SMOS validation results in the Upper Danube Catchment

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SMOS cal/val proposal: AO ID 3236

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Upper Danube Catchment (UDC)

Vils test site

Radiometer

Size: 77000 km²
Approach

- Two airborne campaigns
- Comparison with ancillary remote sensing data: soil moisture product from ENVISAT ASAR (VISTA GmbH)

Radiometers

Soil moisture measurements

L-MEB

Radiative Transfer model

1km

Land surface model PROMET

SMOS L1c BT product

SMOS L2 SM product

soil moisture measurements

Comparison with ancillary remote sensing data: soil moisture product from ENVISAT ASAR (VISTA GmbH)
Basic objective
- Representative coverage of parts of one SMOS pixel

Five flights: 17, 22, 25 May, 12, 17 June 2010

Instruments: EMIRAD, HUT-2D, Thermal camera

Intensive ground campaign in the focus areas (on 8 days):
- Soil moisture (~2500 measurements per day)
- Soil temperature
- Vegetation parameters
- Land cover

Vils test site
ISEA ID 2027099
40km
Soil moisture:
- RMSE: 0.040 - 0.045 m³/m³
- random error: 0.023 - 0.04 m³/m³

Brightness temperatures:
- RMSE: 12.09 – 16.52 K

Mean focus area soil moisture PROMET vs. inSitu

Brightness temperature comparison for ISEA ID 2027099 - EMIRAD vs. PROMET-L-MEB 40°
SMOS L2 vs. in situ 2010 in Vils: absolute values

dall’Amico et al., accepted for TGRS special issue on SMOS 2012
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SMOS L2 vs. inSitu
2011 in Vils: absolute values
SMOS L2 vs. inSitu 2011 in Vils: anomalies
SMOS L2 vs. PROMET
2011 in Vils: absolute values

R = 0.71; bias = 0.132 m³/m³
SMOS L2 vs. PROMET
2011 in UDC

mean bias = 0.143 m³/m³
Optical Depth: SMOS (L2) vs. PROMET

Data comparison (ID 2027099)

- PROMET 2027099
- SMOS 2027099

Grass cuts / Crop harvests
mean bias = 5.2 K
mean RMSE = 15.7 K
The surface soil moisture is retrieved by VISTA from ASAR for the area of the VILS (mean of 3 SMOS grid cells)

Correlation between SMOS and ASAR for observations at approx same time (incl. +/- 1 day)
SMOS L2
- SMOS still severely underestimates soil moisture contents in the whole UDC (mean bias = 0.143 m³/m³)
- SMOS L2 data quality has improved significantly in 2011. Large drying out phases are clearly captured (R = 0.4 – 0.8; mean RMSE of anomalies = 0.057 m³/m³)
- The spatial pattern of SMOS L2 data quality in the UDC has changed completely since 2010
- Despite its large spatial scale, temporal variability of SMOS data is similar to the variability of the in situ measurements
- SMOS optical thickness seems more consistent in 2011 than 2010 but still shows large variations

SMOS L1c
- SMOS brightness temperatures improve in some areas in 2011 when compared to simulations after extensive SMOS data processing/filtering
- The spatial pattern of SMOS L1c data quality is similar to 2010
Thanks!