Subband Calibration Approaches

• Approach 1
  – All of the 16 subbands’ TAs are compared to expected TA
    • Same as full band calibration

• Approach 2
  – Subbands TAs are compared to full band TA
    • Calibrate Tnd and Tref offset of each subband
  – Relation between subband & fullband TAs
    \[ T_{A, fb} = aT_{A, sb} + b \]
    Adjusted subband TA: \[ \hat{T}_{A, sb} = \hat{a}T_{A, sb} + \hat{b} \]
  – Subband Tnd and Tref will be adjusted
    \[ T'_{nd, sb} = \hat{a}T_{nd, sb} \]
    \[ T'_{ref, sb} = \hat{a}T_{ref, sb} + \hat{b} \]
    \[ = T_{ref, sb} + (\hat{a} - 1)T_{ref, sb} + \hat{b} \]
Data Selection Criteria

• Data selection criteria
  – L1B quality flag bit 0 = 0
  – ta_filtered = ta
  – Reflected antenna boresight away from galactic plane

• Training dataset
  – April 01 ~ 03, 2015
  – RAD high-rate data mode

• Test dataset
  – April 04 ~ May 05, 2015
Subband Adjust Coefficient

- Training dataset: ~3 days (April 1 ~ 3, 2015)
- Half data for ocean, half data for land/ice
Performance
(training dataset)

- Subband TA difference

\[ \delta \hat{T}_{A,sb} = \hat{T}_{A,sb} - T_{A,fb} \]
Performance
(test dataset)

• Initial result for the test dataset
  – Low rate mode data
  – Daily averaged

\[
\hat{T}_{A,fb} = \sum_{i=1}^{16} \hat{T}_{A,sb,i}
\]

\[
\delta \hat{T}_{A,fb} = \hat{T}_{A,fb} - T_{A,fb}
\]
• Tested using one half orbit
• Subband cal coefficients (Tnd, Tref offset) updated
Drift Monitor Approach

• Compare calibrated antenna temperature to modeled antenna temperature over desired calibration targets

• Selected Calibration Target
  – 1) whole ocean exclude heavy rain zone
  – 2) Selected ocean calibration region
    • for backup
  – 3) Dome-C
    • work in progress

• Daily averaged TA difference monitor the calibration drift
TA Forward Model

• Generate expected antenna temperature

• Earth surface TB models
  – Earth surface is classified as Land, Ocean and Ice
    • Ocean includes sea ice.
  – Land TB from Nature Run v03
  – Ocean TB model: L-band GMF \(^1\)
  – Ice dielectric constant model: the Ulaby et al. model \(^2\)
    • used by Aquarius

• Atmospheric RT model
  – \(T_{\text{up}}, T_{\text{down}}, \text{Loss}\) are functions of the Earth’s surface elevation

• Faraday rotation model
  – Use IGS TEC to compute Faraday rotation angle
  – IGS TEC is scaled by factor 0.75

• APC
  – Inversion of L1B APC correction in general


Data Selection Criteria

• L1B data quality flag bit 0 = 0
  – brightness temperature measurement has acceptable quality
• Reflected antenna boresight away from galactic plane
• TA is within reasonable range
  – L1B TA
  – expected TA
Current Performance

- Global ocean target
Conclusion

- Two subband calibration approaches are tested.
  - Using fullband to calibration subbands
    - 0.1 K bias exists for low-rate mode data
  - Using expected TA to calibrate both fullband and subbands
    - ~0.05 K bias switching from low-rate mode to high-rate mode
    - Used for the main method to calibrate approach

- Radiometer drift satisfy requirement
  - Less than 0.1 K / month