

Interpretation of L-band brightness temperatures of differently tilled bare soil plots

Marin Dimitrov



Forschungszentrum Jülich GmbH
Institute of Bio- and Geosciences
Agrosphere (IBG-3)

Interpretation of L-band brightness temperatures of differently tilled bare soil plots

Marin Dimitrov

Schriften des Forschungszentrums Jülich
Reihe Energie & Umwelt / Energy & Environment

Band / Volume 292

ISSN 1866-1793

ISBN 978-3-95806-098-2

Content

Summary	III
Zusammenfassung	IV
Content	V
List of figures	VIII
List of tables	XII
List of abbreviations	XIV
I General introduction	15
1 Research unit MUSIS: overall goals of the research project	15
2 Background	16
II New improved algorithm for sky calibration of L-band radiometers JÜLBARA and ELBARA II	18
1 Abstract	19
2 Introduction	19
3 Calibration algorithms	19
3.1 Internal calibration	19
3.2 External calibration	20
3.2.1 Algorithm 1: Cable loss correction	20
3.2.2 Algorithm 2: Effective transmissivity	20
4 Sky measurements	21
5 Results and discussion	22
5.1 JÜLBARA	22
5.2 ELBARA II	24
6 Conclusions	26
7 Acknowledgments	26
III Soil hydraulic parameters and surface soil moisture of a tilled bare soil plot inversely derived from L-Band brightness temperatures	27
1 Abstract	28
2 Introduction	28
3 Materials and methods	31
3.1 Experimental setup and instrumentation	31
3.2 Models	32
3.2.1 Hydrologic model	32

3.2.2	Radiative transfer model	33
3.2.3	Coherent radiative transfer model (CRTM).....	34
3.2.4	Fresnel equation	36
3.2.5	Surface roughness correction model.....	37
3.3	Model coupling and parameter estimation.....	38
3.4	Model validation	40
4	Results and discussion	42
4.1	Measured and modelled brightness temperature.....	42
4.2	Surface roughness correction factor.....	46
4.3	Water retention and hydraulic conductivity functions.....	48
4.4	Site- and depth- specific calibration of soil moisture sensors.....	53
4.5	Comparison between retrieved and in situ measured soil moisture.....	55
5	Summary and conclusion	62
6	Acknowledgments.....	64
IV	Soil hydraulic parameters of bare soil plots with different soil structure inversely derived from L-band brightness temperatures	65
1	Abstract.....	66
2	Introduction.....	66
3	Materials and Methods.....	69
3.1	Experimental setup and instrumentation.....	69
3.2	Models.....	72
3.2.1	Governing flow equation and soil hydraulic properties.....	72
3.3	Model coupling and parameter estimation.....	73
3.3.1	Forward run and model coupling.....	73
3.3.2	Parameter estimation for plots with different soil structure.....	74
3.3.3	Global optimization algorithms	75
3.4	Objective / likelihood functions.....	75
4	Results and discussion.....	76
4.1	Measured and modelled brightness temperature.....	76
4.2	Water retention and hydraulic conductivity functions.....	83
4.3	Surface roughness correction factor.....	88
4.4	Retrieved and in situ measured soil moisture content	90
4.5	Soil surface temperature and evaporation	96
5	Summary and conclusion	99

6	Acknowledgments.....	101
V	Synopsis	102
1	Summarizing conclusions	102
2	Outlook	103
	References	105
	Acknowledgements	116

Energie & Umwelt /
Energy & Environment
Band/ Volume 292
ISBN 978-3-95806-098-2

