A Proposal for Tighter Stability Requirements on the Wet Path Delay Correction for Jason-3

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• A Level-1 Mission Requirement for OSTM is that the system

  “maintain the stability of the global mean sea level measurement with a drift less than 1 mm/year over the life of the mission”
• Maintaining the stability is not important for just determining the mean rate

• To understand climate change and test predictions, we have to understand how the rate is changing over time

From Merrifield et al., *J. Climate*, 2009

15-year trends from global tide gauge analysis
• How much confidence do we have that the observed rate change between TOPEX and Jason-1 is real?

• Neither one had any requirement for 1 mm/year stability
• TMR began drifting almost immediately after launch
• Was not quantified until 1996/1997
• Only an *ad hoc* correction available until after Jason-1 launch
• JMR did not drift, but had two sizeable bias changes that were in same direction

• Not fully understood until November 2004 (1 year after second jump)

• Again, only *ad hoc* correction available for some time
To meet the 1 mm/year GMSL goal, the requirement for the Advanced Microwave Radiometer is

“The radiometer path delay shall be monitored in flight to 1 mm over any one-year period.”

Is this sufficient for climate science and GMSL?

Does not account for other potential drifts

Reference frame, altimeter range

No requirement for a timely correction if system drifts more than 1 mm/year
Other Potential Drifts

• Reference Frame
  » Our knowledge of geocenter rates is uncertain at the ± 1 mm/year level
  » This corresponds to a potential drift in GMSL of ± 0.1 mm/year
  » Should not change unless inconsistent reference frames are used between missions

• Altimeter range
  » Hard to separate range drift only
  » Instrumented calibration sites (e.g., Harvest) have uncertainties of ± 1-2 mm/year
  » Averages over multiple tide gauges has uncertainty of ± 0.5 mm/year
  » Both require a year of more of data to reach this level
In order to see changes in long-term GMSL rates of the order observed by Merrifield et al. [2009], we need at a minimum 1 mm/year stability in GMSL for all current and future altimeters.

That is still only a signal-to-noise ratio (SNR) slightly more than 1.

- Would prefer a stability of 0.5 mm/year in order to get a SNR > 2.

Timeliness of the calibration is equally important.

- One should not have to wait years to ensure the stability for an operational-class mission.
Proposed Requirements

• On-board calibration of the radiometer appears to be the most useful way to reach the goal

• Requirements need to account for possible drifts in other systems (range, orbit) and include a statement on correcting data when drifts are detected

• Proposed statement for Jason-3 radiometer

  » “The radiometer path delay shall be monitored in flight to less than 1 mm over any one-year period and data shall be corrected for excursions larger than 1 mm when averaged over a cycle before release of the geophysical data records (GDRs).”
Proposed Goal

- The radiometer path delay shall be monitored in flight to less than 0.5 mm over any one-year period and data shall be corrected for excursions larger than 0.5 mm when averaged over a cycle before release of the geophysical data records (GDRs).