
Contents

Introduction	xi
Chapter 1. Coupling Radar and Optical Data for Soil Moisture Retrieval over Agricultural Areas	1
Mohammad EL HAJJ, Nicolas BAGHDADI, Mehrez ZRIBI and Hassan BAZZI	
1.1. Context	1
1.2. Study site and satellite data	2
1.2.1. Radar images	2
1.2.2. Optical image	4
1.2.3. Land cover map	4
1.3. Methodology	5
1.3.1. Inversion approach of radar signal for estimating soil moisture	5
1.3.2. Segmentation of crop and grasslands areas	6
1.3.3. Soil moisture mapping	8
1.4. Implementation of the application via QGIS	10
1.4.1. Layout	10
1.4.2. Radar images	14
1.4.3. Optical image	20
1.4.4. Land cover map	26
1.4.5. Segmentation of crop's areas and grasslands	26
1.4.6. Elimination of small spatial units	29
1.4.7. Mapping soil moisture	33
1.4.8. Soil moisture maps	43
1.5. Bibliography	44
Chapter 2. Disaggregation of Thermal Images	47
Mar BISQUERT and Juan Manuel SÁNCHEZ	
2.1. Definition and context	47

2.2. Disaggregation method	48
2.2.1. Image pre-processing	48
2.2.2. Disaggregation	50
2.3. Practical application of the disaggregation method	53
2.3.1. Input data.	53
2.3.2. Step 1: pre-processing	54
2.3.3. Step 2: disaggregation	63
2.4. Results analysis	73
2.5. Bibliography	75
Chapter 3. Automatic Extraction of Agricultural Parcels from Remote Sensing Images and the RPG Database with QGIS/OTB	77
Jean-Marc GILLIOT, Camille LE PRIOL, Emmanuelle VAUDOUR and Philippe MARTIN	
3.1. Context	77
3.2. Method of AP extraction	79
3.2.1. Formatting the RPG data	79
3.2.2. Classification of SPOT satellite images.	81
3.2.3. Intersect overlay between extracted AP and FB with crop validation	81
3.3. Practical application of the AP extraction	82
3.3.1. Software and data.	83
3.3.2. Setting up the Python script.	86
3.3.3. Step 1: formatting the RPG data	89
3.3.4. Step 2: classification of SPOT satellite Images	97
3.3.5. Step 3: intersect overlay between extracted AP and FB and crop validation.	110
3.4. Acknowledgements	116
3.5. Bibliography	116
Chapter 4. Land Cover Mapping Using Sentinel-2 Images and the Semi-Automatic Classification Plugin: A Northern Burkina Faso Case Study	119
Louise LEROUX, Luca CONGEDO, Beatriz BELLÓN, Raffaele GAETANO and Agnès BÉGUÉ	
4.1. Context	119
4.2. Workflow for land cover mapping	120
4.2.1. Introduction to SCP and S2 images	120
4.2.2. Pre-processing.	122
4.2.3. Land cover classification	126
4.2.4. Classification accuracy assessment and post-processing.	129
4.3. Implementation with QGIS and the plugin SCP	131

