

# → 4th ADVANCED COURSE ON RADAR POLARIMETRY

30 January – 2 February 2017 | ESA-ESRIN | Frascati (Rome), Italy



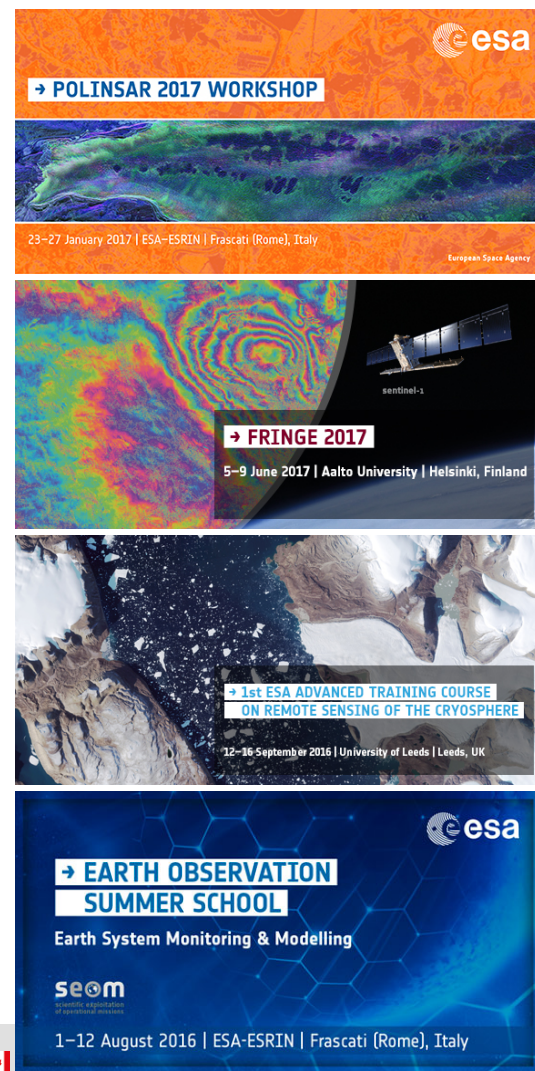
## Course Context

### ESA ADVANCED TRAINING COURSES

- Action of **SEOM** (Scientific Exploitation of Operational Missions) element of EOEP-4 (Earth Observation Envelope Programme)

### SEOM Action Lines:

- **RESEARCH and DEVELOPMENT STUDIES**  
Stimulate research and exploitation of operational missions.
- **SCIENTIFIC TOOLBOXES DEVELOPMENT**  
Provide OS tools to the scientific community.
- **USERS' CONSULTATIONS**  
Organise thematic workshops for scientific consultation and user feedback.
- **TRAINING NEXT GENERATION SCIENTISTS**  
Foster emergence of next generation EO scientists through thematic training.
- **PROMOTING SCIENCE DATA USE AND RESULTS**  
Promote widespread scientific use of European data and publicise results.



<http://seom.esa.int>

# seom

scientific exploitation of operational missions

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**ESA EO**

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COPERNICUS

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+ POLINSAR 2017 WORKSHOP

23–27 January 2017 | ESA–ESRIN | Frascati (Rome), Italy

European Space Agency

FRINGE 2017

Polinsar 2017

Pollarmetry Course 2017

ESA EO summer school

EO OPEN SCIENCE

UPO 2016

Augmented Reality App

Wallois EO Open Science 2.0 videos

Archive

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### SEOM STUDIES RESULTS

<p>Chile earthquake on the Radar</p> <p style="font-size: 0.7em;">C/NASA/JAP study PPO-Jalisco/NetUF</p>	<p>S1 Toolbox Mosaic of Bafina</p> <p style="font-size: 0.7em;">C/Copernicus Data/ESA (2015)</p>	<p>Ocean Virtual Laboratory</p> <p style="font-size: 0.7em;">C/Germany/Gooslab</p>
<p>Launch of EO Open Science 2.0</p>	<p>SENTINEL-2 for Science Workshop</p> <p style="font-size: 0.7em;">Image by Agence</p>	<p>Shaping next-generation</p>

