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

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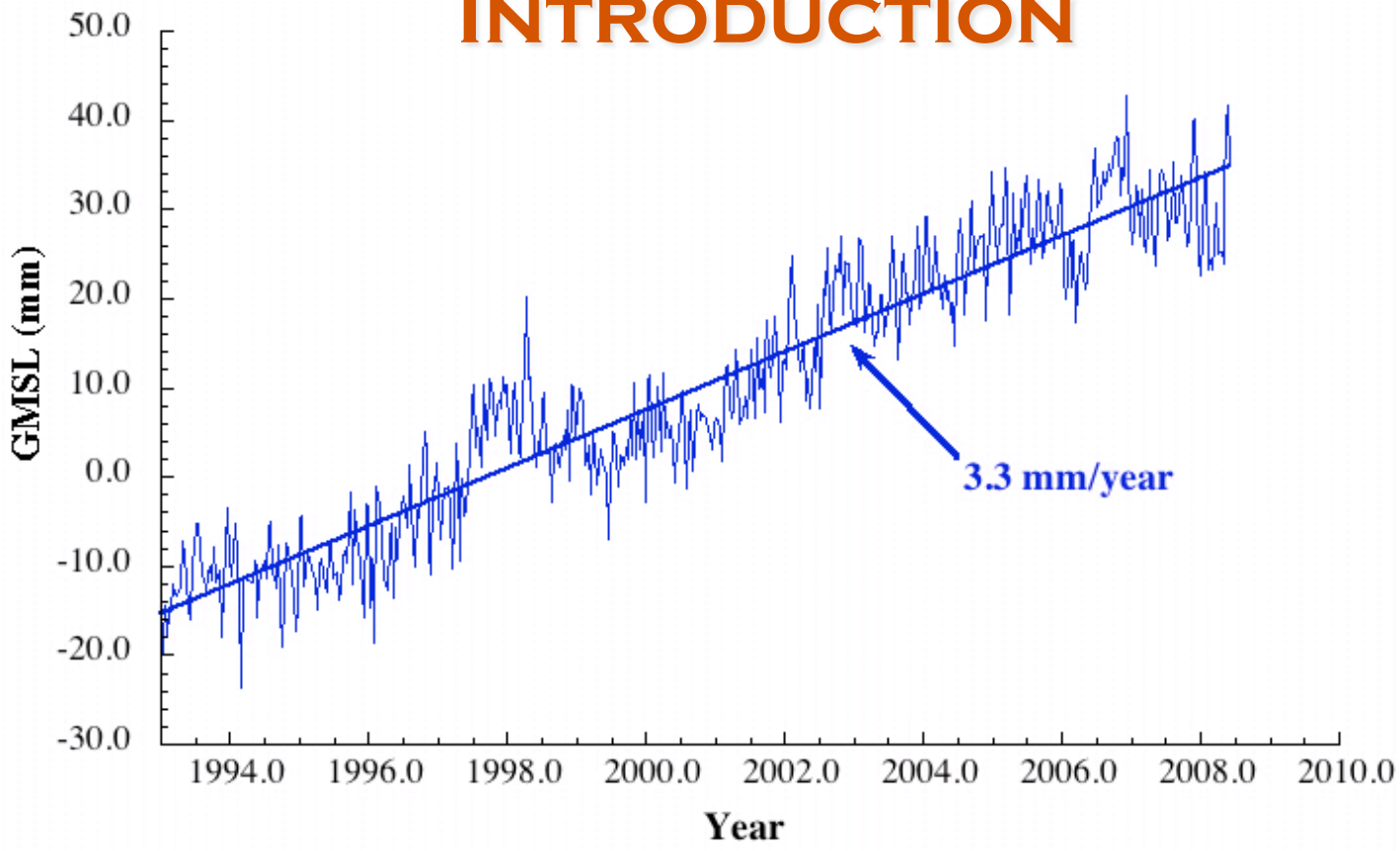
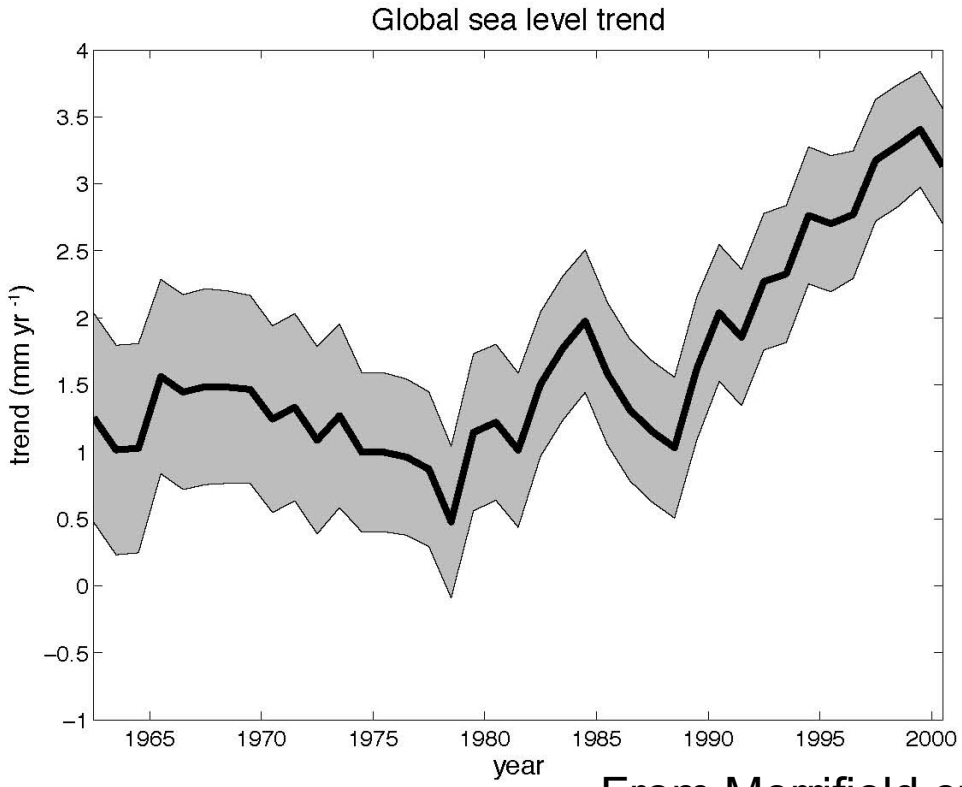
Introduction



