



INSARAP Workshop

SEOM program element

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European Space Agency ESRIN/ESTEC/HARWELL

SEOM objectives:

- Federate, support and expand the research community
- Strengthen the leadership of European EO research community
- Enable the science community to address new scientific research

Please visit SEOM.ESA.INT

The screenshot displays the SEOM website interface. At the top, the SEOM logo and 'scientific exploitation of operational missions' are visible. A navigation menu includes links for ESA, SEOM, OBJECTIVES, ACTION LINES, CONFERENCES, NEWS, TOOLBOX, and TRAININGS. The main content area features a large banner for the 'FRINGE 2015 WORKSHOP' with the subtitle 'Advances in the Science and Applications of SAR Interferometry and Sentinel-1 InSAR Workshop', dated 23-27 March 2015 in Frascati, Italy. Below this, a section titled 'SENTINEL-1 INTERFEROMETRY SEOM STUDIES RESULTS' shows a map of Norway with interferogram fringes. A grid of smaller images highlights various studies and events, including '7th Summer School', 'SENTINEL-2 for Science Workshop', 'ESA trains tomorrow's earth observation scientists', '7th Summer School', 'SENTINEL-2 for Science Workshop', 'ESA trains tomorrow's earth observation scientists', '8th Coastal Altimetry Workshop', and '5th Advanced Training Course on Land Remote Sensing 2014'. A sidebar on the right contains additional workshop and training course information.

Science Users Consultations

Organising a series of regular international **thematic workshops** for science users consultation and gathering users feedback

Scientific Toolboxes Development

Developing, validating and maintaining open-source, multi-mission, **scientific software toolboxes**

Research & Development Studies

Launching state-of-the-art **R&D studies** for scientific exploitation of operational missions

Training Next Generation of EO Scientists

Offering a multi-year programme of advanced international **training courses**, summer schools and educational materials

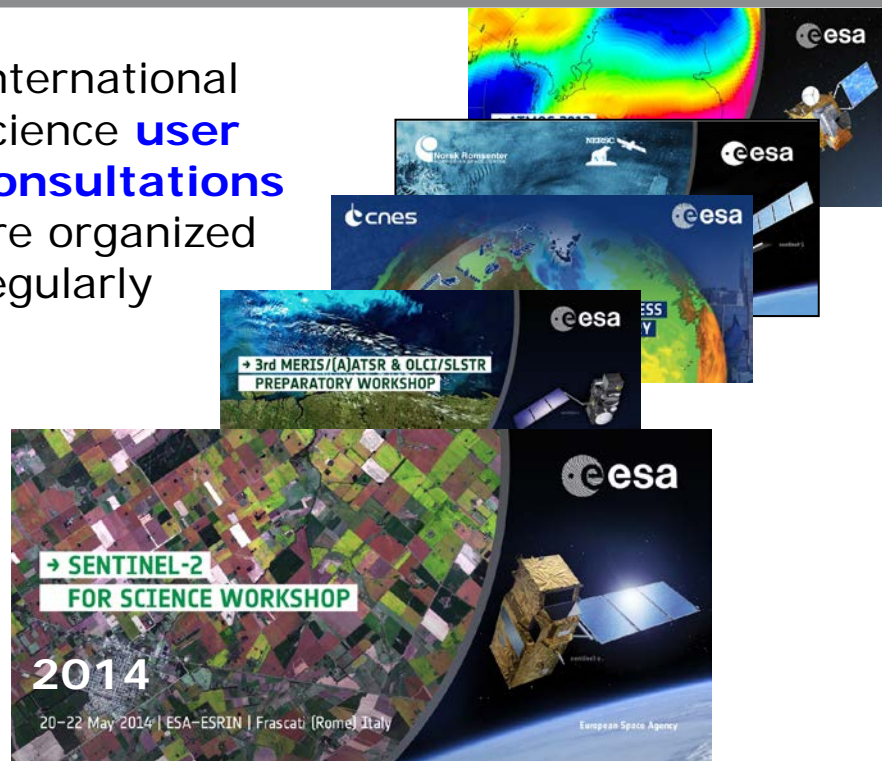
Promoting Science Data Use and Results

Promoting scientific use of data and ensuring a responsive ESA channel for regular, timely, high-quality **scientific publications**

- ◆ **POLINSAR & 1st BIOMASS WS** - ESRIN 26-30 Jan 2015
<http://seom.esa.int/polinsar-biomass2015/>
- ◆ **9th FRINGE WS** - ESRIN 23-27 Mar 2015
<http://seom.esa.int/fringe2015/>
- ◆ **Atmospheric Science** – Sentinel 5P (Univ. of Crete, Greece 8-12 June 2015)
- ◆ **EO science 2.0 conference** (ESRIN 12-14 October 2015)
- ◆ **S3-Science WS** – VENICE , ITALY 2-5 June 2015
<http://seom.esa.int/S3forScience2015/>
- ◆ **SEASAR** – ESRIN 25-29 January 2016



