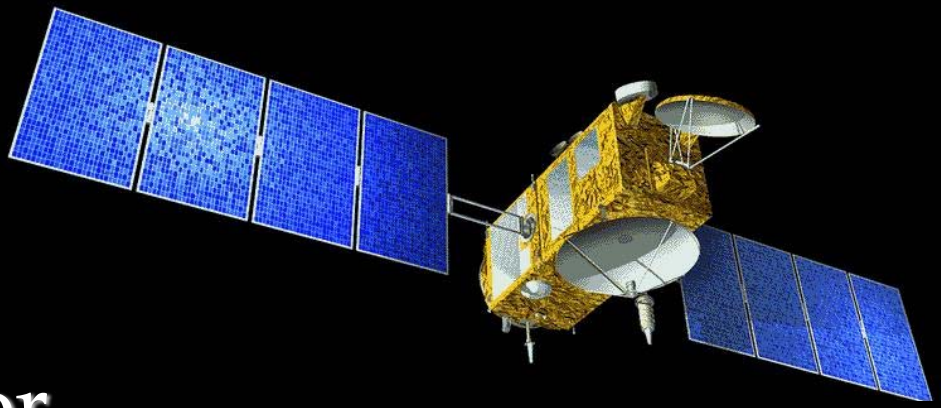

Improvements to the Radiometer Processing for GDR-D

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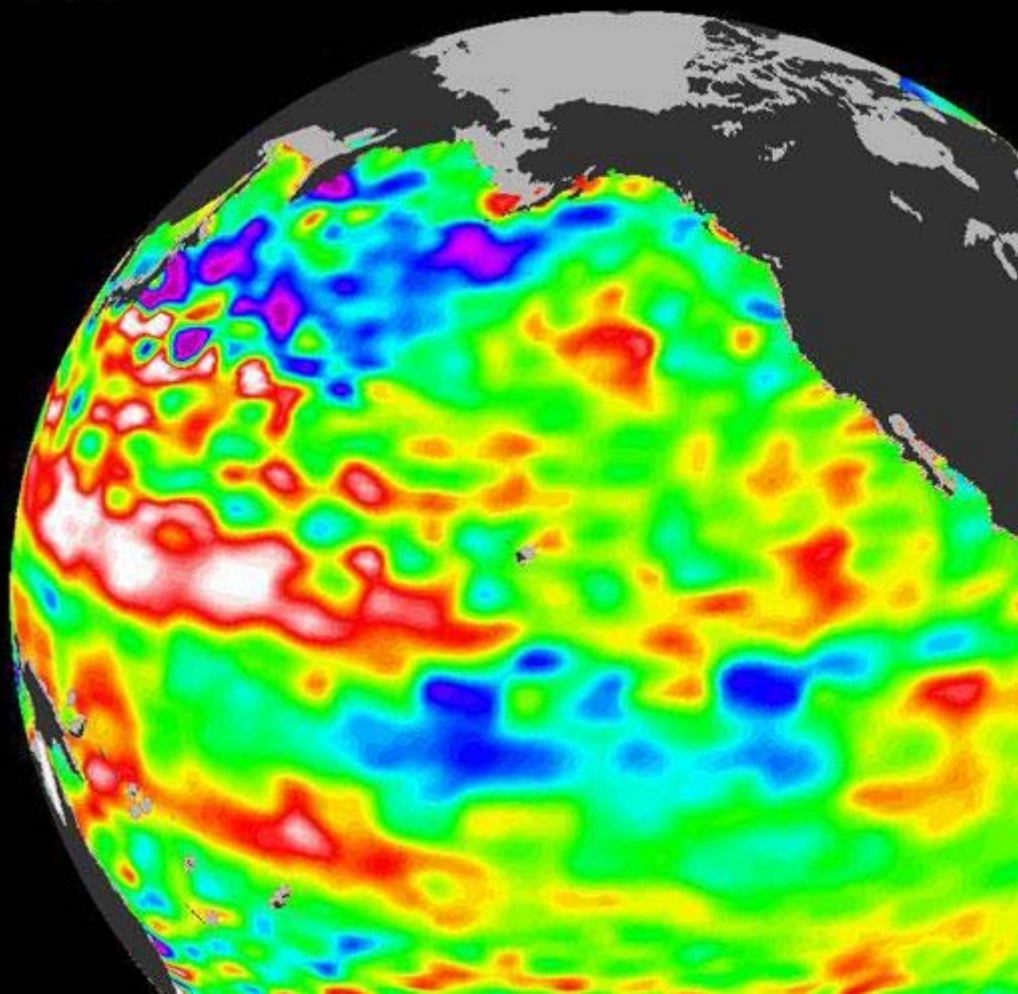
Jet Propulsion Laboratory, California Institute of Technology