The SEOM (Scientific Exploitation of Operational Missions) element:

The prime objective of the SEOM element of the Earth Observation Envelope Program 4 is to federate, support and expand the large international research community that the ERS, ENVISAT and the Envelope programmes have built up over the last 20 years. It aims to further strengthen the international leadership of European Earth Observation research community by enabling them to extensively exploit observations from future European operational EO missions. SEOM will enable the science community to address many new avenues of scientific research that will be opened by free and open access to data from operational EO missions.

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scientific exploitation of operational missions



POLARIMETRY COURSE 2017 SEOM ESA

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#### PROGRAMME

### 4th ESA Advanced Course on Radar Polarimetry

#### APPLICATION

30 January - 2 February 2017, ESA ESRIN, Frascati (Rome), Italy

#### IMPORTANT DATES

#### LINKS

#### ORGANISING COMMITTEE

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### + 4th ADVANCED COURSE ON RADAR POLARIMETRY

30 January - 2 February 2017 | ESA ESRIN | Frascati (Rome), Italy

### Background

As part of the Scientific Exploitation of Operational Missions (SEOM) programme element, the European Space Agency (ESA) is organising the 4th Advanced Course on Radar Polarimetry devoted to train the next generation of Earth Observation (EO) scientists to exploit dual and fully polarimetric data for science and applications development.

Post graduate, PhD students, post-doctoral research scientists and users from European countries and Canada interested in Radar Polarimetry and its applications are invited to apply to the 4 day course on the subject, which will be held in ESA ESRIN, Frascati, Italy from 30 January to 2 February 2017.

Research scientists and students from all other countries are also welcome to apply and participate to the course subject to space availability.

No participation fees will be charged for the training but participants are expected to cover their own travel and accommodation expenses (financial support is not available).

The official language of the training course is English.

### Objectives

The main objectives of the course are to:

- Train the next generation of European and Canadian Principal Investigators (PIs);
- Explain theoretical principles, processing algorithms, data products and their use in applications;
- Introduce available tools and methods for the exploitation of dual polarization and fully polarimetric data;
- Provide first-hand and up-to-date information on the state of the art in Radar Polarimetry and Polarimetric SAR Interferometry.





→ 4th ADVANCED COURSE ON RADAR POLARIMETRY



## → 4th ADVANCED COURSE ON RADAR POLARIMETRY



30 January – 2 February 2017 | ESA-ESRIN | Frascati (Rome), Italy

4<sup>th</sup> in the series of Advanced Courses on Radar Polarimetry: 2015, 2013, 2011.  
Always held at ESA/ESRIN in Frascati

## Training Team: theory and practical

- Prof Eric Pottier, **University of Rennes, France**
- Prof Laurent Ferro-Famil, **University of Rennes, France**
- Prof Stefano Tebaldini, **Politecnico di Milano (POLIMI), Italy**
- Prof Irena Hajnsek, **German Aerospace Center (DLR), Germany**
- Mr Chris Stewart, RSAC c/o **European Space Agency (ESA), Italy**
- Dr Michael Foumelis, RSAC c/o **European Space Agency (ESA), Italy**

## Training Team: mission presentations

- Prof Irena Hajnsek, **German Aerospace Center (DLR), Germany**
- Dr Francesco Caltagirone, **Italian Space Agency (ASI), Italy**
- Dr Klaus Scipal, **European Space Agency (ESA), Netherlands**
- Dr Malcolm Davidson, **European Space Agency (ESA), Netherlands**
- Dr Pierre Potin, **European Space Agency (ESA), Italy**

## Organising Committee

- Yves-Louis Desnos (ESA)
- Chris Stewart (RSAC c/o ESA)
- Sabrina Lodadio (Serco c/o ESA)
- Giulia Vinicola (NIKAL FM c/o ESA)