International science **user consultations** are organized regularly



Reporting at next WS



Science User recommendations are gathered



SEOM work plan approved at **PB-EO**

ITTs & Contracts are being placed

R&D-New Methods
Scientific Toolboxes
Trainings
Workshops Results

Title	Subjet/ Status	Cost (K€)	Team
S1-ToolBox	Multi-mission SAR TBX Kick-off Feb 2014 1st Release Sep 2014	530	ARRAY (CAN) DLR (D), Brockmann Consult (D) OceanDataLab (F)
S2-ToolBox	Multi-mission high-resolution multi-spectral TBX Kick-off Jan 2014 1st Release Sep 2014	550	CS Systemes d'Information (F) CS (RO) , Brockmann Consult (D) Telespazio Vega Germany (D), INRA (F), UCL (B)
S3-ToolBox	Multi-mission multi-spectral TBX Kick-off Feb 2014 1st Release Sep 2014	530	Brockmann Consult (D) CS (F), ACRI (F), Array (CAN), Univ. Reading (UK)
S5P-ToolBox	Atmospheric TBX for the S-5P Mission 1st Release Nov 2014	250	S&T (NL)
Polsarpro Toolbox	SAR Full Polarimetry TBX new functionalities V5.0 Next Release January 2015	163	SATIM Monitoring Satelitarny (POL) & University of Rennes (FR)
S3-ALT – Toolbox	Scientific exploitation of SAR altimetry ITT issued Q3 2014	300	In preparation Kick Off January 2015
	Total	2.323 M€	

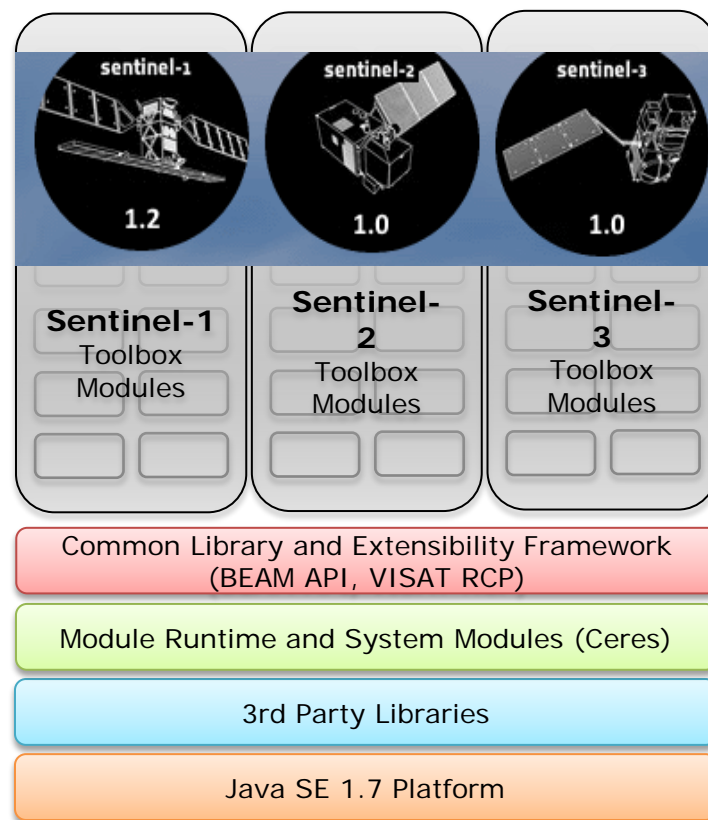
Sentinel1/2/3 Toolboxes

- Scientific Toolboxes facilitating the exploitation of Sentinel 1/2/3 data
- Developed as open source software
- The S1/S2/S3 toolboxes share a common architecture and are multi-missions
- Support ERS/ENVISAT and 3rd Party SAR & VIS/NIR/TIR imaging sensors
- Based on evolution of the ENVISAT-TPM toolboxes (BEAM/NEST/ORFEO)
- Sentinel toolboxes are specified to be portable to a Cloud infrastructure
- Three toolboxes developed in coordination by ESA with regular developer forums