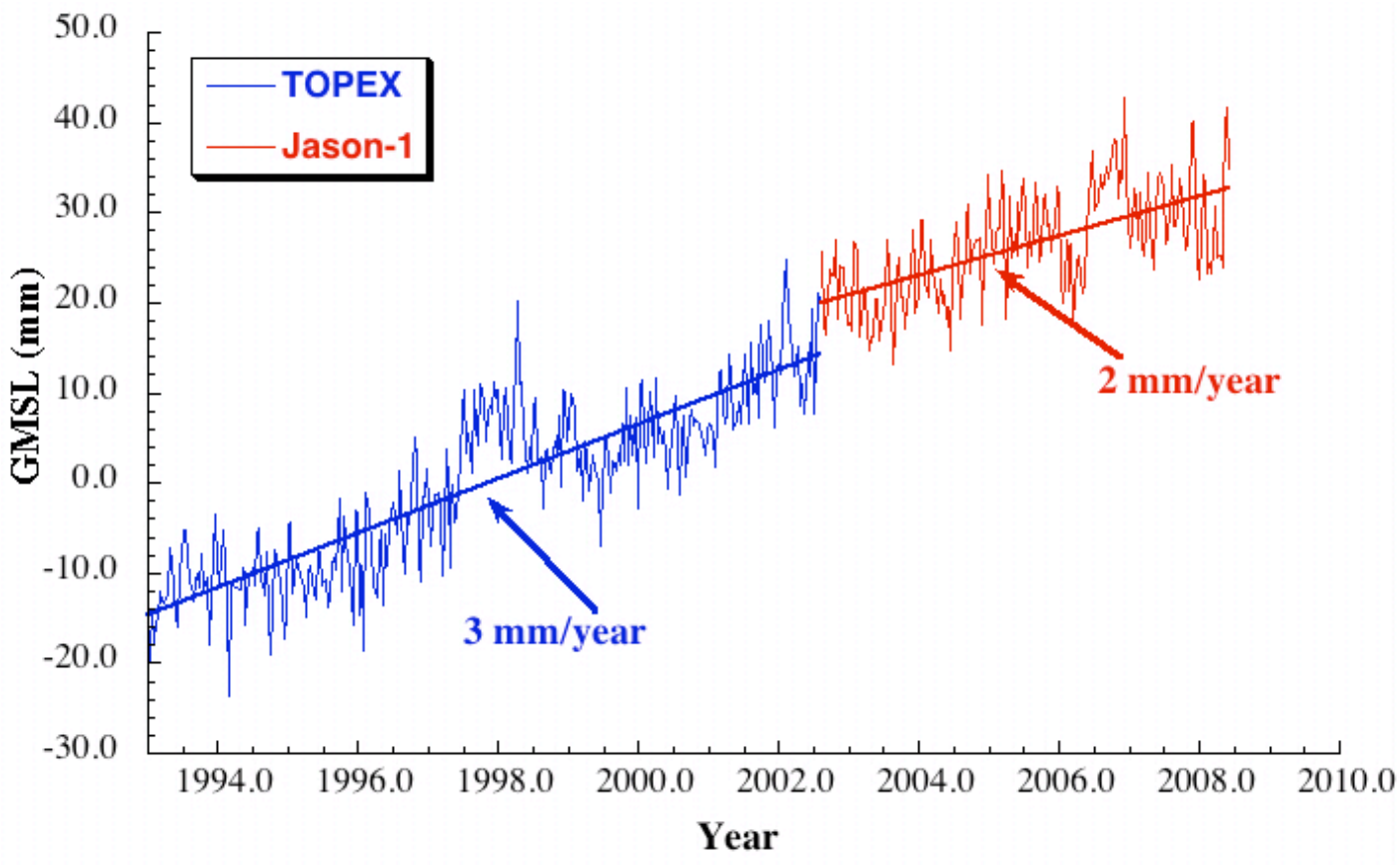
- A Level-1 Mission Requirement for OSTM is that the system
  - » "maintain the stability of the global mean sea level measurement with a drift less than 1 mm/year over the life of the mission"