## 52 Selected Participants



<b>Female</b>	<b>27</b>
<b>Male</b>	<b>25</b>

- PhD students
- Post-Doc researchers
- Bachelor's and Master's students
- Industry, service community



	Mon 30 Jan	Tue 31 Jan	Wed 1 Feb	Thu 2 Feb
09:00-09:15	Registration	COSMO-SkyMed Second Generation <i>Francesco Caltagirone (ASI, Italy)</i>	TanDEM-X and TanDEM-L <i>Irena Hajnsek (DLR, Germany)</i>	Sentinel-1 <i>Pierre Potin (ESA/ESRIN, Italy)</i>
09:15-09:30	Welcome from ESA <i>Yves-Louis Desnos (ESA/ESRIN, Italy)</i>			
09:30-10:00	BIOMASS <i>Klaus Scipal (ESA/ESTEC, Netherlands)</i>	PolSAR theory <i>Eric Pottier (University of Rennes, France)</i>	Pol-InSAR theory <i>Irena Hajnsek (DLR, Germany)</i>	Pol-TomoSAR theory <i>Laurent Ferro-Famil (University of Rennes, France) and Stefano Tebaldini (POLIMI, Italy)</i>
10:00-11:30	PolSAR theory <i>Eric Pottier (University of Rennes, France)</i>			
11:30-11:45	Coffee Break			
11:45-13:00	PolSAR theory <i>Eric Pottier (University of Rennes, France)</i>	PolSAR theory <i>Eric Pottier (University of Rennes, France)</i>	Pol-InSAR theory <i>Irena Hajnsek (DLR, Germany)</i>	Pol-TomoSAR theory <i>Laurent Ferro-Famil (University of Rennes, France) and Stefano Tebaldini (POLIMI, Italy)</i>
13:00-14:00	Lunch			
14:00-15:15	Practical with ESA OS toolboxes <i>Eric Pottier (University of Rennes, France), Chris Stewart and Michael Foumelis (RSAC c/o ESA/ESRIN, Italy)</i>	Practical with ESA OS toolboxes <i>Eric Pottier (University of Rennes, France), Chris Stewart and Michael Foumelis (RSAC c/o ESA/ESRIN, Italy)</i>	Pol-InSAR practical <i>Irena Hajnsek (DLR, Germany)</i>	Pol-TomoSAR practical <i>Laurent Ferro-Famil (University of Rennes, France) and Stefano Tebaldini (POLIMI, Italy)</i>
15:15-15:30	Coffee Break			
15:30-16:00	Practical with ESA OS toolboxes <i>Eric Pottier (University of Rennes, France), Chris Stewart and Michael Foumelis (RSAC c/o ESA/ESRIN, Italy)</i>	SAOCOM-CS and airborne campaigns <i>Malcolm Davidson (ESA/ESTEC, Netherlands)</i>	Pol-InSAR practical <i>Irena Hajnsek (DLR, Germany)</i>	Pol-TomoSAR practical <i>Laurent Ferro-Famil (University of Rennes, France) and Stefano Tebaldini (POLIMI, Italy)</i>
16:00-16:30		Practical with ESA OS toolboxes <i>Chris Stewart and Michael Foumelis (RSAC c/o ESA/ESRIN, Italy)</i>		
16:30-17:00		Closure		

<b>Colour code</b>			
	Mission presentation	Theory	Practical

# RAJO

4th Polarimetry Advanced Course

**31 JAN 2017**

15€ p.p.

Bruschetta, Pizza and Drink





# Course Material

Training material will be available online through the course website, including:

- Presentations
- Exercises
- Data

POLARIMETRY COURSE 2017 SEOM ESA

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## 4th ESA Advanced Course on Radar Polarimetry

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### → 4th ADVANCED COURSE ON RADAR POLARIMETRY

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## Background

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<http://seom.esa.int/polarimetrycourse2017/>

Users from European countries are invited to apply to the course, which will take place in Frascati, Italy from 30

Welcome to apply and

No participation fees will be charged for the training but participants are expected to cover their own travel and accommodation expenses (financial support is not available).