Available at <https://sentinel.esa.int/>

Slide 7

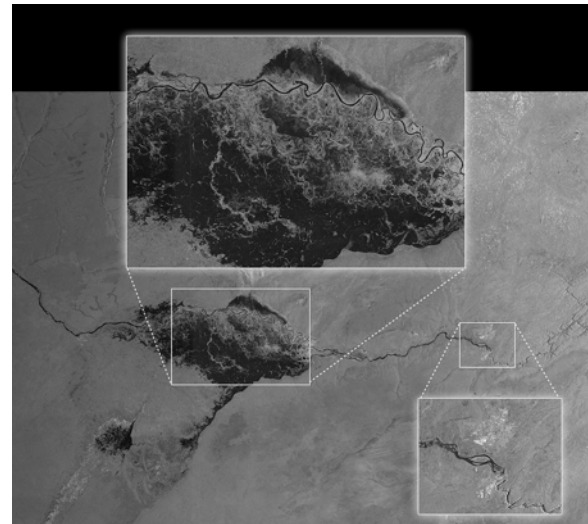
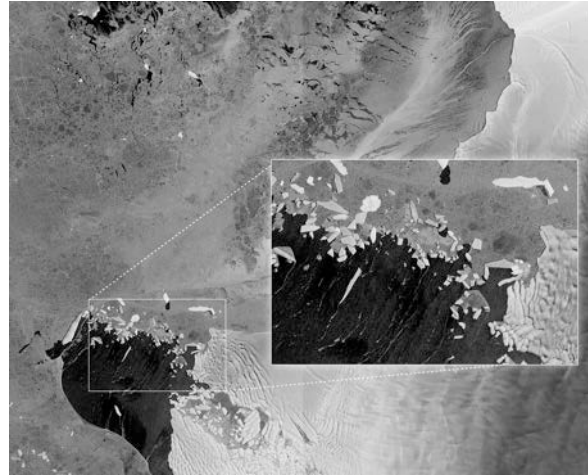
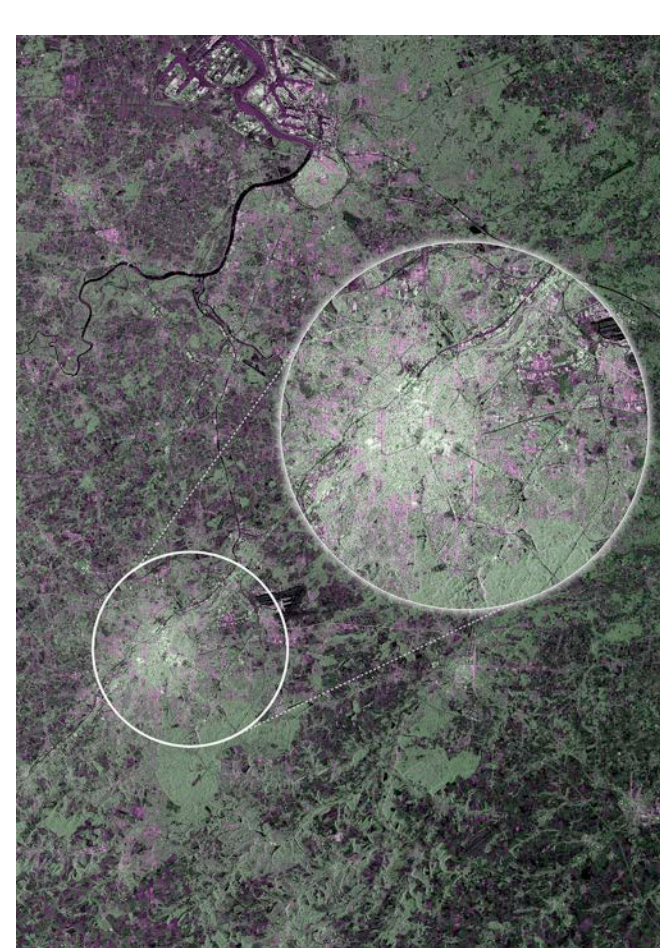
ESA UNCLASSIFIED – For Official Use



S1TBX: Array Systems Computing (CAN)
S2TBX: CS sytemes d'information (F)
S3TBX: Brockmann Consult (D)

Sentinel-1A First images

Post-Processing with S1TBX



Title	Subject	Cost (K€)	Team
S1-INSARAP	SENTINEL-1 INSAR Performance study using TOPS data	250	DLR (D) ; GFZ (D) e- GEOS (I), INGV (I)
	Two contracts kicked off in Mar 2014	250	NORUT (NO) ; University of Leeds (UK), PPO Labs (NL), Polish Geological Institute (PO), Geological Survey of Norway (NO)
S5P ISAS	Improved Atmospheric Spectroscopy Data-Bases (IAS) for S5-P Kick-off Jan 2014 1 st PM June , Paris	530	DLR (D) , Karlsruhe Institute of Technology (D),URCA - Université de Reims (F),LIPhy - Laboratoire interdisciplinaire de Physique (F), SERCO (I)
S3-CAWA	Advanced C louds, A erosols and W ater vapour products for Sentinel-3/OLCI Kick-off in July 2014, Berlin	350	SpectralEarth (D) , Brockmann Consult (D),Université de Lille (F), Catalysts (A)
EDUCEO	Pilot Projects Education for EO using Citizen science approach Kick-off in June and May 2014 respectively	150	Geodan Holding b.v. (NL) ,IIASA (A), Terranea UG (D), Sterrewacht Leiden (NL), KNMI (NL), ASTRIUM Ltd (GB)
		150	VTT (FI) , Pajat Solutions (FIN), PLAN Finland (FIN)
	Total	1.68 M€	