4.3.1. Software and data	131
4.3.2. Step 1: data pre-processing	133
4.3.3. Step 2: land cover classification	139
4.3.4. Step 3: assessment of the classification accuracy and post-processing	144
4.4. Bibliography	150
Chapter 5. Detection and Mapping of Clear-Cuts with Optical Satellite Images	153
Kenji OSE	
5.1. Definition and context	153
5.2. Clear-cuts detection method	154
5.2.1. Step 1: change detection – geometric and radiometric pre-processing.	154
5.2.2. Steps 2 and 3: forest delimitation	160
5.2.3. Step 4: clear-cuts classification.	160
5.2.4. Steps 5 and 6: export in vector mode	162
5.2.5. Step 7: statistical evaluation.	164
5.2.6. Method limits	166
5.3. Practical application.	166
5.3.1. Software and data.	166
5.3.2. Step 1: creation of the changes image	168
5.3.3. Steps 2 and 3: creation, merging and integration of masks	170
5.3.4. Step 4: clear-cuts detection	174
5.3.5. Step 5: vector conversion	177
5.4. Bibliography	180
Chapter 6. Vegetation Cartography from Sentinel-1 Radar Images	181
Pierre-Louis FRISON and Cédric LARDEUX	
6.1. Definition and context	181
6.2. Classification of remote sensing images	183
6.3. Sentinel-1 data processing	185
6.3.1. Radiometric calibration	186
6.3.2. Ortho-rectification of calibrated data	186
6.3.3. Clip over a common area	187
6.3.4. Filtering to reduce the speckle effect	187
6.3.5. Generation of color compositions based on different polarizations	188
6.4. Implementation of the processing within QGIS	189
6.4.1. Downloading data	194
6.4.2. Calibration, ortho-rectification and stacking of Sentinel-1 data over a common area	198
6.4.3. Speckle filtering.	201

6.4.4. Other tools	202
6.5. Data classification	205
6.6. Bibliography	212
Chapter 7. Remote Sensing of Distinctive Vegetation in Guiana Amazonian Park	215
Nicolas KARASIAK and Pauline PERBET	
7.1. Context and definition	215
7.1.1. Global context	215
7.1.2. Species	216
7.1.3. Remote sensing images available	217
7.1.4. Software	219
7.1.5. Method implementation	219
7.2. Software installation	220
7.2.1. Dependencies installation available in OsGeo	220
7.2.2. Installation of scikit-learn	221
7.2.3. Dzetsaka installation	222
7.3. Method	222
7.3.1. Image processing	223
7.3.2. Cloud mask creation	225
7.4. Processing	227
7.4.1. Creating training plots	227
7.4.2. Classification with dzetsaka plugin	230
7.4.3. Post-classification	236
7.5. Final processing	239
7.5.1. Synthesis of predicted images	240
7.5.2. Global synthesis and cleaning unwanted areas	242
7.5.3. Statistical validation – limits	244
7.6. Conclusion	245
7.7. Bibliography	245
Chapter 8. Physiognomic Map of Natural Vegetation	247
Samuel ALLEAUME and Sylvio LAVENTURE	
8.1. Context	247
8.2. Method	247
8.2.1. Segmentation of the VHSR mono-date image	249
8.2.2. Calculation of temporal variability indices	249
8.2.3. Extraction of natural vegetation using time series	251
8.2.4. Vegetation densities	252
8.2.5. Maximum productivity index of herbaceous areas	255
8.3. Implementation of the application	256
8.3.1. Study area	256

8.3.2. Software and data	257
8.3.3. Step 1: VHSR image processing	259
8.3.4. Step 2: calculation of the variability indices on the time series	264
8.3.5. Step 3: extraction of the natural vegetations from the time series of Sentinel-2 image by thresholding method.	267
8.3.6. Step 4: classification of vegetation density by supervised classification SVM.	274
8.3.7. Step 5: extraction of the level of productivity of grasslands.	277
8.3.8. Step 6: final map	279
8.4. Bibliography	282
Chapter 9. Object-Based Classification for Mountainous Vegetation Physiognomy Mapping	283
Vincent THIERION and Marc LANG	
9.1. Definition and context	283
9.2. Method for detecting montane vegetation physiognomy	284
9.2.1. Satellite image pre-processing	286
9.2.2. Image segmentation	289
9.2.3. Sampling, learning and segmented image classification	291
9.2.4. Statistical validation of classification	295
9.2.5. Limits of the method	297
9.3. Application in QGIS	298
9.3.1 Pre-processing	299
9.3.2. Segmentation	312
9.3.3. Classification	319
9.4. Bibliography	337
List of Authors	341
Index	343
Scientific Committee	347