Pasadena, CA

OSTST - San Diego, CA

October 19-21, 2011

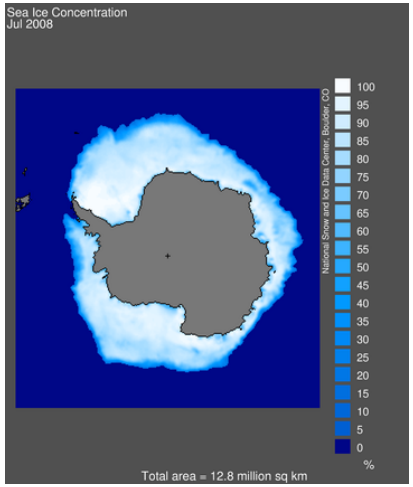


Improvements for GDR-D

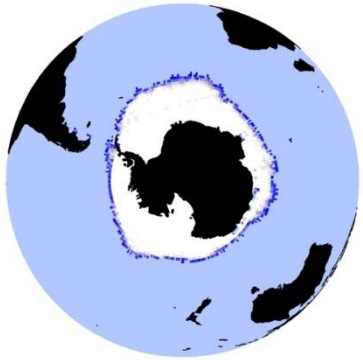
- AMR sea ice flag
- AMR rain flag
- AMR coastal path delay processing
- All-weather ocean sigma-0 attenuation correction
- Improved long term calibration

New AMR Flags

July 2008 Sea Ice From NSIDC

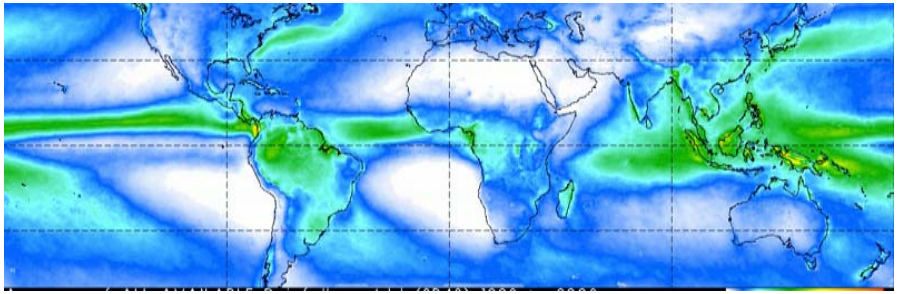


Cycle 1-5 average of AMR sea ice flag

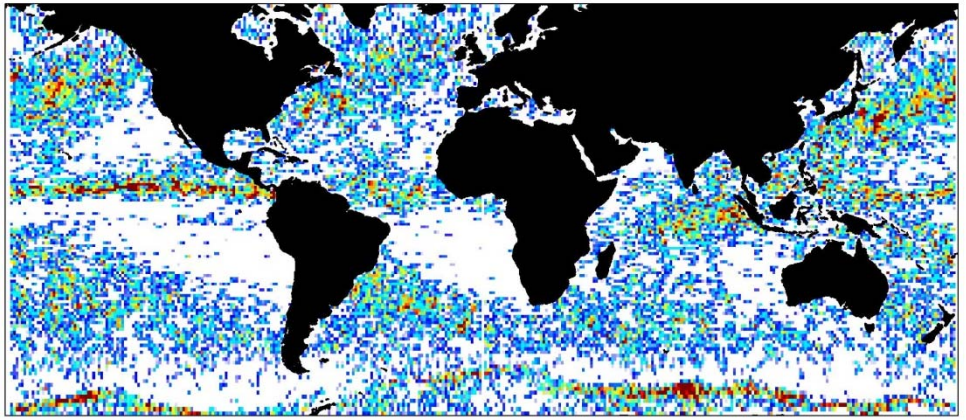


- Radiometer specific flags added to processing
  - Rain, sea ice, new land flag
- New land flag is tri-valued
  - 0 – ocean
  - 1 – coastal processing applied
  - 2 – land

