GRS-20306

Remote Sensing

Period 2 and 5, Academic Year 2016-2017

Contact person
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Course Guide for the course "Remote Sensing" (GRS-20306) at Wageningen University.

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WAGENINGEN UNIVERSITY
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Remote Sensing (GRS-20306)

Language	English
Credits	6
Components	classroom lectures: about 16 contact hours (2 credits) practicals: about 90 contact hours (4 credits)
Period	2 2016-2017, Weeks 9 – 14 5 2016-2017, Weeks 29 – 34

The detailed draft schedule for period 2 is provided in Appendix A and the one for period 5 in Appendix B.

Time and venue	mornings, Gaia-building
Contact person	dr. Jan Clevers email: jan.clevers@wur.nl telephone number: 0317-481802
Lecturer(s)	dr. Jan Clevers dr. Harm Bartholomeus dr. Lammert Kooistra prof.dr. Martin Herold, a.o.
Examiners	dr. Jan Clevers dr. Harm Bartholomeus
Secretariat	Antoinette Stoffers location: Gaia room C303 telephone number: 0317-481834
Website of the course	BlackBoard: https://blackboard.wur.nl

Profile of the course

This course offers the basic theories in the field of remote sensing, starting from the information needs of various land applications. It is directed at providing a basic knowledge of remote sensing concepts and methods: recording techniques in the optical and microwave region, image construction, digital image analysis and pattern recognition, geometric and atmospheric correction procedures and the subsequent quality of images. Then image classification is dealt with. As a next step, the estimation of biophysical object properties is treated using both statistical and radiative transfer approaches. Special emphasis is on imaging spectroscopy. Subsequently, monitoring through time-series analysis is dealt with. Finally, new developments will be dealt with. Throughout the course attention is paid to the possibilities and limitations of remote sensing from airplanes and satellites as a source of information for the inventory, monitoring and policy making in the fields of agriculture, forestry, land use, agrohydrology, nature conservation and environmental issues. Handling remote sensing data yourself is central in the practicals.

Assumed prerequisite knowledge

GRS-10306 (Introduction Geo-Information Science)

Continuation courses

GRS-32306 (Advanced Earth Observation)
GRS-60312 (Remote Sensing and GIS Integration)

Learning outcomes

After successful completion of this course students are expected to be able to:

- Demonstrate understanding and knowledge of the basic remote sensing theories, concepts and methods taught in the course;
- Analyse the use of remote sensing for various spatial problems;
- Apply digital image processing techniques for spatial problems;
- Explain the application possibilities of remote sensing for the inventory, monitoring and policy making in the fields of agriculture, forestry, land use, agrohydrology, nature conservation and environmental issues.

Course materials and resources

The exercises are described in the practical manual. This is available at the BlackBoard site of this course.
A copy of the lecture sheets is available at the BlackBoard site of this course.
Theoretical aspects are described in the book "Fundamentals of Satellite Remote Sensing, An Environmental Approach" of Emilio Chuvieco, 2016, Second Edition (ISBN 978-1-4987-2805-8). This book can be bought at the WUR-Shop. This book is recommended, but not obligatory.
Detailed reading instructions for this book are given in Appendix C (also in relation to the requirements for the exam).
Students may still use the first edition of this book (ask J. Clevers).

Educational (=teaching and learning) activities

- Acquiring basic knowledge of the main remote sensing theories, concepts and methods in a theoretical and practical way;
- Performing exercises on theoretical aspects of remote sensing, after introductory lectures;
- Working with real remote sensing image data;
- Working with digital image processing techniques;
- Working with a common image processing software tool.

Assessment strategy

The student's final mark will be based on:
- a closed book examination (75%);
- results of the practical exercises (report to be handed in) (25%).

The closed book examination will be in the examination week of the respective period. The first re-examination opportunity for period 2 will be after period 3 and the first re-examination opportunity for period 5 will be in August.

The assessment strategy (Toetsplan) is provided in Appendix D.

Course schedule

The detailed draft schedule for period 2 is provided in Appendix A and the one for period 5 in Appendix B.

The detailed course schedule and updates will be made available through the BlackBoard site of this course.

Appendices

Appendix A Time schedule period 2

Appendix B Time schedule period 5

Appendix C Reading-up directions GRS-20306

Appendix D Assessment strategy (Toetsplan)

Appendix A: Time schedule Remote Sensing course – period 2

Program course Remote Sensing (GRS-20306) Oct/Dec 2016

All mornings week 9-14, starting at 8:30
Start: 31 October 2016 at 8:30, room C0093, GAIA, Building 101, Droevendaalsesteeg 3, Wageningen