Sentinel-1A Napa Valley Earthquake

INSARAP (NORUT-PPO.labs-Univ. Leeds-COMET)



Sentinel-1 maps earthquake

The biggest earthquake in 25 years struck California's Napa Valley in the early hours of 24 August 2014. By processing two Sentinel-1A images, acquired on 7 August and 31 August 2014 an interferogram was generated. Deformation on the ground causes phase changes in radar signals that appear as the rainbow-coloured patterns around the Napa Valley. Each colour cycle corresponds to a deformation of 28 mm deformation. The maximum deformation is more than 10 cm, and an area of about 30x30 km was affected significantly.

Copyright: Copernicus data (2014)/ESA/PPO.labs/Norut/COMET-SEOM Insarap study

VTT, Pajat Solutions, Plan Finland



**Pilot Project: Forest Biomass
Analysis**



PHOTO: UNICEF, JEOFFREY MAITERM

**Pilot Project: Emergency Data
Management**

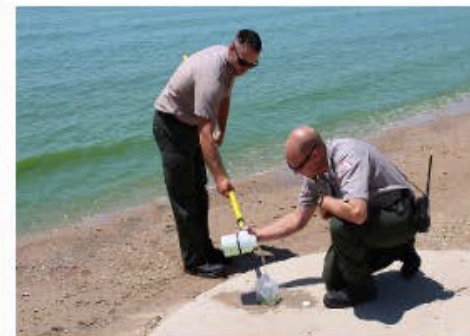


PHOTO: MARVIN G. BOYER

**Pilot Project: Water Quality
Monitoring**

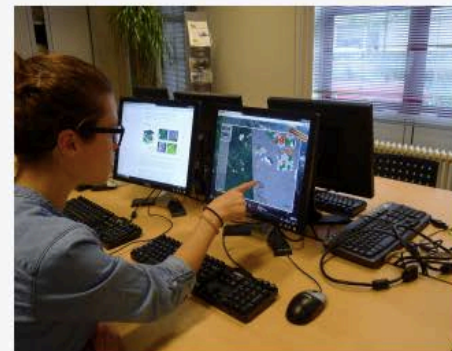
Geodan, IIASA, Astrium, KNMI, Leiden Uni, Terrenea



PILOT 1: AGRICULTURE



PILOT 2: LAND COVER



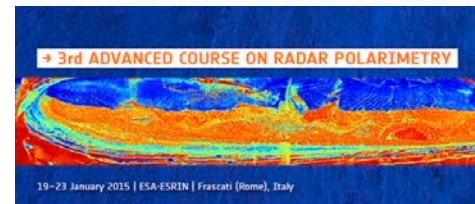
PILOT 3: FOREST MONITORING

Title	Subject	Cost (K€)	Team
SY-4SCI Synergy	S1-S2 Land cover & agricultural mapping products The project was successfully kicked off on October 23 rd 2014.	250	CLS/Altamira(F), CNR IRPI(IT), EURAC(IT).
SY-4SCI Synergy	S2-S3 New type of Vegetation products The project successfully kicked off on 28 November 2014.	250	Assimila Ltd (UK), UCL (Uk), ITC Uni Twente (NL)
SY-4SCI Synergy	S5P-S3 Phytoplankton Functional Types (PFTs) The study has been kicked off on the 1st December 2014.	250	Alfred Wegener Institute (AWI) Helmholtz Centre for Polar and Marine Research (D), with the University of Bremen (D) as sub-contractor.
SY-4SCI Synergy	S1-2-3 Ocean virtual laboratory The project successfully kicked off at ESTEC on 23-24th October 2014.	250	Ocean Data Laboratories (FR), NERSC (NO), IOPAN (PO), PML (UK), UPT (RO).
	Total	1.0 M€	

ITTs in preparation - Contracts to be awarded **in 2014/2015** (total of 6.35 M€) :