Rainfall climatology from TRMM

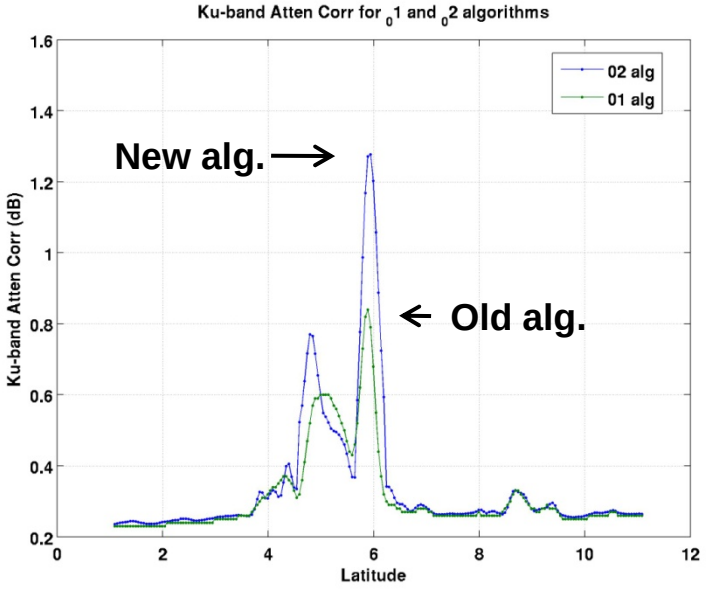


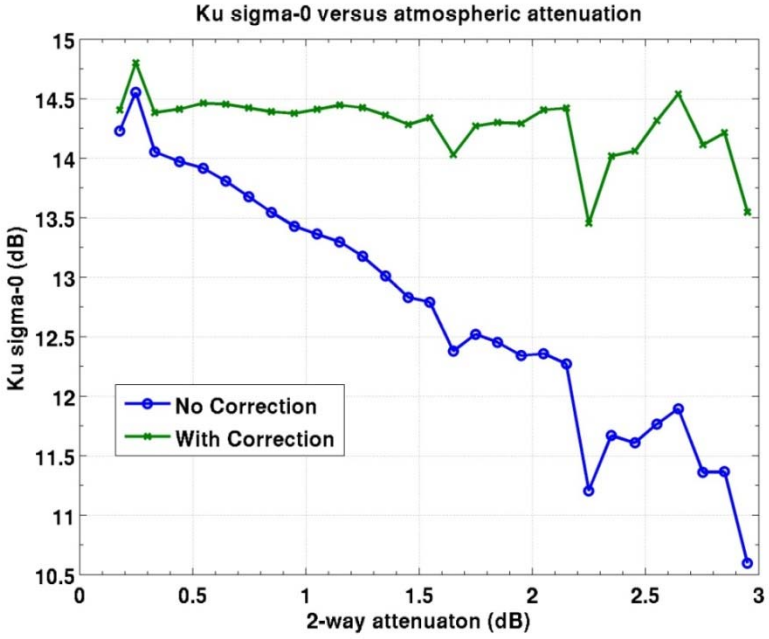
200-day average of AMR rain flag



New Attenuation Correction Algorithm

- Previous atmospheric attenuation was only valid for non-precipitating scenes
- Algorithm updated for GDR-D to be valid for all ocean scenes
- Algorithm trained using simulated observations for both raining and non-raining scenes

