ESA LAND TRAINING COURSE, SZIU GODOLLO, HUNGARY
Daily Programme with summary of contents

ESA	MISSIONS AND TOOLS	PHYSICAL PINCIPLES (THEORY)	APPLICATIONS (THEORY)	PRACTICAL	FIELD TRIP

SUNDAY 3 September 2017

18:00–19:00: Registration in the student hostel lobby.

MONDAY 4 September 2017

	Technical Museum of the Faculty of Mechanical Engineering, Hall TK9:
08:00–09:00	*Registration (outside of Hall TK9)*
09:00–09:10	***Welcome speeches*** János Tőzsér *(Rector of SZIU),* Erika Michéli *(Head of the Institute of Environmental Sciences, SZIU)*
09:10–09:20	***Course Introduction & Overview*** Zoltan Bartalis *(ESA-ESRIN)*
09:20–09:40	***Space-Related Activities in Hungary*** Zoltán Zboray, Hungarian Space Office
09:40–10:15	***Land Remote Sensing in Hungary*** Dániel Kristóf, Government Office of the Capital City Budapest
Group Photo (outside steps of the museum)	
Coffee Break (registration area of museum)	
10:45–11:00	***ESA Science for Society Programme*** Zoltan Bartalis *(ESA-ESRIN, Italy)*
11:00–11:30	***Sentinels for Science and Applications*** Zoltan Bartalis *(ESA–ESRIN, Italy)* • Sentinels 1, 2 & 3 missions for land applications • Instruments and geo-physical parameters retrieval • Science and applications
11:30–12:10	***Earth Explorers for Science and Applications (CryoSat-2, SMOS, FLEX, Biomass)*** Zoltan Bartalis *(ESA-ESRIN, Italy)*, José Moreno *(Univ. Of Valencia, Spain)* • Current and future ESA Earth Explorers missions for land applications • Instruments and geo-physical parameters retrieval • Science and applications
12:10–12:30	***Third-Party Missions Data*** Andy Zmuda *(Serco S.p.A. c/o ESA ESRIN, Italy)* • Overview of ESA TPM missions' & data, data access
Lunch	
14:00–14:45	***Sentinel Data Access and Processing Tools*** Michael Foumelis *(BRGM, France)* • How to access, visualise and process Sentinels' data

MONDAY 4 September 2017 (continued)

14:45–15:45	**D1T1** ***Introduction to Optical Remote Sensing and Atmospheric Correction*** José Moreno *(Univ. Of Valencia, Spain)* • Optical systems • Optical properties and retrievable information • Corrections & modelling of Surface reflectance • Land applications from Sentinels data
Coffee Break (registration area of museum)	
	Computer Room 114 (10 mins walk):
16:15–17:45	**D1P1** ***ESA SNAP Sensinel-2 Tools*** Fabrizio Ramoino *(Serco S.p.A. c/o ESA ESRIN, Italy)* • Introduction and background to SNAP & S2 data • Processing, corrections and bio-physical products • Hand on ingestion, display, corrections and processing of S2 imagery using SNAP
18:00–20:00	***Rector's Hall: Ice-breaker***

TUESDAY 5 September 2017

	Rector's Hall:
08:00–09:00	**D2T1** ***Introduction to SAR and InSAR*** Kostas Papathanassiou *(DLR, Germany)* • Motivation for SAR remote sensing • SAR Imaging • Principle of SAR Interferometry; • Principle of Differential SAR Interferometry; • Examples of SAR, DEM and D-InSAR Applications
Short break	
09:15–10:15	**D2T2** ***SAR Polarimetry*** Eric Pottier *(Univ. Rennes 1, France)* • Intro.to radar polarimetry & land applications • Review of space borne POLSAR sensors • Principles, scattering and target behaviours • Processing, speckling and target decompositions
Coffee break outside of the Rector's Hall	
	Computer Room 114:
10:45–12:15	**D2P1** ***ESA SNAP Sensinel-1 Tools*** Michael Foumelis *(BRGM, France)* • Intro. to open source ESA SNAP Toolbox & Sentinel-1 SAR products • Training on calculation and analysis of backscatter coefficient from Sentinel-1 detected products • Inspection of manual as well as batch processing options of ESA SNAP Toolbox • End-to-end showcase over the broader area of Budapest (Hungary)
Lunch break	
13:30–15:00	**D2P2** ***Introduction to PolSARpro Toolbox*** Eric Pottier, Laurent Ferro-Famil *(Univ. of Rennes 1, France)* • Visualisation, handling and processing of polarimetric and polarmetric interferometric SAR data using POLSARPRO v5.1
Short break	

