



TRAINING

IV ESA EARSEL CNR SCHOOL: Remote Sensing for Forest Fires

30 September 2019
01 October 2019

Training Room 9007 (Building 9) ESA ESRIN
Largo Galileo Galilei, 1
00044 Frascati (RM), Italy

ORGANIZED
BY



EUROPEAN ASSOCIATION
OF REMOTE SENSING LABORATORIES



TRAINING PROGRAMME

30 September 2019

8.30:9.00_Registration

9.00:9.15_Opening Ceremony Speaker: ESA (Francesco Sarti)
EARSel/CNR (Rosa Lasaponara)

9.15:10.00_Introduction to ESA EO Program and to ESA projects/activities
on Forest Fires.

Speaker: Stephen Plummer (ESA), Francesco Sarti (ESA)

10.00:11.00_An Overview of remote sensing for Forest fire

Speaker: Rosa Lasaponara (CNR-IMAA)

11.00:11.30_Coffee Break

11.30:12.00_Theory: Theory: Self Organized Maps (SOM) for Burned Areas
and Fire Severity. Fire Emissions: Sentinel- based monitoring.
Speaker: Rosa Lasaponara / Maria Danese (CNR)

12.00:13.00_Launch Break

13.00:14.45_Exercise/Demo (TBC): Machine Learning for Burnt Areas and Fire Severity
Speaker: Dimitris Stavrakoudis (Aristotle University of Thessaloniki)

14.45:15.15_Coffee Break

15.15:16.15_Theory: Reminders of SAR basics. Discussion on
challenges of S1 for Fire applications

Speaker: Antonio Pepe (CNR)

16.15:17.15_Exercise: Burned area mapping with S1 (SNAP)

Speaker: Amalia Castro (RSAC c/o ESRIN), Antonio Pepe (CNR)

17.15:17.30_Open Discussion, Questions and Answers

17.30:19.00_Ice Breaker

01 October 2019

9.00:10.30_Theory: Satellite Time Series Analysis. Combined
InSAR/SAR-Amplitude-based approaches for
Change Detection Analyses
Speaker: Antonio Pepe (CNR)

10.30:11.00_Coffee Break

11.00:12.30_Reminders of Theory and Exercise: Burned area
mapping with S2 (SNAP)
Speaker: Miguel Castro Gómez (RUS)

12.30:13.30_Lunch Break

13.30:14.30_Reminders of Theory and Exercise: Active fire mapping
with S3 (SNAP)

Speaker: Tereza Smejkalova (RUS)

14.30:15.30_Reminders of Theory and Exercise: Aerosol monitoring
with Sentinel-5P

Speaker: Georgia Karadimou (RUS)

15.30:15.45_Coffee Break & Feedback collection

15.45:16:45_Exercise: Soil Moisture for Fire Hazard Estimation
(CCI Toolbox, Python)

Speaker: Amalia Castro

16.45:17.30_Exercise: EO Browser Wildfire case study
(S1, S2 and S5-P)

17.30:18.00_Open Discussion & Closing Remarks (all speakers)

17.30:18.00_Closing & Feedback

TEACHERS

FRANCESCO SARTI
ESA - ESRIN



Francesco was born in Rome, Italy.

After his Master Degree in Electrical Engineering at the University of Rome La Sapienza and a first research contract at the CNR, he was hired in 1990 at the Operation Center of the European Space Agency in Germany (ESA/ESOC) in the area of mission analysis and orbit control manoeuvre optimization. He then moved to precise orbit determination and to orbit and attitude control and continued his career at ESA/ESTEC in The Netherlands.

After attending the SSP 1996 of the International Space University in Vienna, he moved to Toulouse, France, in 1997, where he got a Post-graduate Master in Applied Remote Sensing and Image Processing followed by a PhD on the subject of optical-radar remote sensing for the monitoring of surface deformation (University of Toulouse Paul Sabatier). In France, he was first employed by CESBIO (1998) and later by the French Space Agency, CNES (1999-2001), working as a Project Manager for the International Charter on Space and Major Disasters, conducting R&D activities for remote sensing applications to disaster management and natural risk monitoring, interferometric monitoring of several seismic areas and providing training courses in Earth Observation.

ROSA LASAPONARA
IMAA - CNR



Rosa Lasaponara PhD, is Research Director at National Council Research of Italy, where she leads the Remote Sensing Laboratory for forest fire (since 2008) and the ARGON research group (since 2002). In the 2017 she founded the Digital Belt and Road International Centre of Excellence (ICoE Potenza) and currently leads the Sino-Italian (CNR - CAS-) research group.

She is adjunct professor of Microwave Teaching at the university of Basilicata, and member of the scientific committee of the PhD "Cities Landscapes: Architecture, Archaeology, Cultural Heritage, History".