The official language of the training course is English.

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→ LAND TRAINING COURSE 2015

14-18 September | University of Agronomic Science and Veterinary Medicine Bucharest

Bucharest, Romania

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SEOM STUDIES RESULTS

Chile earthquake on the Radar

S1 Toolbox Mosaic of Estonia

Ocean Virtual Laboratory

Launch of EO Open Science 2.0

SENTINEL-2 for Science Workshop

Shaping next-generation scientists

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FRINGE 2017

Polaris 2017

Polarimetry Course 2017

ESA EO summer school

EO OPEN SCIENCE

UPS 2016

Augmented Reality App

Wallois EO Open Science 2.0 videos

<http://seom.esa.int>



SEOM > Toolbox

S1 Toolbox

ESA is developing, under the SEOM program element, new free open source toolboxes for the scientific exploitation of the Sentinels missions:

S2 Toolbox

The **Sentinel-1**, **Sentinel-2** and **Sentinel-3 toolboxes** are based on a common architecture called the Sentinel Application Platform (SNAP) and are being developed in a coordinated joint venture of several industrial partners and scientists. The first public release of the toolboxes, under GNU GPL open source license, was in September 2014.

S3 Toolbox

The **Sentinel 5P toolbox** is a collection of executable tools and an application programming interface (API) which has been developed to facilitate the utilisation, viewing and processing of ESA and Third Party atmospheric data products. The first public release of the software is available from November 2014 under a GNU GPL open source license.

S5P Toolbox

PolSARpro

The **Polarimetric SAR Data Processing and Educational Tool (PolSAR pro)** aims to facilitate the accessibility and exploitation of multi-polarised SAR datasets including those from ESA (Envisat ASAR Alternating Polarisation mode products and Sentinel-1 dual pol) and Third Party Missions (ALOS-1 PALSAR, ALOS-2 PALSAR, COSMO-SkyMed, RADARSAT-2, RISAT, TerraSAR-X and Tandem-X).

BRAT

The **Broadview Radar Altimetry Toolbox (BRAT)** is a collection of tools and documents designed to facilitate the use of radar altimetry data, in particular the novel SAR-mode Altimetry on CryoSat, Sentinel-3 and Sentinel-6. It can read most distributed radar altimetry data and performs processing and data editing, extraction of statistics, and visualisation of results. BRAT is an open source software with a LGPL-3 license type. Its source code is publicly available on-line in a dedicated GitHub repository.



## PolSARpro Version 5.0

The Polarimetric SAR Data Processing and Educational Tool aims to facilitate the accessibility and exploitation of multi-polarised SAR datasets including those from ESA (Envisat ASAR Alternating Polarisation mode products and Sentinel-1) and Third Party Missions (ALOS-1 PALSAR, ALOS-2 PALSAR, COSMO-SkyMed, RADARSAT-2, RISAT, TerraSAR-X and Tandem-X).

A wide-range of tutorials and comprehensive documentation provide a grounding in polarimetry and polarimetric interferometry necessary to stimulate research and development of scientific applications that utilise such techniques; the toolbox of processing functions offers users the capability to implement them.

PolSARpro is developed under contract with ESA since 2003 where the initiative was a direct result of recommendations made during the first PolInSAR Workshop held at ESRIN in 2003. The [IETR \(Institute of Electronics and Telecommunications of Rennes - UMR CNRS 6164\)](#) of the [University of Rennes 1](#), France is in charge of the development of the PolSARpro software.

All elements of the PolSARpro project are distributed by ESA free of charge, including the source code.

This website provides details of the project, giving users access to the tutorial material and software as well as information about sources of multi-polarised datasets.