TUESDAY 5 September 2017 (continued)

	Rector's Hall:
15:15–16:15	**D2T3** ***Advanced Optical and Thermal Applications*** Costas Cartalis *(Uni of Athens, Greece)* • Thermal remote sensing and laws governing thermal dynamics • Kinetic vs radiant temperature • Emissivity and role in thermal remote sensing • Link between LST & thermal properties of materials • How to estimate LST and interpret thermal images • LST applications
Coffee break outside of the Rector's Hall	
	Computer Room 114:
16:45–18:15	**D2P3** ***ESA SNAP Sentinel-3 Tools, OLCI and SLSTR data*** Anna Ruescas *(Brockmann Consult GmbH, Germany)* • Synergistic use of S3 OLCI/SLSTR instruments to retrieve LST products • Visualisation and processing using the Sentinel-3 SNAP Tools • Optical and thermal image processing over land: vegetation indices, emissivity, land surface temperature. • Validation activities and batch processing included

WEDNESDAY 6 September 2017

	Rector's Hall:	
08:30–09:30	**D3T1a** ***Multitemporal Analysis*** Lorenzo Bruzzone *(Univ. Of Trento, Italy)* • Current trends and background on multitemporal images • Change detection in multispectral and SAR images • Change detection in VHR multispectral images • Change detection in VHR SAR images • Change detection in hyperspectral images • Change detection in multisensor/multisource images	
	Computer Room 111:	***Computer Room 114:***
09:30–10:15	**D3P1a** ***Multitemporal Analysis using ILU Products*** Michael Foumelis *(BRGM, France)* • Familiarize with open source ESA SNAP Toolbox • Familiarize with Copernicus Sentinel-1 SAR products. • Training on the generation of Coherence-Intensity False Colour Composites. • Provide instruction on step-by-step processing for land cover mapping • End-to-end showcase over the broader area of Budapest (Hungary).	**D3T1b** ***Cloud Computing and the ESA Exploitation Platforms*** Alessandro Marin (*Solenix co ESA*) Show case of 3 TEPs: 1. Execution of interactive applications on a platform: Case studies Forestry & Coastal TEP 2. Integration of user applications on a platform for hosted processing: Case Studies Forestry & Coastal TEP 3. Visualization and analysis of land-cover products generated by the TEPs: Case Studies Urban TEP
Coffee break (outside of Rector's Hall)		
10:45–12:30	**D3P1a** *(continued)*	**D3P1b** *(continued)*
Lunch		

WEDNESDAY 6 September 2017 (continued)

14:00–15:00	**D3T2a** ***Forest Retrievals using SAR*** Kostas Papathanassiou *(DLR, Germany)* • Interferometric Imaging of Forests • Tomographic Imaging of Forests • The effect of frequency and polarization in forest monitoring • 3D Forest Structure from SAR Data • Applications and Examples	**D3T2b** ***Urban Mapping & Change Detection*** Sebastian van der Linden *(Humboldt-Universität zu Berlin, Germany)* • Motivation for urban remote sensing • Challenges and characteristics of urban land cover • Contribution of different sensor types for urban mapping, • The influence of scale • Examples of mapping growth and composition • Quantitative mapping of land cover fractions in urban areas
15:00–15:45	**D3P2a** ***Forest Retrievals using SAR Polarimetry*** Laurent Ferro-Famil, Eric Pottier *(Univ. Rennes 1, France)* • Fully polarimetric and interferometric SAR simulation of forest using POLSARPRO-SIM	**D3P2b** ***Urban Mapping & Change Detection*** Sebastian van der Linden *(Humboldt-Universität zu Berlin, Germany)* **Case study Berlin:** • Create quantitative maps on impervious/vegetation cover using Sentinel-2 data and regression modelling • Sentinel-2 feature space in urban areas • Empirical modelling with support vector regression, • Parameterisation of support vector regression, training data generation • Quantitative accuracy assessment
Coffee break (outside of Rector's Hall)		
16:15–18:00	**D3P2a** *(continued)*	**D3P2b** *(continued)*
18:00-19:30	***Corridor next to Rector's Hall: Poster session & refreshments***	

