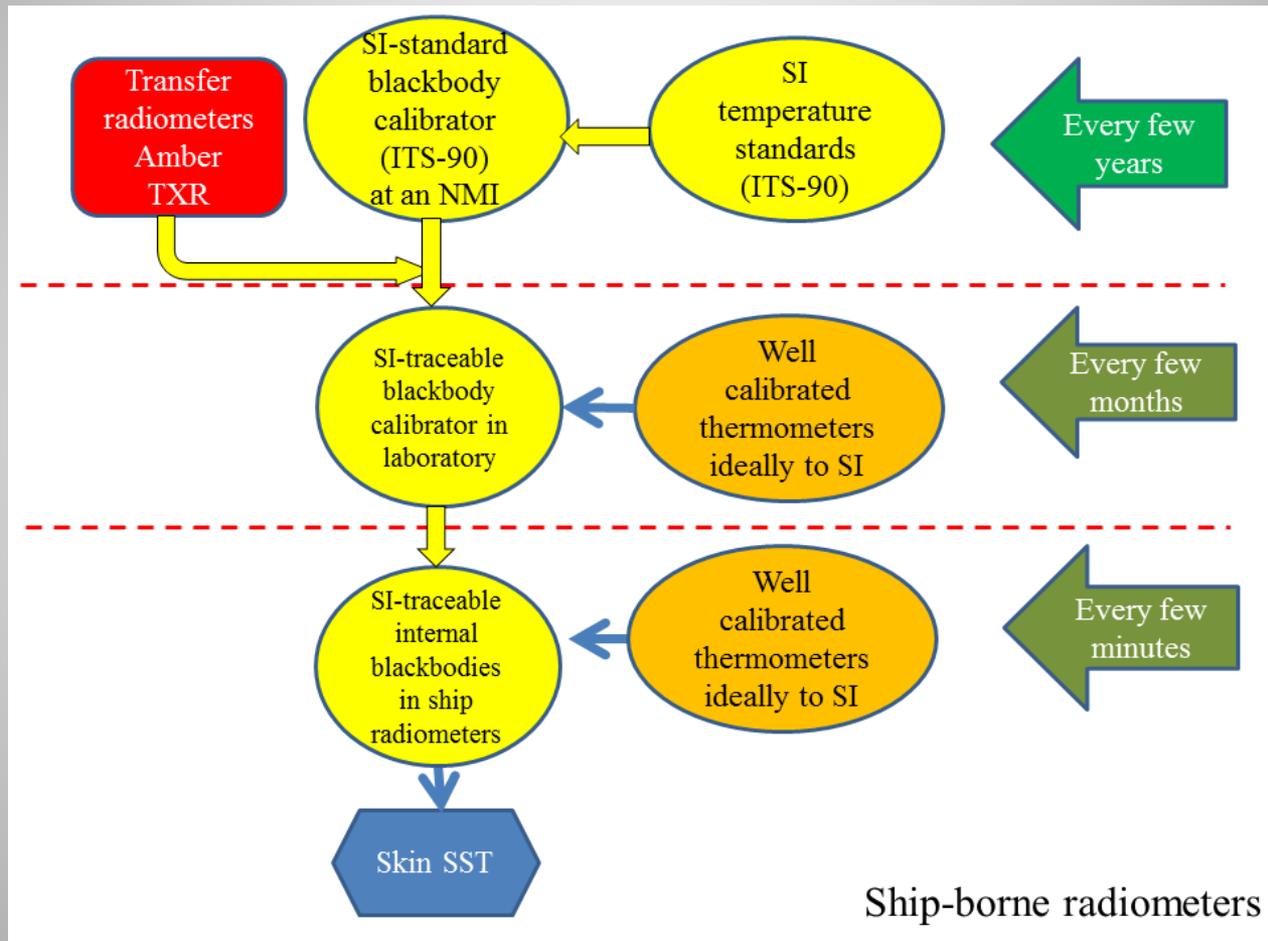
Repeated calibration and characterization of the ship-radiometers allows estimation of uncertainties in the SST validation system.