## Latest News

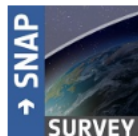
- [New PolSARpro version 5.0.4 released](#)
- [PolSARpro version 5.0.3 released](#)
- [PolSARpro version 4.2 released](#)
- [PolSARpro version 4.1.5 released](#)
- [PolSARpro version 4.0 Beta 1.3 released](#)

## Useful Links

- [Home](#)
- [Data Sources](#)
- [Overview](#)
- [Download PolSARpro 5.0](#)
- [Release Notes](#)
- [Polarimetry Tutorial](#)
- [Technical Documentation](#)
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- SNAP
- Sentinel 1 Toolbox
- Sentinel 2 Toolbox
- Sentinel-3 Toolbox
- SMOS Toolbox
- Download
- Community
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[Home](#) > Scientific Toolbox Exploitation Platform



ESA is developing **free open source toolboxes** for the scientific exploitation of **Earth Observation missions** under the the Scientific Exploitation of Operational Missions (SEOM) programme element. **STEP** is the ESA **community platform** for accessing the software and its documentation, communicating with the developers, dialoguing within the science community, promoting results and achievements as well as providing tutorials and material for training scientists using the Toolboxes.

The ESA toolboxes support the **scientific exploitation** for the **ERS-ENVISAT** missions, the **and Third Party** missions. The three 3 Toolboxes and share a common nalities of historical toolboxes such as er the last years.

<http://step.esa.int/main/>



SNAP Features



Download



Tutorials



Community



Documentation



Developers



Gallery



Blog

The following results have been obtained thanks to the Sentinel Toolboxes :

Search...

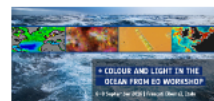
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2017



ESA POLiNSAR 2017 Workshop

2016



Colour and Light in the Ocean from  
Earth Observation



Earth Observation Open Science  
2016 Conference

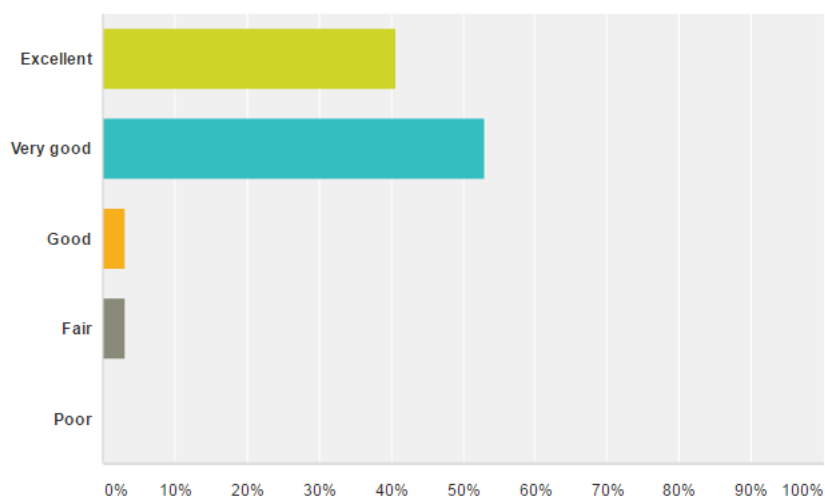


ESA EO summer school on "Earth  
System Monitoring & Modelling"

# Online Course Evaluation

## How would you rate the course?

Answered: 32 Skipped: 0



Answer Choices	Responses
Excellent	40.63% 13
Very good	53.13% 17
Good	3.13% 1
Fair	3.13% 1
Poor	0.00% 0
Total	32

Many thanks for your feedback!

In general, good feedback, many new users of ESA software and European data.

Main points to improve include:

- **Maths heavy**, insufficient time to take in all information
- **More time needed for practical sessions**
- **Acoustics** in Big Hall
- Despite the full programme, if more time had been available, **additional topics** could include:
  - **Marine** applications
  - **Terrain motion**



**We look forward to seeing  
you again!**