	Date 2016	Subject	Lecturer	Room	Book Funda-mentals RS	Exercise
Remote sensing - an introduction						
1	**31 Oct.**	Introduction Remote Sensing	Clevers Bartholomeus	C0093 PC95/96	Ch. 1 and §2.1-2.5	1
Technology and sensors						
2	**1 Nov.**	Optical remote sensing	Clevers Bartholomeus	C0093 PC95/96	§3.1, 3.2, 3.4	2
3	**2 Nov.**	Microwave remote sensing	Clevers Bartholomeus	C0093 PC95/96	§2.7, 3.3	2
4	**3 Nov.**	Accessibility of Earth Observation data	Kooistra Bartholomeus	C0093 PC95/96	Ch. 4	3
5	**4 Nov.**	Selfstudy Finish previous exercises		PC95/96		
Preprocessing of remote sensing data						
6	**7 Nov.**	Geometric correction	Clevers Bartholomeus	C0093 PC95/96	§6.6, 6.7	4
7	**8 Nov.**	Atmospheric correction I	Clevers Bartholomeus	C0093 PC95/96	Study exercise reader, §2.8	5
8	**9 Nov.**	Atmospheric correction II	Bartholomeus	PC95/96		5
9	**10 Nov.**	Quality assessment	Kooistra Bartholomeus	C0093 PC95/96	Study exercise reader	6
10	**11 Nov.**	Selfstudy Finish previous exercises		PC95/96		
Image analysis						
11	**14 Nov.**	Digital filters	Clevers Bartholomeus	C0093 PC95/96	§6.5.4	7
12	**15 Nov.**	Principal Component Analysis I	Clevers Bartholomeus	C0093 PC95/96	§7.1.2	8
13	**16 Nov.**	Principal Component Analysis II	Bartholomeus	PC95/96		8
14	**17 Nov.**	Image Classification	Clevers Bartholomeus	C0093 PC95/96	§7.2, 8.7	9
15	**18 Nov.**	Selfstudy Finish previous exercises		PC95/96		

16	**21 Nov.**	Object-based classification Image classification	Clevers Bartholomeus	C0093 PC95/96		9
17	**22 Nov.**	Imaging Spectroscopy 1	Kooistra Bartholomeus	C0093 PC95/96	§3.4.10, 7.1.5, 7.2.3.7	10
18	**23 Nov.**	Imaging Spectroscopy 2	Kooistra Bartholomeus	PC95/96		10
19	**24 Nov.**	Interpretation in radar remote sensing	Clevers Bartholomeus	C0093 PC95/96	§2.7.2, 2.7.3, 2.7.4	11
20	**25 Nov.**	Selfstudy Finish previous exercises		PC95/96		
Parameter estimation - quantitative RS						
21	**28 Nov.**	Statistical based approaches and vegetation indices	Clevers Bartholomeus	C0093 PC95/96	§2.5, 7.1.3	12
22	**29 Nov.**	Physical based approaches	Clevers Bartholomeus	C0093 PC95/96	Study exercise reader	13
Applications						
23	**30 Nov.**	Change detection and time series analysis	Herold Bartholomeus	C0093 PC95/96	§7.3	14
24	**1 Dec.**	Soil reflectance	Bartholomeus	C0093 PC95/96	Study exercise reader	15
25	**2 Dec.**	Selfstudy Finish previous exercises		PC95/96		
26	**5 Dec.**	Thermography and albedo	De Wit Bartholomeus	C0093 PC95/96	§2.6	16
27	**6 Dec.**	Energy & water balance	Roerink Bartholomeus	C0093 PC95/96	§2.6	17
28	**7 Dec.**	Guest lecture (8:30) Guest lecture (10:30)		C0093		
29	**8 Dec.**	Earth system science and remote sensing	Clevers	C0093 PC95/96		
30	**9 Dec.**	Selfstudy Finish previous exercises		PC95/96		
	21 Dec.	Final exam, 08:30 – 11:30	Clevers	C0003		

PC95 = PC0095: 2nd floor, GAIA, Building 101, Droevendaalsesteeg 3
PC96 = PC0096: 2nd floor, GAIA, Building 101, Droevendaalsesteeg 3
C0093 = 2nd floor, GAIA, Building 101, Droevendaalsesteeg 3
C0003 = Sporthal De Bongerd, Bornsesteeg 2

Information: Jan Clevers Tel: 0317 – 481802 Email: Jan.Clevers@wur.nl
See also: http://www.geo-informatie.nl/courses/grs20306

Appendix B: Time schedule Remote Sensing course – period 5

Program course Remote Sensing (GRS-20306) March/April 2017

All mornings week 29-34, starting at 8:30
Start: 20 March 2017 at 8:30, room C0093, GAIA, Building 101, Droevendaalsesteeg 3, Wageningen