15-year trends from global tide gauge analysis

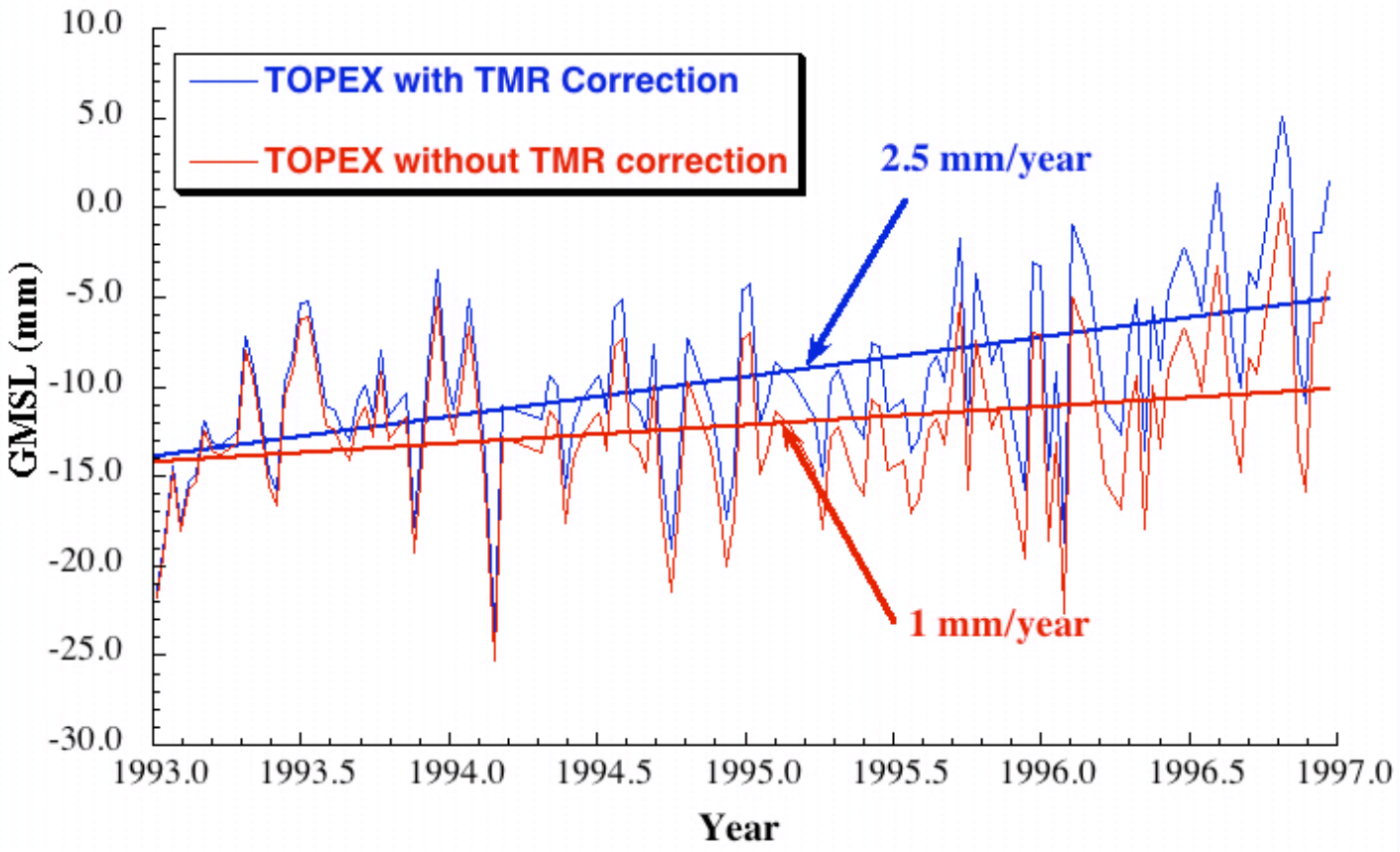


From Merrifield et al., *J. Climate*, 2009

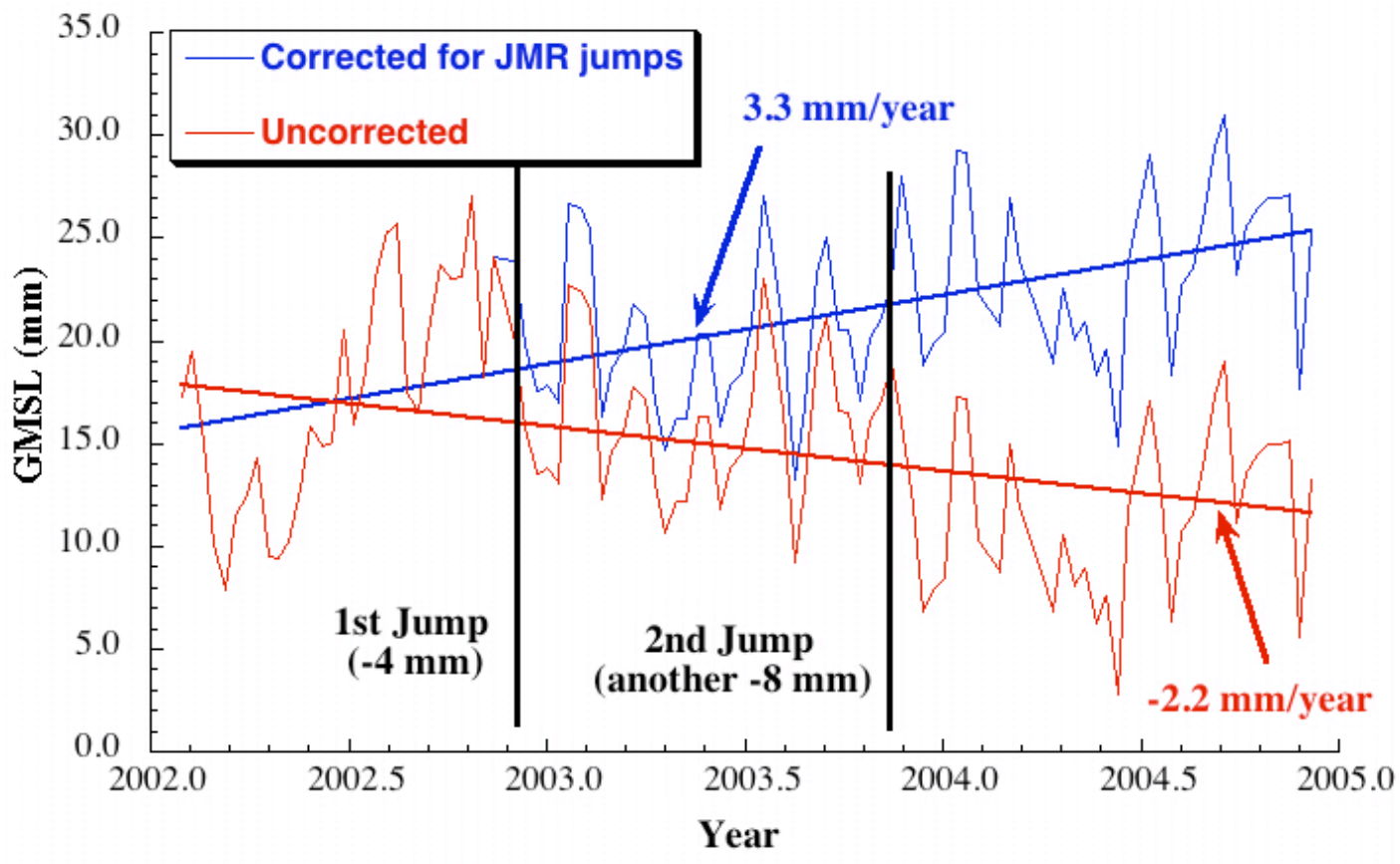
- Maintaining the stability is not important for just determining the mean rate
- To understand climate change and test predictions, we have to understand how the rate is changing over time



- 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

OSTM Requirements

- 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

Commentary

- 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).