SEOM Call	Subject	Cost	ITT Status
S1-4SCI Ocean	* TOPS and Wave mode & Polarisation in C-band (wide swath wind, wave, and current retrieval)	0.35 M€	in preparation Q1 2015
S1-4SCI Land	* Land Cover * Vegetation * Snow * Soil Moisture	1.0 M€	in preparation Q2 2015
S2-4SCI Land and Water	Radiometric Validation * Atmospheric Corr. & Cloud * Classification * Multi-temporal Analysis * Coastal & Inland Water * Coral reefs	1.5 M€	in preparation Q1 2015
S3-4SCI SAR Altimetry	* Coastal * Hydro * Land * Altimetry-Echo	1.0 M€	ITT out September 2014
S3-4SCI Land	* Surface-Atmosphere retrievals * Fire * LST* Data scaling	1.0 M€	in preparation Q2 2015
S3-4SCI Ocean Color	* Carbon Pools in the Ocean * Integrated PAR * Extreme Case2 Waters	0.8 M€	ITT out July 2014 Under approval Kick Off Q1 2015
S5P-4SCI Atmosphere	* Volcanoes* Synergies UV-IR* Fluorescence & Cloud properties* Air Quality	1.0 M€	in preparation Q1/Q2 2015
Total		6.65 M€	

- ◆ **EO Summer School on “Earth System Monitoring & Modeling”** 4-14 Aug 2014, ESRIN
200 applications; 70 selected
- ◆ **Land Remote Sensing** 8-12 Sep 2014, Valencia (E)
173 applicants , 70 selected
- ◆ **SAR Altimetry**, 21-22 Oct 2014, Konstanz (D)
- ◆ **Atmospheric Remote Sensing**, 27-31 Oct 2014
Research Centre Jülich, (D) ,41 Applications -35 selected
- ◆ **Radar Polarimetry Training**, 19-23 Jan 2015, ESRIN 70
Applications, 60 selected
- ◆ **Ocean Remote Sensing**, 7- 11 September 2015 IFREMER France
- ◆ **Land Remote Sensing** 14-18 September 2015,UASMV,
Bucharest ROMANIA



The ESA Living Planet Fellowship Scientific Exploitation of the Sentinels: Call for Research Proposals (closure end June 2014)

7 Post Doc grants for scientific exploitation of the sentinels

Title	name	surname	Host Institution	MS
OCEAN sUrface current reconstruction from the Synergy of SENTINEL 3 sensors.	Cristina	González Haro	Institut Mines Telecom - Telecom Bretagne	FR
Estimation of COastal BATHymetry from Wave motion using Sentinel-1 and -2	Danilo	Céline	University of Trento	IT
Automated avalanche debris detection using Sentinel-1	Markus	Eckerstorfer	Northern Research Institute (Norut)	NO
Improving ocean color data over icy Arctic waters using medium and high spatial resolution satellite images	Clemence	Goyens	Université du Quebec à Rimouski	CAN
Integrating SENTINEL time series products in agro-hydrological studies	Sylvain	Ferrant	CESBIO	FR
Integrating Sentinel-2 and Landsat-8 data to systematically generate value-added products at high resolution	Patrick	Griffiths	Humboldt-Universität	DE
Applications of satellite observations of tropospheric NO ₂ at hIgh Latitudes for Monitoring Air quality: preparing for TROPOMI data exploitation	Iolanda	Ialongo	Finnish Meterological Institute	FIN



Jonathan Amos @BBCAmos · 37m
It's not everyday you see interferograms on the TV, but you would have today
bbc.in/Z5tCQw #napaequake pic.twitter.com/HD2Ri52LBo

Reply Retweet Favorite

Flag media

2 September 2014 Last updated at 10:43



Jonathan Amos

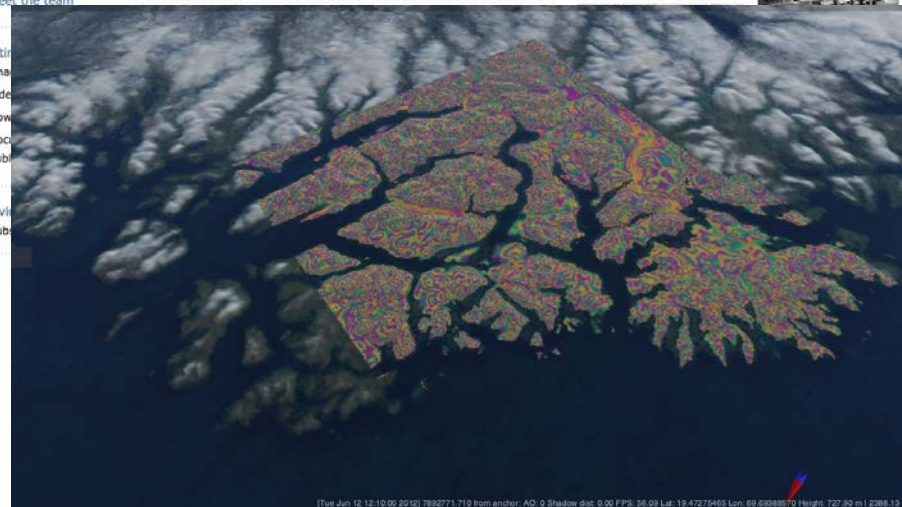
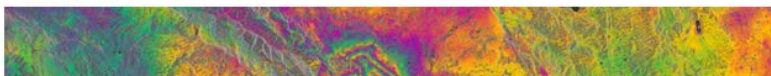
Science correspondent