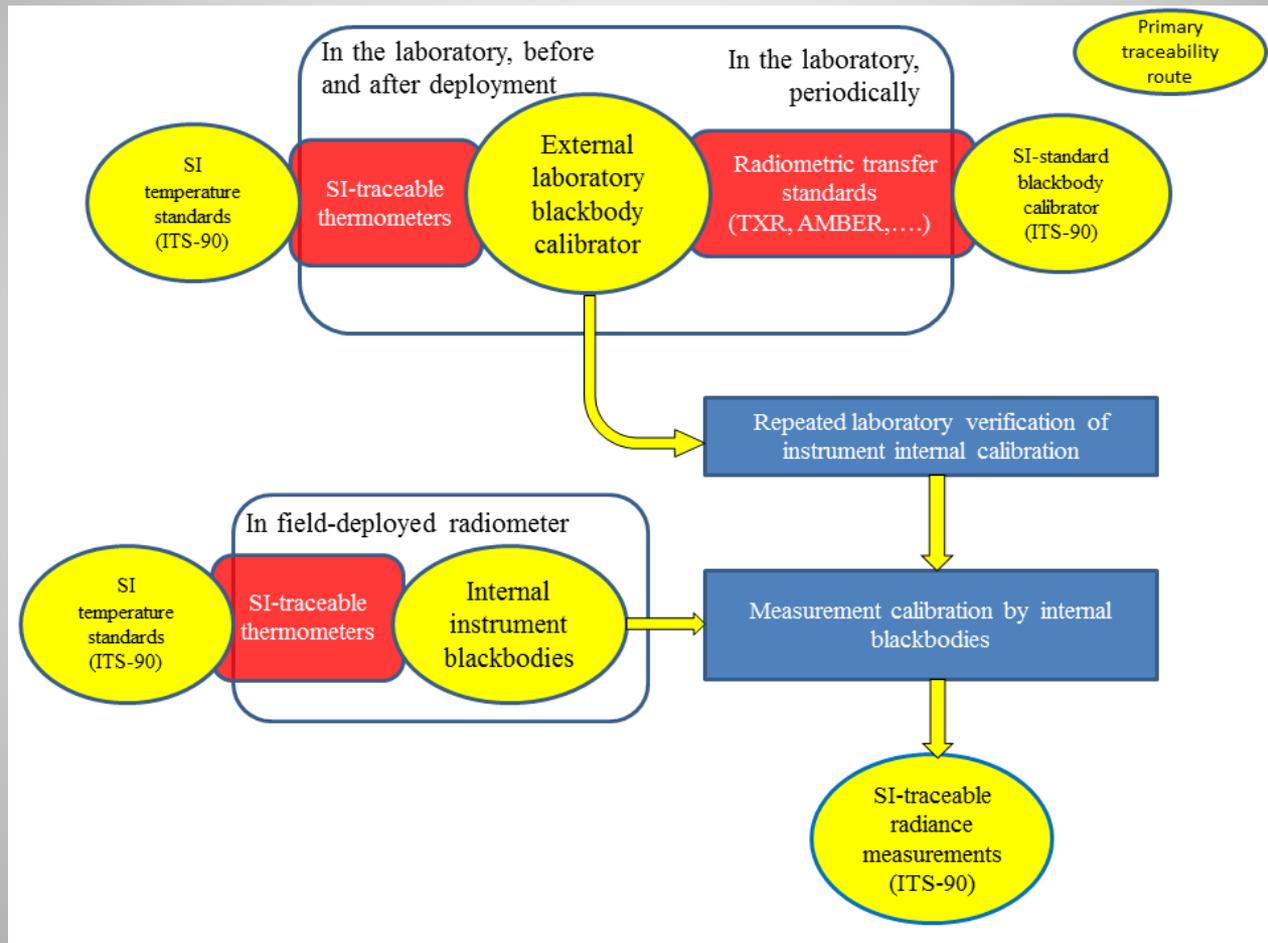
# Calibrating satellite radiometers



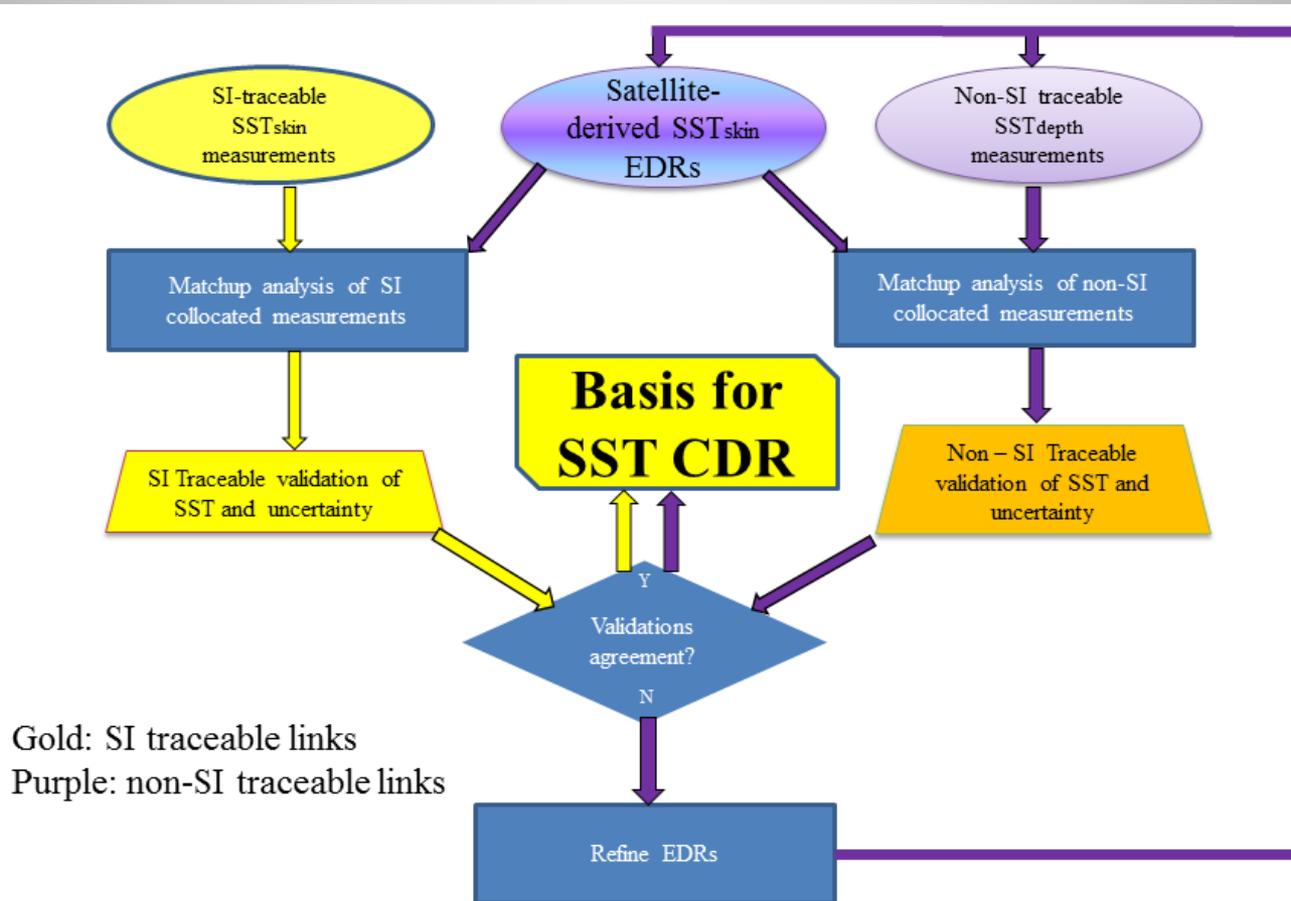
# Calibrating ship-board radiometers



# SI-traceability of ship-board radiometers



# Transfer SI-traceability to satellite retrievals



# SI-transfer standards



Laboratory blackbodies to assess the uncertainties in the ship-borne radiometer measurements pre- and post-launch calibration being compared to SI-standard references by AMBER at NPL (left) and by TXR at Miami (right).



