Estimation of soil moisture retrieval parameters using multi-angular L-band observations

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Background –
SMOS and multi-angle retrieval

• MIRAS – Microwave Interferometer with Aperture Synthesis (L-band)
• Y-shaped antenna with three arms of ~6.5 m
• Total of 69 radiometers (54 along arms)
Background – SMOS and multi-angle retrieval

• MIRAS – Microwave Interferometer with Aperture Synthesis (L-band)
• Y-shaped antenna with three arms of ~6.5 m
• Total of 69 radiometers (54 along arms)

• Retrieval algorithms mainly developed from simulations and tower-based experiments
  --> Validation required
Data Set I

Goulburn River Catchment – National Airborne Field Experiment 2005

Polarimetric L-band Multi-beam Radiometer

- SASMAS stations
- NAFE stations
- Soil moisture sampling
- Multi-angle flights
- NAFE farm boundary

Midlothian
- Merriwa Park
- Cullingral
Forward Model – Default parameter

- SM = 0.45 m$^3$/m$^3$
- SM = 0.42 m$^3$/m$^3$
- SM = 0.21 m$^3$/m$^3$
- SM = 0.14 m$^3$/m$^3$

-> significant difference between simulation and observation
Forward Model – Roughness effect (Hr)

SM = 0.45 m$^3$/m$^3$

SM = 0.42 m$^3$/m$^3$

SM = 0.21 m$^3$/m$^3$

SM = 0.14 m$^3$/m$^3$

-> difference between simulation and observation reduced, but trend for large angles not captured
Forward Model - Veg structure effect (tt<sub>P</sub>)

02-Nov-2005

SM=0.45 m<sup>3</sup>/m<sup>3</sup>

Brightness Temperature (K)

0-50

16-Nov-2005

SM=0.21 m<sup>3</sup>/m<sup>3</sup>

Brightness Temperature (K)

0-50

23-Nov-2005

SM=0.14 m<sup>3</sup>/m<sup>3</sup>

Brightness Temperature (K)

0-50

Source: Panciera et al., 2009
RMSE for Merriwa Park Simulations

Merriwa Park NAFE05

Observed Brightness Temperature (K) vs. Simulated Brightness Temperature (K)

- Hr−tt−opt Model
- Hr−opt Model
- Default Model

02–Nov–2005

09–Nov–2005

16–Nov–2005

23–Nov–2005
Effect of $t_{tp}$ parameter on model performance
Data Set II

Murrumbidgee River Catchment/Yanco – National Airborne Field Experiment 2006
Summary

Forward simulation results were improved by modifying the default parameters (Wigneron et al., 2007):

i) $H_r$...surface roughness

ii) $tt_p$...angular effect of the vegetation structure

-> RMSE for Merriwa Park data reduced from $\sim$37K to $\sim$2.5 K

-> vegetation structure effect more dominant for wet soil condition/high VWC