She has more than 25 years of experience in the field Earth Observation from satellite/airborne/ground based on passive (optical, multi-hyperspectral data) and active (radar, lidar) sensors. Her main research interests are focused on modelling, data processing, integration, and interpretation of big Earth Observation for natural/anthropogenic risk estimation and mitigation, with particular reference to fire monitoring, environmental, palaeo-environmental investigations and archaeological studies.

Authored or co-author of more than 350 peer-reviewed papers (120 in JRC journals, book etc), editor of NHSS, academic Editor of RS and guest editor for several international journals Remote Sensing, IJRS, JAG, Ecological Modeling, Journal of Archaeological science, Archaeological Prospection, Journal of Cultural Heritage

She has been and currently is the scientific coordinator of several research projects at national and international level, funded by the EU, ASI, CNR, ESA, DPC, currently the LPI of SER FOR FIRE ERA4CS EU project Integrated services and approaches for Assessing effects of climate change and extreme events for fire and post fire risk prevention http://www.jpi-climate.eu/nl/25223459-SERV_FORFIRE.html.

TEACHERS



MARIA DANESE
CNR-IMAA

Maria Danese is Researcher at the CNR-IBAM (Potenza) with experience in Geographic Information Science applied to different kind of cultural heritage (from archaeological to artistic heritage) and landscape (PhD in Science and Methods for the European Cities and Territories). Some of her research interests focus on: 1) management, conservation and increase in value of the heritage through GIS and webGIS; 2) development of archaeological predictive models and spatial models to support the interpretation of geophysical data. She has co-authored around 100 publications.

Self-Organizing Maps (SOM) for burnt severity extraction.

The lesson turns around the SOM methodology used to extract in an automatic way the burnt-severity classed in a fire. After a brief theoretical introduction of the SOM a tutorial, with the practical case study of the Chania fire will be conducted. The software used is the Adienko's V-Analytics.



AMALIA CASTRO GOMEZ
ESA-ESRIN

Amalia is a Remote Sensing Project Scientist currently working the European Space Research Institute of the European Space Agency (ESA/ESRIN). Her role supports the Earth Observation educational activities within the Science, Applications and Climate Department of the ESA Earth Observation Programmes Directorate.

Previously she worked as a Remote Sensing Analyst for Airbus in the UK. She holds a bachelor in Environmental Sciences by the Autonomous University of Madrid, Spain, and a master in Geo-Information Sciences by the Wageningen University, The Netherlands.

TEACHERS

GEORGIA KARADIMOU SERC0 ITALIA



Earth Observation Promotion Specialist, SERCO ITALIA SpA, RUS Copernicus - Research and User Support for Sentinel Core Products, Frascati, Italy.

Training Tasks: Generation and teaching of training material for the RUS Webinars and Face to Face events organized by SERCO about Earth Observation applications in various fields, handling Webinars and training events, support planning, setting managing and aiding during training events, managing follow-up and reporting activities.

Outreach Tasks: Support the preparation and production of Earth Observation training and promotional material, support the dissemination of the material in various formats and via various communication channels, raise awareness of Earth Observation products, tools and services amongst different user communities.

Supporting users working with RUS Service for Sentinel products and software.

Active Fire Detection - Portugal

Open vegetation fires are critical elements acting as a driving force by modifying land cover, consuming terrestrial vegetation and reducing ecosystem services. Such fire activity acts across all vegetated areas but is usually very dynamic in its magnitude, impact and specific location. Due to this, frequent satellite Earth Observation data are a key tool to assess large-scale quantification of biomass burning and its effects.

In order to demonstrate the methodology to detect active fires with the SLSTR instrument onboard Sentinel-3, we will employ Sentinel-3 data and the ESA SNAP software, using the Sentinel-3 Toolbox.

In the afternoon of 17 June 2017, a series of four initial deadly wildfires erupted across central Portugal within minutes of each other. During the night of 17–18 June, 156 fires erupted across the country, particularly in mountainous areas 200 km north-northe-

MIGUEL CASTRO SERC0 ITALIA



Miguel Castro graduated from Environmental Science at the Autonomous University of Madrid. He continued his education with a joint MSc program in Earth Observation and GIS at the ITC Faculty, University of Twente (The Netherlands) and Lund University (Sweden). Since then, he has been working as a remote sensing specialist for Serco Italia S.p.A. within the RUS Copernicus project, delivering EO trainings on the use of Copernicus data for a wide variety of applications and providing support in data processing to Copernicus users.

Lesson:

Aerosol Monitoring with Sentinel-5P Exercise description

During this exercise, you will be introduced to Sentinel-5p data and learn how to process the data using the BEAT software. We will demonstrate how using basic analysis, Sentinel-5p data can be used to monitor fire events at regional scale during the Camp Fire which took place in California in November 2018.

Pollutants enter the air from a range of sources such as forest fires, although they are mainly a result of motor vehicle and industrial combustion processes. Governments and decision-makers rely heavily on satellite data and computer models to show how pollution accumulates and how it is carried in the air so that they can develop appropriate mitigation strategies.