# SI-traceable calibration of ship-board radiometers

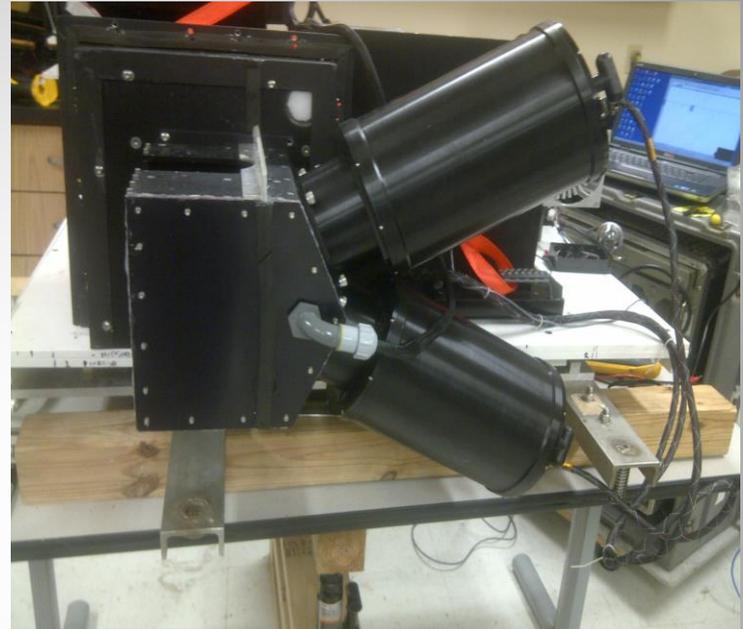
## The NIST EOS TXR



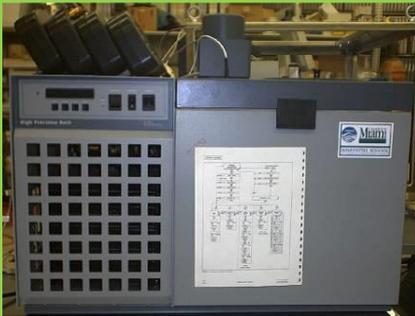
Unique EOS Standard  
Cryogenic detectors (liquid  
 $N_2$ )  
 $\lambda = 5$  &  $10\mu m$

Rice, J. P. and B. C. Johnson, 1998. The NIST EOS Thermal-Infra-Red Transfer Radiometer, *Metrologia*, 35, 505-509.

Rice, J.P. et al., 2004. The Miami2001 Infrared Radiometer Calibration and Intercomparison: 1. Laboratory Characterization of Blackbody Targets. *Journal of Atmospheric and Oceanic Technology*, 21, 258-267



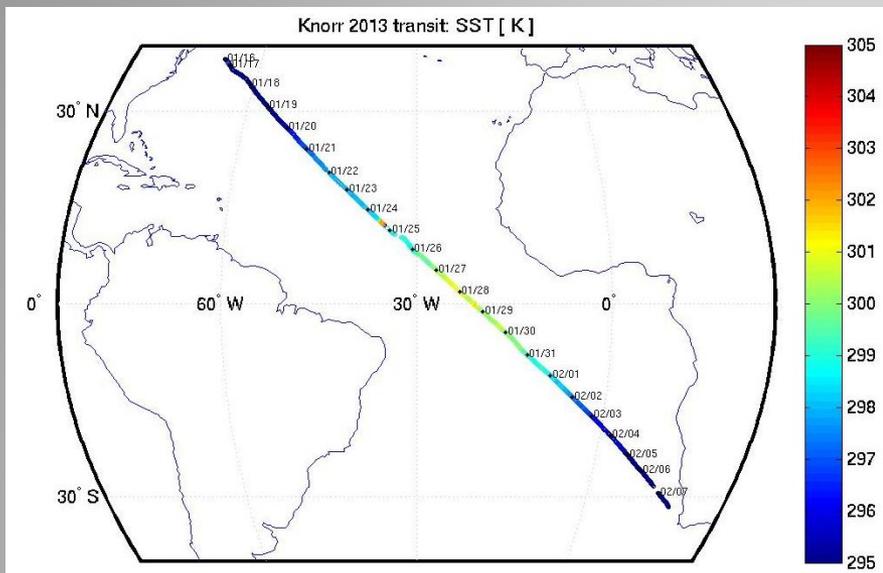
## NIST water-bath black-body calibration target