More from Jonathan Follow Jonathan on Twitter



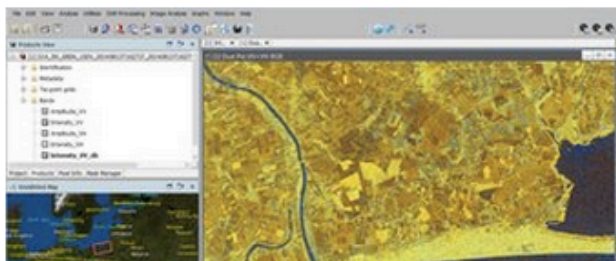
Sentinel system pictures Napa quake

COMMENTS (3)



ESA > Our Activities > Observing the Earth > Copernicus

NEW TOOLBOXES MAKE USING SENTINEL DATA EASY



30 September 2014
built primarily to
environmental se
Copernicus pr
to advance o
Paving the wa
has released

ESA > Our Activities > Observing the Earth



→ ROMANIAN MOSAIC

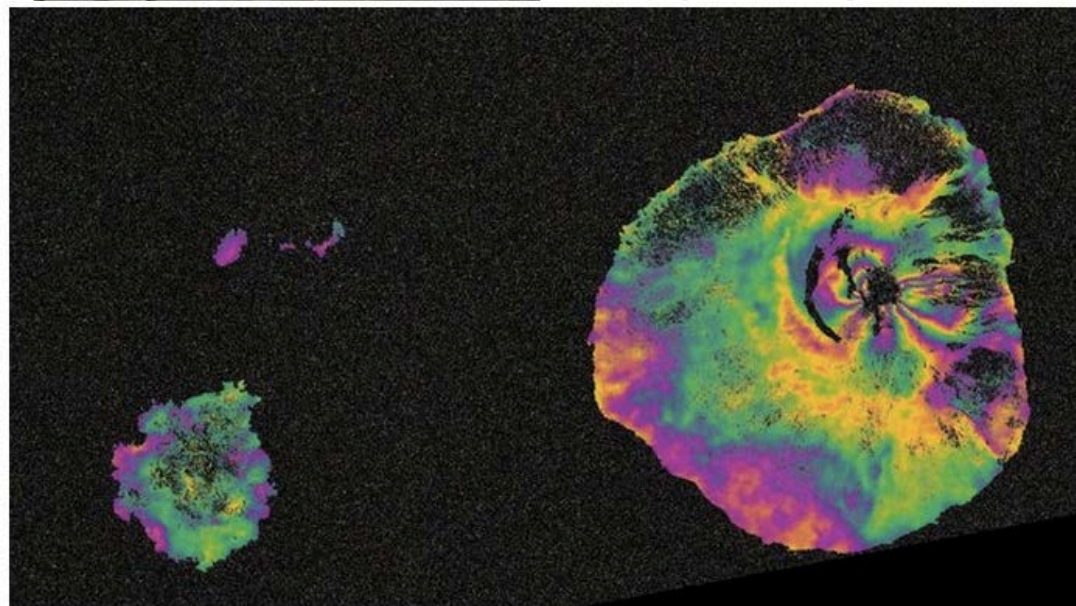
Earth observation image of the week: a mosaic of Sentinel-1A radar scans over Romania, also featured on the Earth from Space video programme

ESA TRAINS TOMORROW'S EARTH OBSERVATION SCIENTISTS



17 September 2014 World-renowned remote sensing experts gathered in Valencia, Spain, last week to train the next generation of Earth observation scientists in the exploitation of satellite data for land applications.

As part of the Scientific Exploitation of Operational Missions programme, ESA organises the advanced



Sentinel-1 maps Fogo eruption

FOGO VOLCANO ON SENTINEL'S RADAR

2 December 2014 Radar images from the Sentinel-1A satellite are helping to monitor ground

1. New exploitation element focused on scientific exploitation (Sentinels)
2. Opportunities for R&D
3. Development of scientific toolboxes ongoing
4. Regular Training for next generation EO scientists
5. Regular Science users workshop consultations
6. Work plan based on science user recommendations and approved at PBEO (every year)

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



Sentinel-1 INSARAP Workshop

Background

The European Space Agency, in the context of the Scientific Exploitation of Operational Missions (SEOM) element INSARAP studies, is organising a technical workshop on Sentinel-1 TOPS interferometry from **10 to 11 December 2014** in ESA-ESRIN, Frascati. During the event, results obtained by the two INSARAP consortia will be presented.