TEACHERS



DIMITRIS STAVRAKOUDIS
Aristotle University of Thessaloniki

Dr. Dimitris Stavrakoudis received the BSc and MSc degrees in 2005 from the Department of Electrical and Computer Engineering of the Aristotle University of Thessaloniki (AUTH), Greece and the PhD degree from the same department in 2013. Since 2014, he has been a member of the Laboratory of Forest Management and Remote Sensing of AUTH, where he has been involved as affiliated researcher at various EU funded and national funded projects. His research focuses on remote sensing and GIS applications in environmental monitoring, with emphasis on forest fire management and land cover/land use mapping. He has authored or co-authored more than 45 publications in peer-reviewed journals and proceedings of international conferences.

Title: Theory: Algorithm for automated burned area mapping with high-resolution data

Short description: An automated burned area mapping algorithm will be presented, which uses Sentinel-2 images and advanced image processing techniques. The session will describe the theoretical basis of the algorithm, as well as the technical detail of each processing step. Examples of applications will be presented and the algorithm's limitations will be discussed.

Title: Exercise: Burned area mapping in QGIS using Sentinel-2

Short description: The exercise will investigate different approaches for mapping burned areas using Sentinel-2 imagery on the free and open source Geographic Information System (GIS) platform QGIS and the Python programming language. Test cases from wildfires in a Mediterranean ecosystem will be considered, using Sentinel-2 images acquired before and after the fire. Different approaches for performing the mapping will be tested: a) empirical thresholds on spectral indices and their difference, b) supervised classification approaches using manually labeled training samples, c) object-based analysis, and d) region growing algorithms.



TEREZA ŠMEJKALOVÁ
SERCO ITALIA

Remote sensing specialist for RUS Copernicus (Research and User Support for Sentinel core products):

EC funded, and ESA managed service designed to increase the uptake of Copernicus Sentinel data by providing free ICT resources and EO expertise.

Role: Expert support for Sentinel1 processing and applications; development and delivery of training materials on Sentinel 1, Sentinel 2 & Sentinel 3 data applications within RUS environment (Linux, ESA SNAP, SAR/optical data processing)

Burned area mapping with S2 Exercise description:

Vegetation burning is a global-scale process that affects the distribution and structure of vegetation, major biogeochemical cycles, and the climate system. As an ecological factor, vegetation fires contribute to maintaining ecosystem dynamics, productivity and biodiversity. It is also extensively used as a land management tool; however, wildfires present a great risk that affects millions of hectares of forests and other vegetation and endangers lives and property, causing substantial economic losses.

In order to be able to assess the scale of the damage inflicted by wildfires we use optical remote sensing to detect and map burn scars and estimate burn severity. In this exercise we will employ Sentinel-2 data and Scientific Toolbox Exploitation Platform (SNAP) to assess the area burned between June and November 2017 in a mountainous region approx. 200 km (120 mi) north-northeast of Lisbon.

TEACHERS

ANTONIO PEPE
IREA - CNR



Antonio Pepe received the Laurea in Electronic Engineering and the Ph.D. degree in Electronic and Telecommunication Engineering from the University of Napoli Federico II, Napoli, Italy, in 2000 and 2007, respectively. In 2001 he joined the IREA-CNR where he is a permanent researcher. He was a Visiting Scientist at the University of Texas, Austin, in 2005, at the Jet Propulsion Laboratory (JPL), Caltech, Pasadena in 2009, and at the East China Normal University, Shanghai from 2014 to 2016 (one monthly visit per year). Dr. Pepe acts as a reviewer for several peer-reviewed international journals. From 2012 to 2016 he was also an Adjunct Professor of Signal Theory at the Università della Basilicata, Potenza, Italy. He was the recipient of the 2014 Best Reviewer mention of the IEEE Geoscience and Remote Sensing Letters. His main research interests include the development of advanced DInSAR algorithms aimed at monitoring surface deformation phenomena induced by subsidence, volcano activities, and earthquakes, with a particular interest toward the phase unwrapping problems. More recently, he has developed research activities for the generation of DInSAR products through the new generation SAR instruments, for the generation of hybrid scanSAR-to-stripmap DInSAR analyses, and for the integration of SAR and optical images.

Lesson:

- Introduction to Synthetic Aperture Radar Images Formation and Properties.
- SAR Image Modes (Stripmap, SpotLight, ScanSAR, TOPSAR)
- Geometric and Statistical Characteristics of SAR signals.
- Basics on Multilook and Noise Filtering Operations.
- SAR Processing Chain: SAR Calibration and Sigma Nought Maps Extraction, Co-registration of the SAR images and multi-temporal SAR data processing.
- Short Introduction to interferometry and Change Detection Analyses.
- Fire Scars Detection and Monitoring: Recent Literature and Examples.
- Combination of SAR and optical datasets.



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