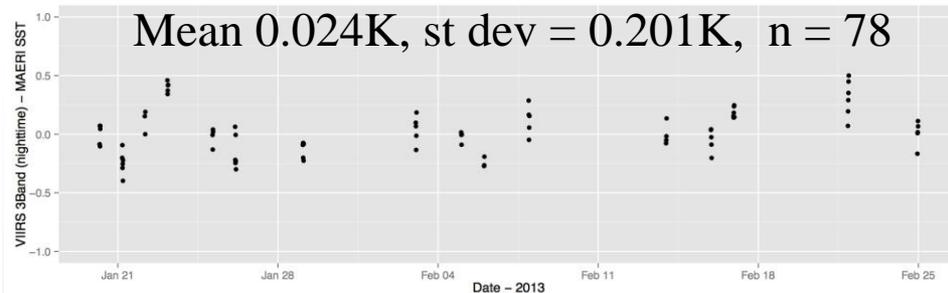
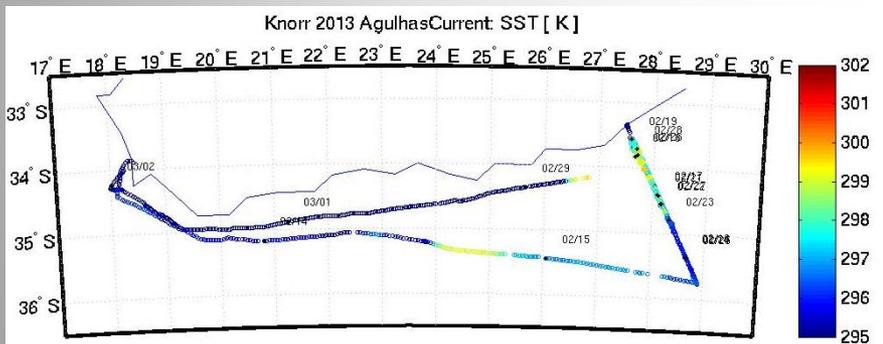
See: Fowler, J. B., 1995. A third generation water bath based blackbody source, *J. Res. Natl. Inst. Stand. Technol.*, 100, 591-599



# Ship radiometers: M-AERIs



M-AERIs, new and old, on R/V *Knorr*. Transit from Woods Hole to Cape Town, and an Agulhas mooring recovery cruise.



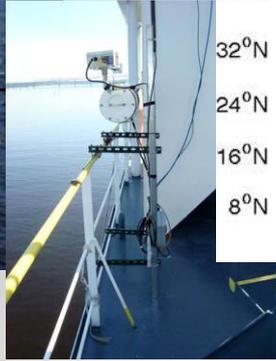
Skin SST measurements from R/V *Knorr*. January – March 2013.

VIIRS v7.0 algorithm  
Reference SST WindSat 5day average.