Background

- In the context of the Scientific Exploitation of Operational Missions (SEOM) element INSARAP studies, is organising a technical workshop on Sentinel-1 TOPS interferometry
- During the event, results obtained by the two INSARAP consortia will be presented.

SENTINEL-1 INSAR ON A CONTINENTAL SCALE

AUG/DEC 2014

RESULTS DESCRIPTION

This 1400km x 250km interferogram covers the Center and South parts of Italy including Sicily, and captures large parts of Slovenia and Croatia. It starts by just capturing a small part of Malta, and ends in the Alps over Slovenia and Austria. In total 8 consecutive IW SLC slices were used in the interferogram formation, specifically, data takes from 09-Aug-2014 and 21-Aug-2014. Notably, this interferogram was computed as a single dataset.

The impressive scale, coverage and coherence clearly demonstrate the potential of Sentinel-1 for many remote sensing and interferometric applications. It also clearly introduces, what will be perhaps be the major challenge in interpretation and analysis of Sentinel-1 interferometric data, and that is the mitigation of the atmospheric effects.

Also, for a slow TV fans, an interferometric fly-through results is available on YouTube, in a short 90 seconds version, and a super slow 2.5 hours version.



FOGO VOLCANO ERUPTION OBSERVED BY SENTINEL-1

NOVEMBER 2014

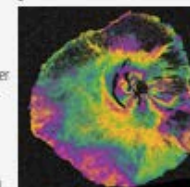
RESULTS DESCRIPTION

The potential and capability of Sentinel-1 TOPS for geophysical applications has yet again been demonstrated. This beautiful interferogram was computed by combining two radar images acquired over the Fogo Island during the time of a volcanic eruption. Specifically, it was computed by combining images acquired on 3rd and 27th of November, both in a ascending Interferometric Wide Swath mode.

Together with the Napa Valley Earthquake study, and now with the satellite in the operational stage, the full potential of Sentinel-1 for relief efforts has been once again unequivocally demonstrated.

While more information on the interpretation and geophysical modeling will soon follow, for more context you can refer to the Copernicus EMS "The MIA-VITA Monitoring Seismic Network of Fogo Volcano" project, and watch the actual footage of the eruption.

Interferometric results available to download soon!



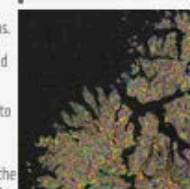
SENTINEL-1 TOPS INTERFEROGRAM

AUGUST 2014

RESULTS DESCRIPTION

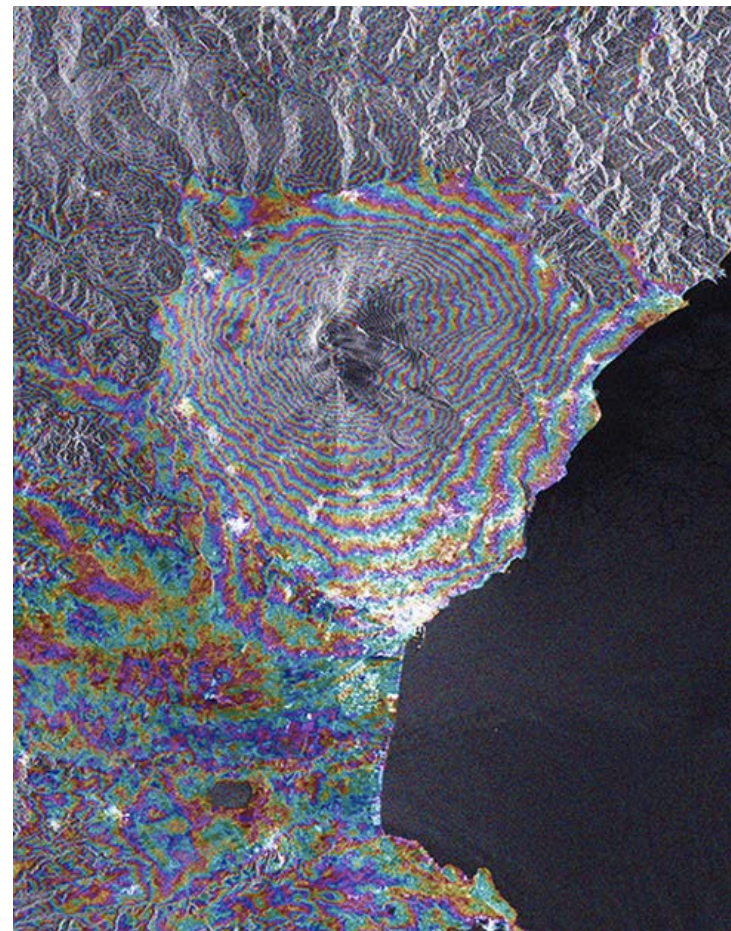
This is one of the first Sentinel-1A TOPS interferograms. It is computed by combining two radar images of the northern coast of Norway acquired by on 11 August and 23 August 2014. Although Sentinel-1A is still being commissioned, this new result clearly demonstrates usefulness and applicability of Sentinel-1 TOPS mode to map the shape of the land and monitor ground movement.