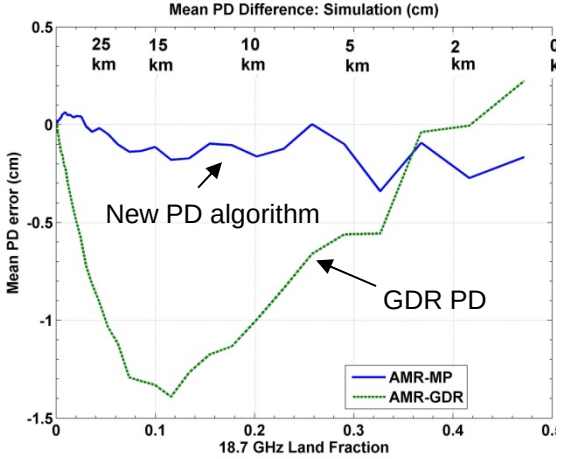




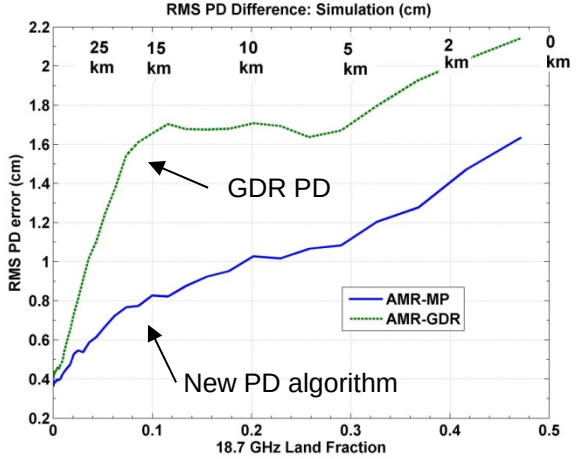
- Little difference between algorithms for non-raining scenes
  - New algorithm will create ~0.2m/s regional differences and wind speed and < 0.6mm differences in SSH
- New algorithm validated by plotting sigma0 as a function of atmospheric attenuation in the tropics
  - Assumes no correlation between roughness and attenuation (e.g. winds and rain)
  - Rain effect on surface should decrease signal slightly

New Coastal Path Delay Algorithm for AMR

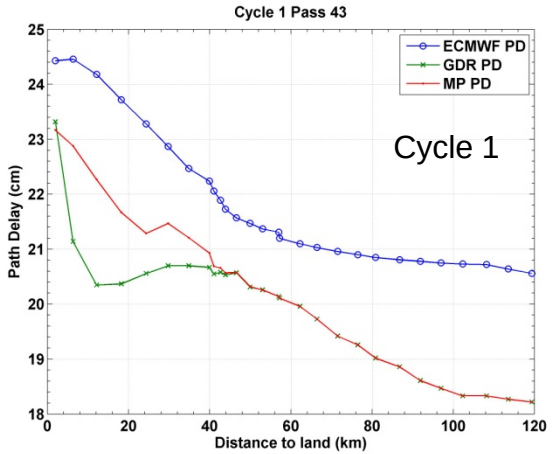
- Mixed-pixel algorithm implemented for AMR (Brown, 2010 TGRS)
- New algorithm is unbiased near land with error less than 1.2 cm up to roughly a 5 km from land
  - Algorithm also applied to JMR and TMR