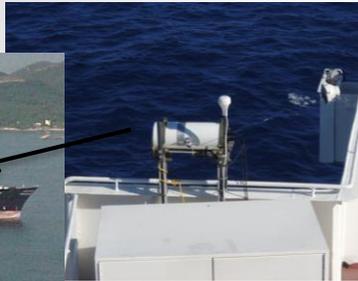
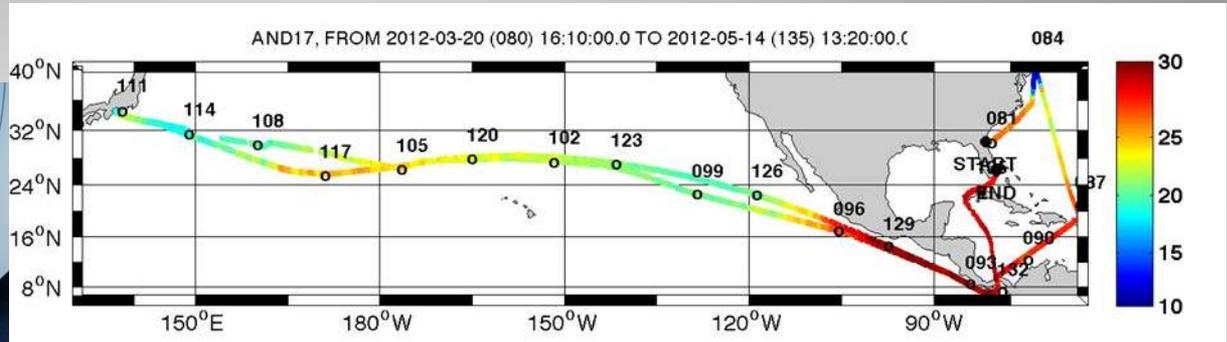
M-AERIs are Fourier Transform Infrared interferometers with two internal blackbody calibration targets. Pre- & post-deployment lab calibration against NIST-traceable calibrators.



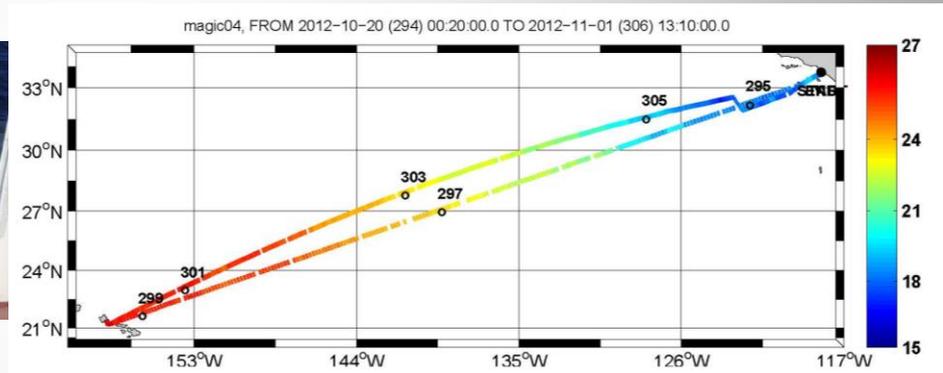
# Ship radiometers: ISARs



M/V *Andromeda Leader*

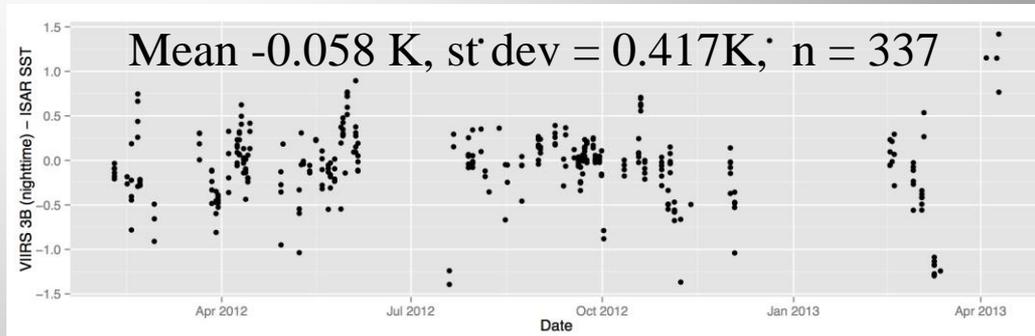


M/V *Horizon Spirit*



ISARs are autonomous filter radiometers with two internal blackbody calibration targets. Pre- & post-deployment lab calibration against NIST-traceable calibrators.

Data relayed in real-time by Iridium.



# Summary

ISARs have provided a good data stream from the *Andromeda Leader* and the *Horizon Spirit*.

M-AERI Mk2 has been deployed on the NOAA Ship *Ronald H Brown* and R/V *Knorr*.

M-AERI Mk2 will be installed on *Allure of the Seas* in September for unattended operations.

Validation of S-NPP VIIRS SSTs using M-AERIs and ISARs is giving very good results.