	Date 2017	Subject	Lecturer	Room	Book Funda-mentals RS	Exercise
Remote sensing - an introduction						
1	**20 Mar.**	Introduction Remote Sensing	Clevers Bartholomeus	C0093 PC0095	Ch. 1 and §2.1-2.5	1
Technology and sensors						
2	**21 Mar.**	Optical remote sensing	Clevers Bartholomeus	C0093 PC0095	§3.1, 3.2, 3.4	2
3	**22 Mar.**	Microwave remote sensing	Clevers Bartholomeus	C0093 PC0095	§2.7, 3.3	2
4	**23 Mar.**	Accessibility of Earth Observation data	Kooistra Bartholomeus	C0093 PC0095	Ch. 4	3
5	**24 Mar.**	Selfstudy Finish previous exercises		PC0095		
Preprocessing of remote sensing data						
6	**27 Mar.**	Geometric correction	Clevers Bartholomeus	C0093 PC0095	§6.6, 6.7	4
7	**28 Mar.**	Atmospheric correction I	Clevers Bartholomeus	C0093 PC0095	Study exercise reader, §2.8	5
8	**29 Mar.**	Atmospheric correction II	Bartholomeus	PC0095		5
9	**30 Mar.**	Quality assessment	Kooistra Bartholomeus	C0093 PC0095	Study exercise reader	6
10	**31 Mar.**	Selfstudy Finish previous exercises		PC0095		
Image analysis						
11	**3 Apr.**	Digital filters	Clevers Bartholomeus	C0093 PC0095	§6.5.4	7
12	**4 Apr.**	Principal Component Analysis I	Clevers Bartholomeus	C0093 PC0095	§7.1.2	8
13	**5 Apr.**	Principal Component Analysis II	Bartholomeus	PC0095		8
14	**6 Apr.**	Image Classification	Clevers Bartholomeus	C0093 PC0095	§7.2, 8.7	9
15	**7 Apr.**	Selfstudy Finish previous exercises		PC0095		

16	**10 Apr.**	Object-based classification Image classification	Clevers Bartholomeus	C0093 PC0095		9
17	**11 Apr.**	Imaging Spectroscopy 1	Kooistra Bartholomeus	C0093 PC0095	§3.4.10, 7.1.5, 7.2.3.7	10
18	**12 Apr.**	Imaging Spectroscopy 2	Kooistra Bartholomeus	C0093 PC0095		10
19	**13 Apr.**	Interpretation in radar remote sensing	Clevers Bartholomeus	C0093 PC0095	§2.7.2, 2.7.3, 2.7.4	11
20	**14 Apr.**	**Holiday:** Good Friday				
Parameter estimation - quantitative RS						
21	**17 Apr.**	**Holiday:** Easter Monday				
22	**18 Apr.**	Statistical based approaches and vegetation indices	Clevers Bartholomeus	C0093 PC0095	§2.5, 7.1.3	12
23	**19 Apr.**	Physical based approaches	Clevers Bartholomeus	C0093 PC0095	Study exercise reader	13
24	**20 Apr.**	Change detection and time series analysis	Herold Bartholomeus	C0093 PC0095	§7.3	14
25	**21 Apr.**	Selfstudy Finish previous exercises		PC0095		
26	**24 Apr.**	Soil reflectance	Bartholomeus	C0093 PC0095	Study exercise reader	15
27	**25 Apr.**	Thermography and albedo	De Wit Bartholomeus	C0093 PC0095	§2.6	16
28	**26 Apr.**	Energy & water balance	Roerink Bartholomeus	C0093 PC0095	§2.6	17
29	**27 Apr.**	**Holiday:** King's Birthday				
30	**28 Apr.**	Earth system science and remote sensing	Clevers	C0093 PC0095		
	? May	Final exam	Clevers			

PC0095 = 2nd floor, GAIA, Building 101, Droevendaalsesteeg 3
C0093 = 2nd floor, GAIA, Building 101, Droevendaalsesteeg 3

Information: Jan Clevers Tel: 0317 – 481802 Email: Jan.Clevers@wur.nl
See also: http://www.geo-informatie.nl/courses/grs20306

Appendix C: READING-UP DIRECTIONS GRS-20306

Final mark: 75% exam (closed book!!) and 25% exercises (presence compulsory)

Questions during the exam concern the lectures and theoretical aspects of the practical exercises presented during the course. In this respect, the link between practical exercises and theory is important.
The book of Chuvieco should be considered more as reference book, and as a means to read and understand aspects that were not clear from the lectures.
During the exam no questions will be asked on details of the book, which were not dealt with during the course (do not learn formulae and technical details). So, the book should mainly be used for reading, not for learning by heart!

Prerequisite is the course “Introduction Geo-Information Science” (IGI, GRS-10306). Since this remote sensing course continues on all remote sensing subjects of the IGI course, it is assumed that the theory dealt with in the IGI course is known.

Appendix D: Assessment strategy (Toetsplan) GRS-20306 Remote Sensing

	Learning outcomes \ where assessed?	Report practical	Exam
1	Demonstrate understanding and knowledge of the basic remote sensing theories, concepts and methods taught in the course		x
2	Analyse the use of remote sensing for various spatial problems	x	
3	Apply digital image processing techniques for spatial problems	x	
4	Explain the application possibilities of remote sensing for the inventory, monitoring and policy making in the fields of agriculture, forestry, land use, agrohydrology, nature conservation and environmental issues		x
	Contribution to final mark (%):	25	75
	Report practical has to be handed in at the end of the course and will be judged shortly after the exam	Examiners: Harm Bartholomeus and Jan Clevers	
	Exam consists of open questions (closed book exam)	Examiners: Jan Clevers and Harm Bartholomeus	
	The marks for the individual parts of this course will remain valid for 2 academic years. Further details on the assessment criteria (e.g., for the practical part) will be provided during the course.		