One of the InSAR pilot sites, Nordnes, is situated in the Lyngen Alps, in the rightmost part of the interferogram. The area is particularly prone to landslides, and the particularly dangerous landslide at Nordnes is highlighted



Technical Objectives

- Present Sentinel-1 interferometric results in TOPS mode.
- Adapt InSAR and PSI processing techniques to TOPS SAR data.
- Discuss the first InSAR and PSI results over selected pilot sites.
- Assess the synergy between Sentinel-1 and previous C-band SAR missions.



Additional Objectives

- Dialogue with INSAR specialists
- Gather your feedback on ESA products, tools and services for the INSAR science community
- Prepare for FRINGE 2015
- Share the KNOW-HOW for Sentinel 1 INSAR scientific exploitation
- Propose Sentinel-1 INSAR session(s) at IGARSS 2015 in Milano

The screenshot shows the ESA Sentinel-1 Data Hub interface. At the top, there are navigation tabs: Overview, Search, Profile, Cart, and About. A search bar is visible with the text "Request done : productType:'SLC'". Below the search bar, there are input fields for Product Type (SLC), Sensor Mode, Sensing Period, Polarisation, Swath, and Ingestion Period. The main area displays a map of the Mediterranean region with various countries labeled. A legend on the right side of the map shows the Base Layer, City/Lands, Road, Aerial, Overlays, Sentinel-1, and All Footprint Layer. Below the map, there is a list of products with columns for a thumbnail, product ID, URL, date, instrument, mode, satellite, and size. The first product listed is S1A_IW_SLC__1SDV_20141003T054235_20141003T054304_002661_002F66_D5C8.



10 December 2014

09:15 Welcome and Introduction - Y-L. Desnos, ESA

09:15 Sentinel-1 Mission Status - *P. Potin, ESA*

09:30 Sentinel-1 Data Access - *J. Martin, ESA*

Session 2 - INSARAP Consortium results by DLR-HR, e-GEOS, INGV & GFZ

Chairs: *A. Hooper & U. Wegmüller*

09:45 Presentation of consortium and brief description of pilot sites

10:15 Interferometric TOPS chain description

09:45 Special considerations in the TOPS case

11:15 *Coffee Break*

11:45 Investigations with Sentinel-1 IW data

12:15 Options for PSI time series processing

12:45 Preliminary scientific results with Sentinel-1

13:15 *Lunch Break*

10 December 2014

**Session 2 - INSARAP Consortium results by Norut, PPO.labs, Univ. of Leeds,
PGI & NGU**

Chairs: D. Geudtner

- 14:30** Overview - "InSARap at a glance"
- 15:00** Sentinel-1 TOPS - technical challenges (and opportunities)
- 16:00** *Coffee Break*
- 16:30** Sentinel-1 for InSAR based scientific applications
- 17:30** *Welcome Cocktail*
- 18:30** *End of First Day*

11 December 2014

Session 3 - Sentinel-1 TOPS InSAR Results

Chairs: P. Prats & Y. Larsen

09:00 Sentinel-1 InSAR Capabilities: Results fr
Phase -*D. Geudtner, ESA*

09:15 Adaptation of DIAPASON processing soft
interferometry - *J. Duro, Altamira*

09:45 Sentinel-1 InSAR progress and experien
Gamma Remote Sensing AG

10:15 Enabling the processing of Sentinel-1 TOPS data with the open-source
DORIS software - *F. van Leijen, Delft University of Technology*

10:45 *Coffee Break*

11:00 SBAS-DInSAR processing chain for Interferometric Wide Swath Sentinel-1
data - *M. Manunta, IREA-CNR*

11:30 Sentinel-1a Interferometry using the Integrated Wide Area Processor – First
Experiences -*R. Brcic, DLR*

12:00 *Lunch Break*

Round Table Discussion

Chairs: Y-L. Desnos & F. Rocca

14:00 **Round Table**

17:00 *End of the Workshop*

Wish you a Fruitful Workshop