THURSDAY 7 September 2017

	Computer Room 111:	***Computer Room 114:***
08:30–09:30	**D4T1a** ***Terrain Motion using InSAR and PSInSAR*** Andy Hooper *(Univ. of Leeds, UK)* • Comparison and processing algorithms • PS techniques • Estimation with time • Comparing reflectors with levelling • Case studies	**D4T1b** ***Urban Heat Islands*** Costas Cartalis *(Univ. of Athens, Greece)* • Urban thermal climatology and temporal trends • 3D structure & urban climate • Weather effects on urban thermal environment • Urban heat islands and influence of environmental and human factors • The physics of the thermal environment (including UHI)
09:30–10:15	**D4P1a** ***Terrain Motion using PSInSAR – case study using SNAP and STAMPS*** Andy Hooper *(Univ. of Leeds, UK)* • Data selection and pre-processing • PS selection & corrections • Phase unwrapping • Velocity estimation • Error analysis due to atmospheric artifacts	**D4P1b** ***Urban Heat Islands*** Costas Cartalis *(Univ. of Athens, Greece)* • To estimate and map LST, NDVI and land surface emissivity • To define areas with increased LST and to assess the link between land use/land cover and LST • To assess the existence of an UHI as well as to define its intensity.
Coffee break and briefing on field trip logistics		
10:45–12:30	**D4P1a** *(continued)*	**D4P1b** *(continued)*

THURSDAY 7 September 2017 (continued)

Pick-up of Brown Bag Lunch sandwiches in front of the Rector's Hall	
	Rector's Hall (Brown Bag Lunch):
12:45–13:15	**D4T2** ***Water Ponding in Hungary – case study*** Zoltán Vekerdy *(SZIU, Hungary)*, János Tamás *(Univ. Debrecen)*
13:15–18:00	**FIELD TRIP** ***Water Ponding in Hungary: Collection of Ground and Drone Data*** Zoltán Vekerdy *(SZIU, Hungary)*, János Tamás *(Univ. Debrecen)*
19:00–22:00	***Lázár Lovaspark (Bus transport provided): Social Dinner (Hosted)***

FRIDAY 8 September 2017

	Computer Room 111:	***Computer Room 114:***
08:30–09:30	**D5T1a** ***SAR Tomography*** Laurent Ferro-Famil *(Univ. Rennes 1, France)* • SAR tomography basics • Application of PolTomoSAR • Towards spaceborne SAR tomographic missions	**D5T1b** ***Surface Energy Balance and Evapotranspiration*** Bob Su *(Univ. of Twente, Netherlands)* • Principles of advanced thermal remote sensing • Critical processes in surface energy balance (SEBs) • Using SEBS for deriving different flux terms and evapotranspiration • Developing applications of SEBS
09:30–10:15	**D5P1a** ***SAR Tomography using PolSARpro Toolbox*** Laurent Ferro-Famil, Eric Pottier *(Univ. Rennes 1, France)* • SAR tomography forest retrievals using P and L band airborne SAR data	**D5P1b** ***Surface Energy Balance and Evapotranspiration*** Bob Su *(Univ. of Twente, Netherlands)* • EO data in SEBs and estimating surface fluxes and moisture content • Processing in ILWIS and SNAP
Coffee break		
10:45–12:30	**D5P1a** *(continued)*	**D5T2** **River Discharge and Lake Volume using Radar Altimetry and Imaging Sensors** Angelica Tarpanelli *(CNR, Italy)* **<u>Radar altimetry</u>** • Principles and definitions • Missions & Technologies • Data access • Toolboxes (BRAT, GUT, SARvatore) • Applications (sea, ice rivers hydrology) **<u>Optical and multispectral sensors</u>** • Principles and classifications • Missions (MODIS and MERIS) • Technologies for detecting water signal from NIR sensors • Data access **<u>Case Studies</u>** • Dunube, Po and Niger Rivers
Lunch		

FRIDAY 8 September 2017 (continued)