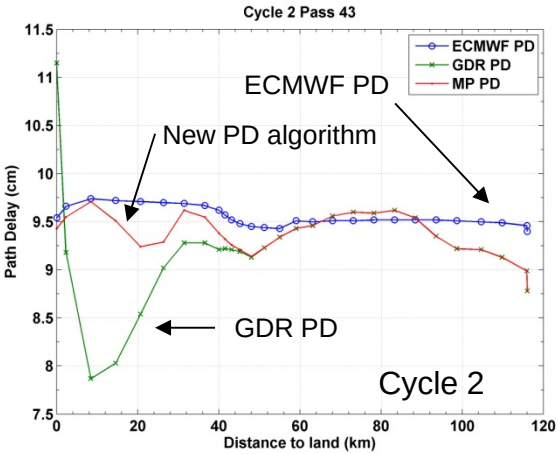


Mean PD error approaching land for GDR algorithm and new algorithm



RMS PD error approaching land for GDR algorithm and new algorithm



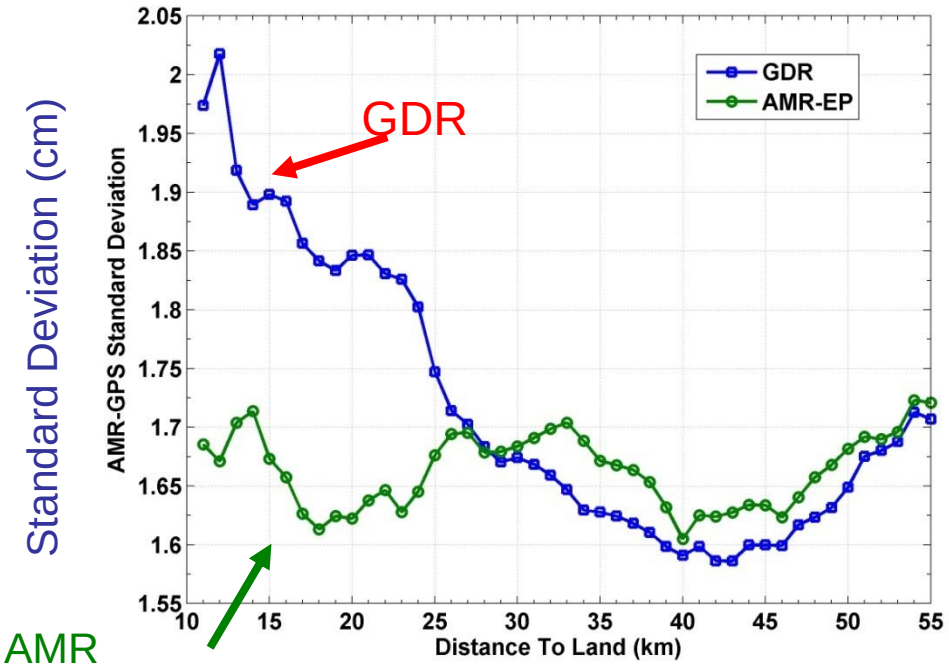


Comparison of new near-land algorithm, GDR algorithm and ECMWF PD approaching California coast (pass 43 over Harvest, cycles 1 and 2)

GPS Validation of New Coastal PDs

- Coastal GPS sites used to validate new coastal PD algorithm
- Coastal PD algorithm shows little excess variance from GPS up to coastline

GPS-AMR Standard Deviation Approaching Coast



–"A Novel Near-Land Radiometer Wet Path Delay Retrieval Algorithm: Application to the Jason-2/OSTM Advanced Microwave Radiometer" , TGRS, 2010

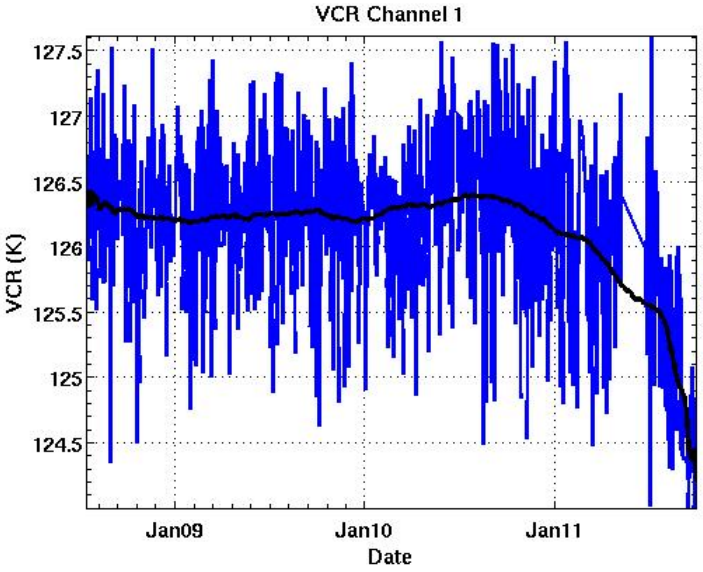
Jason-2 Long Term Calibration

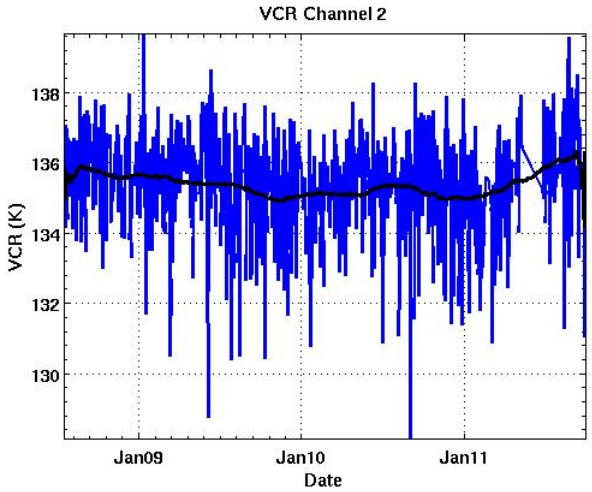
- **On-orbit calibration for Jason-2 AMR divided into operational and off-line (research) segment**

