MWR $T_b$ Anomaly: Antenna Pattern Effects

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Antenna Main Beam Efficiency Issue with Even Number Beams

• MWR has a parabolic torus reflector antenna design with 8 component beams
  – For mechanical purposes, the feeds are staggered in two offset planes resulting in two earth incidence angles (odd beams: 52° & even beams: 58°)
  – Even beams have higher sidelobes in the elevation plane, which result in “smearing” of the radiometer response for high-contrast step-function targets
  – Examples of the “worst-case” are shown for land/ocean crossings
MWR Antenna

Ka-Band
MWR Antenna Patterns for Beam 2 & 3

Beam-2

Beam-3

High Sidelobes
Antenna Beam Efficiency (Beams-2 & -3)
MWR Ascending Pass: Land/Ocean Crossings

Channel: 36.5 H-Pol

MWR Swath (8 Beams)

Australia

T$_B$, Kelvin
Beams 2 & 3: Land/Ocean Crossings

Channel: 36.5 H-Pol

Beam 2
EIA=58°

Beam 3
EIA=52°

Australia
95% Beam Efficiency Contours
Beam-2 blue & Beam-3 red
Time Series of MWR $T_{ant}$

Channel: 36.5 H-Pol

- Beam 2
- Beam 3

A, B, C, D points on the graph.
MWR $T_{ant}$ Time Series
with 14 Samples Shift to Align Beams 2 & 3

Main Beam (MB)
Side lobe (SL)

MB Entering Land

MB Over Land
SL Over Ocean

MB over Ocean
SL Over Land

MB & SL Over Ocean

$20$ Kelvin

$~6$ Kelvin (Due to EIA)

$27$ Kelvin
Conclusions

• The antenna pattern effects for even beams are significant and must be corrected in a robust APC algorithm
  – Based on anecdotal evidence for land/water crossings, Beam -2 appears significantly worst
    • This is perplexing given the similarity of antenna patterns for even# beams

• Uncorrected, this results in a significant error in Tb in the vicinity of strong contrast targets
  – Land/water crossings
  – Rain events in open ocean
  – Strong ocean winds
  – Sea ice edge
BACK-UP
Channel: 36.5 H-Pol