14:00–15:00	**D5T3a** ***Monitoring Vegetation in a Changing Climate*** Grégory Duveiller *(JRC, Italy)* • Measuring vegetation productivity from space • measuring biophysical properties of vegetation • links between remote sensing and climate modelling • biophysical versus biochemical effects of vegetation change • inter comparison of data streams	**D5T3b** ***Observing the Hydrological Cycle over Land using SMOS*** Ahmad Albitar *(CESBIO, France)* • Background to SMOS and SM applications • Processing levels and products • Data access • Tool boxes for visualisation and further processing • Comparison with other EO sensors
15:00–15:45	**D5P3a** ***Monitoring Vegetation in a Changing Climate*** Grégory Duveiller *(JRC, Italy)* • Using R for climate data analysis, • Data visualization with ggplot, • Data wrangling with dplyr, • Manipulating netcdf files, • Comparing datasets in climate space	**D5P3b** ***Observing the Hydrological Cycle over Land using SMOS*** Ahmad Albitar *(CESBIO, France)* • SMOS tools in SNAP • Hungarian Case Study – Regionals drought index using root zone soil moisture
Coffee break		
16:15–17:15	**D5P3a** *(continued)*	**D5T4** ***Long-Term Hydrological Land Monitoring with Active and Passive Microwave Missions*** Wouter Dorigo *(Vienna Univ. of Technology, Austria)* • Multi-mission potential and characteristics of the long-term satellite data records of soil moisture
17:15–18:00		**D5P4** ***Long-Term Hydrological Land Monitoring with Active and Passive Microwave Missions*** Wouter Dorigo *(Vienna Univ. of Technology, Austria)* • On-line tools for display and analysis of long term multi-mission soil moisture for climate change studies

SATURDAY 9 September 2017

	Computer Rooms 111 & 114:
08:30–10:15	**D6P1** ***Water Ponding in Hungary: Analysis of Ground and Drone Data, Sentinel-1/2 Data, Digital Elevation Models and the SNAP Toolbox*** Zoltan Vekerdy *(SZIU, Hungary)* • Excercises with EO and ground data collected during Thursday's field trip
Coffee break	
	Rector's Hall:
10:45–11:15	**D6T1** ***Summary and Conclusions***
11:15–12:00	***Closing Ceremony, Awarding of Diplomas***

List of Lecturers

First name	Surname	Institute	Country	Email
Ahmad	Albitar	CESBIO	France	ahmad.albitar@cesbio.cnes.fr
Zoltan	Bartalis	ESA ESRIN	Italy	zoltan.bartalis@esa.int
Lorenzo	Bruzzone	University of Trento	Italy	lorenzo.bruzzone@ing.unitn.it
Costas	Cartalis	University of Athens	Greece	ckartali@phys.uoa.gr
Wouter	Dorigo	Vienna University of Technology	Austria	wouter.dorigo@geo.tuwien.ac.at
Grégory	Duveiller	Joint Research Centre	Italy	gregory.duveiller@jrc.ec.europa.eu
Laurent	Ferro-Famil	University of Rennes 1	France	laurent.ferro-famil@univ-rennes1.fr
Michael	Foumelis	BRGM	France	mfoumelis@gmail.com
Andy	Hooper	Leeds University	UK	a.hooper@leeds.ac.uk
Daniel	Kristóf	Government Office of the Capital City Budapest	Hungary	kristof.daniel@bfkh.gov.hu
Sebastian	van der Linden	Humboldt-University Berlin	Germany	sebastian.linden@geo.hu-berlin.de
Alessandro	Marin	Solenix c/o ESA ESRIN	Italy	Alessandro.Marin@esa.int
Jose	Moreno	Univeristy of Valencia	Spain	jose.moreno@uv.es
Kostas	Papathanassiou	German Aerospace Center (DLR)	Germany	kostas.papathanassiou@dlr.de
Eric	Pottier	University of Rennes 1	France	eric.pottier@univ-rennes1.fr
Fabrizio	Ramoino	Serco c/o ESA ESRIN	Italy	Fabrizio.Ramoino@esa.int
Ana	Ruescas	Brockmann Consult GmbH	Germany	ana.ruescas@brockmann-consult.de
Bob	Su	University of Twente	Netherlands	z.su@utwente.nl
János	Tamás	University of Debrecen	Hungary	tamas@agr.unideb.hu
Angelica	Tarpanelli	National Research Council (CNR)	Italy	angelica.tarpanelli@irpi.cnr.it
Zoltán	Vekerdy	Szent Istvan University	Hungary	vekerdy.zoltan@mkk.szie.hu
Zoltán	Zboray	Hungarian Space Office	Hungary	zoltan.zboray@nfm.gov.hu
Andy	Zmuda	Serco c/o ESA ESRIN	Italy	andy.zmuda@esa.int