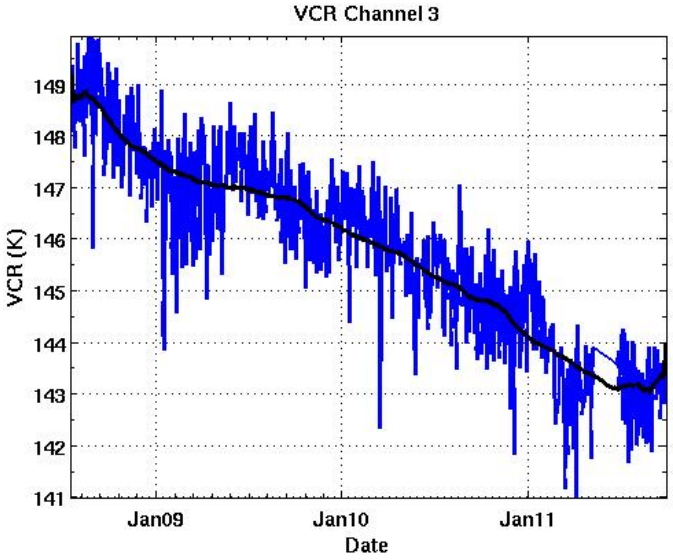
- **Autonomous (Assisted) Radiometer Calibration System (ARCS) performs end-to-end on-orbit system calibration for AMR to remove gross errors with < 60-day latency**
  - **Does not produce “climate quality” calibration**

- **1 mm/yr stability goal (requirement) can only be met through rigorous on-orbit calibration using long time series**

TB Stability w/o ARCS



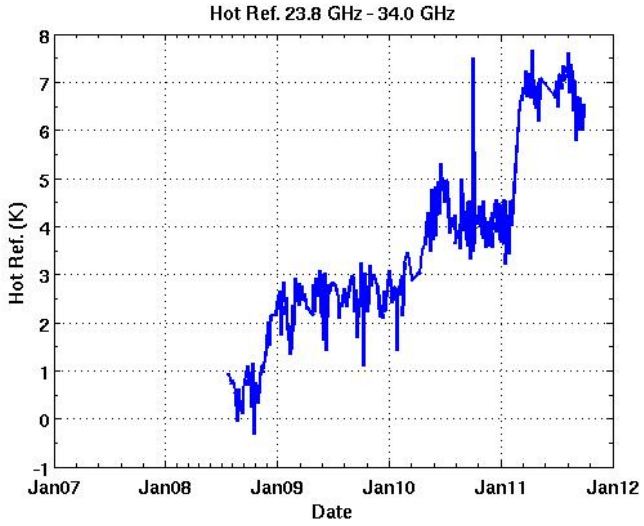




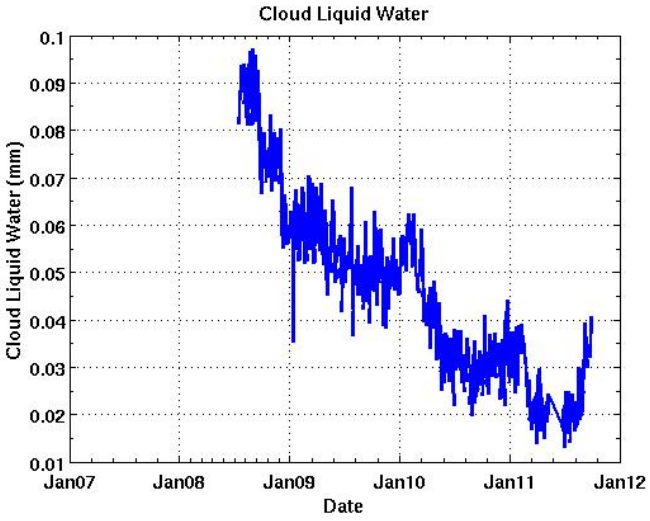
- 18.7 GHz channel stable until August 2011 when 2 1K jumps occurred
- 23.8 GHz channel showed 0.5K shift around July 2009
- 34 GHz channel has trended downward about 6K since launch

Operational Calibration

AMR 23.8 GHz – 34.0 GHz TB over Amazon Rainforest



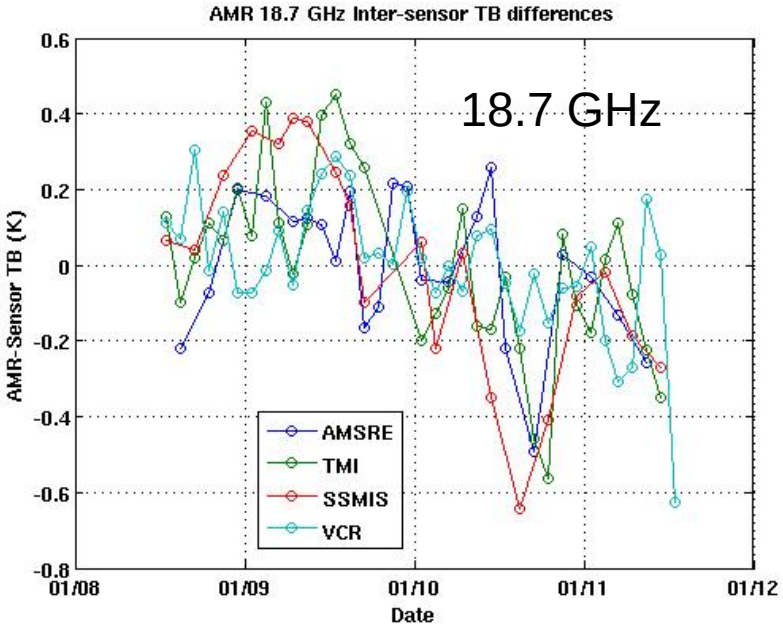
AMR Daily Global Average Cloud Liquid Water

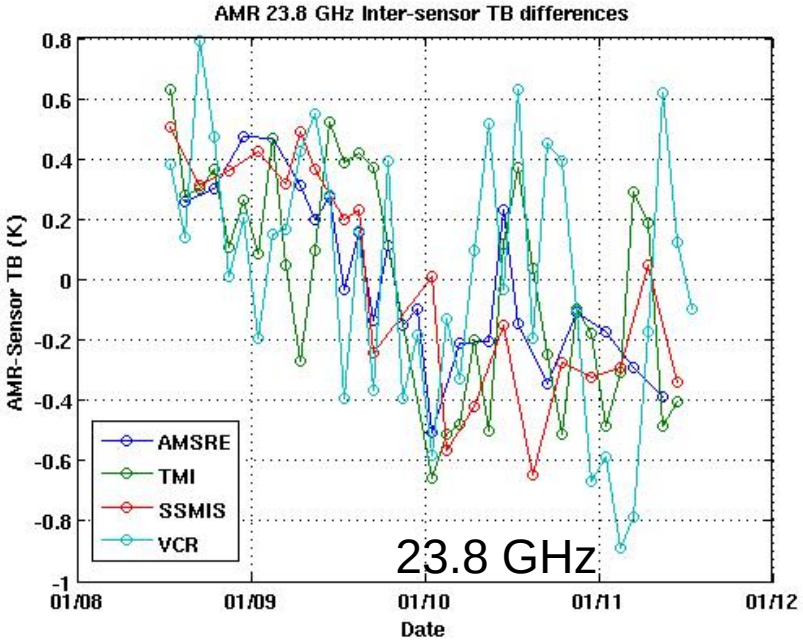


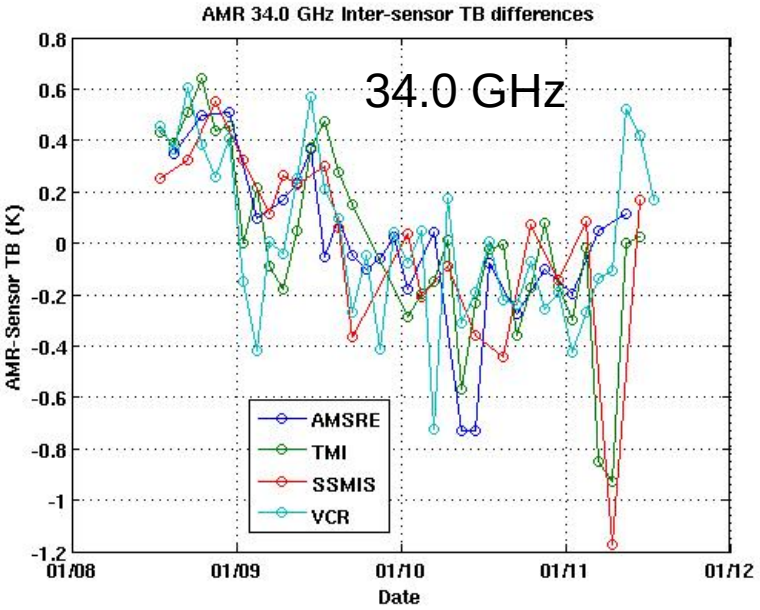
- All calibration shifts in AMR to date have been discrete offset shifts
  - Engineering assessment is that it could be linked to noise susceptibility issue identified late in ATLO
- Operational corrections performed by analyzing inter-channel differences, comparisons to on-Earth references and other models/sensors to detect and assess the magnitude of calibration shifts
- Fortunately, discrete offset shifts are generally detectable and can be robustly corrected
  - Discrete shifts stand out from geophysical signals as the global climate system generally doesn't change significantly from day to day

GDR-D Calibration

- GDR-D calibration based on consensus TB calibration using other sensors and on-Earth references







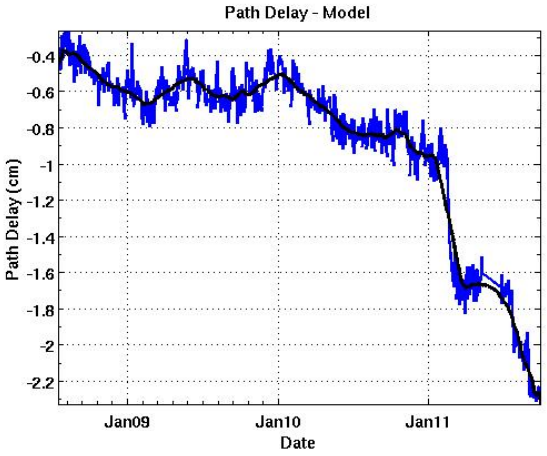
Path Delay Stability

- Without ARCS processing, PDs would exhibit 7 mm/yr drift
- Drift on GDR-T product < 1mm/yr
- Drift on GDR-D product < 1mm/yr

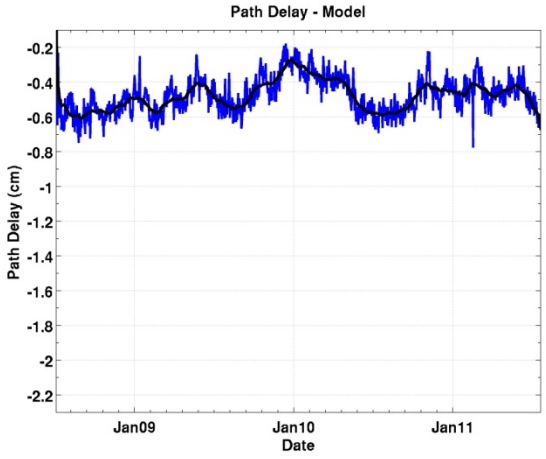
GDR-D	Trend [mm/yr]
PD ECMWF	-0.1 ± 0.02
PD AMSR-E[1]	+0.6± 0.04
PD SSMI F15[1]	+0.3± 0.1
PD TMI[1]	+0.6± 0.05
PD GPS	+0.9± 0.25

[1]data from RSS

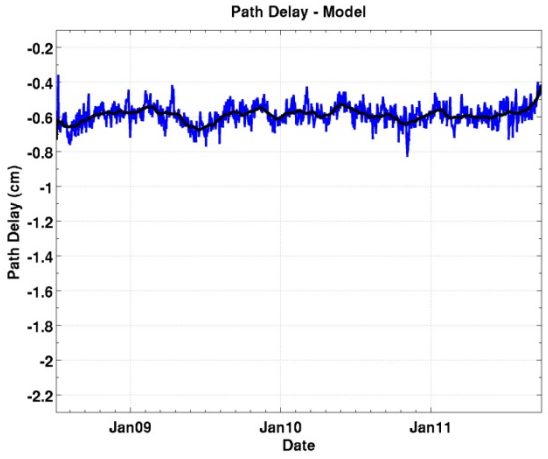
Without ARCS



GDR-T



GDR-D



Summary

- Drift in wet PD on GDR-D product estimated to be < 1 mm/yr for cycles 1-114
- ARCS successful is reducing drift from 7mm/yr to <1mm/yr
- GDR-D also includes improved rain and sea ice flags and an all-weather atmospheric attenuation correction algorithm