



The ESA Scientific Exploitation of Operational Missions element

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European Space Agency

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Slide 1

SEOM Element of EOEP4



SEOM objectives:

- Federate, support and expand the ۲ research community
- Strengthen the leadership of • European EO research community
- Enable the science community to ۲ address new scientific research

Please visit SEOM.ESA.INT



ESA EO

SENTINEL

PROTAFOS

PROJECTS

CONTACTS



Action Lines



Science Users Consultations

Scientific Toolboxes Development

Research & Development Studies

Training Next Generation of EO Scientists

Promoting Science Data Use and Results Organising a series of regular international **thematic workshops** for science users consultation and gathering users feedback

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

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

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

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

Slide 3



Reporting at next WS



ITTs & Contracts are being placed

R&D-New Methods Scientific Toolboxes Trainings Workshops Results

pace Agency

Science Users Consultations



- 9th FRINGE WS ESRIN 23-27 Mar 2015 http://seom.esa.int/fringe2015/
- ♦ S3-Science WS VENICE , ITALY 2-5 June 2015 http://seom.esa.int/S3forScience2015/
- Atmospheric Science Sentinel 5P (Univ. of Crete, Greece 8-12 June 2015) http://seom.esa.int/atmos2015/
- EO science 2.0 conference ESRIN 12-14 October 2015 http://eoscience20.org
- ESA Living Planet Symposium Prague ,CZ http://lps16.esa.int 9-13 May 2016



Advances in Atmospheric Science and Applications 8-12 June 2015, University of Crete, Heraklion, Greece

FOR SCIENCE WORKSHOP





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ESA Living Planet Symposium 2016 Themes: CE



Open Science 2.0



Abstract Submission by 16 October 2015

European Space Agency

Scientific Toolboxes S-1/2/3 TBX & STEP



Sentinel 1/2/3 Toolboxes

- Multi-mission Scientific Toolboxes
- Developed as open source software
- Common architecture
- Portable to a Cloud infrastructure

Download https://sentinel.esa.int/



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Contains modified Copernicus Sentinel data [2014]



• 6th ESA ADVANCED TRAINING COURSE ON LAND REMOTE SENSING 14–18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Romania-



Contains modified Copernicus Sentinel data [2014]

• 6th ESA ADVANCED TRAINING COURSE ON LAND REMOTE SENSING 14–18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Romania **Sentinel-1A** Napa Valley Earthquake INSARAP (NORUT-PPO.labs-Univ. Leeds-COMET)



esa

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



Research & Development INSARAP



Sentinel-1A subsidence monitoring with PS - INSARAP (DLR-HR)

[cm/month]

Twelve Sentinel-1A radar TOPS scans acquired in a descending configuration between 15 October 2014 and 8 March 2015 were combined to create this image of ground deformation in Mexico City.

The deformation is caused by ground water extraction, with some areas of the city subsiding at up to 2.5 cm/month (red). Image size: 50 km x 40 km.

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Research & Development INSARAP





Ten Sentinel-1A radar scans acquired between 7 October 2014 and 12 March 2015 were combined to create this image of ground deformation around the city of Naples, which includes the active volcanic areas of the Campi Flegrei caldera and the Vesuvius volcano. The purple square over the city of Naples indicates the location of the calibration point. Image size: 44 km x 18 km.

Sentinel-1A shows uplift movement in the Campi Flegrei caldera of about 0.5 cm/month.

Nepal Earthquake INSARAP Study (NORUT/PPO.labs)



Differential interferogram from Sentinel-1A showing the ground deformation pattern of the 25 April 2015, M7.8R Nepal earthquake.

Generated from two Sentinel-1A scans on 17 and 29 April 2015 – before and after the 25 April earthquake.

An overall area of 120x100 km has moved, half of that uplifted and the other half, north of Kathmandu subsided.

Slide 15 ESA UNCLASSIFIED – For Official Use ESA SEOM INSARAP study



Nepal Earthquake INSARAP Study (NORUT/PPO.labs)



Each interferometric fringe represents about 3 cm of deformation. The large amount of fringes indicates a large deformation pattern with ground motions of more than 1m.

O Kathmandu

Copyrights Copernicus data (2015)/ ESA/Norut/PPO.labs/COMET-



Nepal Earthquake INSARAP Study (DLR-HR)





Nepal Earthquake INSARAP Study (DLR-HR)



Full swath 250km differential interferogram.

Scaling of interferogram to allow better representation of the affected area (~13cm/fringe).

Accurate measurement of ground motion after phase unwrapping. Copyrights Copernicus data (2015)/ DLR-HR/GFZ/e-GEOS/INGV-ESA SEOM INSARAP study

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Sem scientific exploitation

scientific exploitation of operational missions

Research & Development S1-S2 synergy



Forest monitoring







Landslides and Floods

Agriculture



Example of combined use of optical and SAR images for landslide detection. A: an rgb composite of an HH and HV Terrasar-x image and an infrared channel of a Formosat-2 showing the Shaolin



RGB composite derived from a S1 image simulated from a Rd-2 image acquired over Indian Head



Snow cover

research



Show status monitoring by combining COSMO-SkyMed image (wet snow ratio) and LANDSAT to detect the snow extension (results from SNOX project funded by the Italian Space Agency and led by EURAC)



European Space Agency



Research & Development Citizen Science – EDUCEO



VTT, Pajat Solutions, Plan Finland



Pilot Project: Forest Biomass Analysis



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

Agency



Research & Development Citizen Science – EDUCEO



The ESA EducEO Project: Geodan, IIASA, Airbus D&S, KNMI, Leiden Uni, Terrenea



PILOT 4: AIR QUALITY MONITORING USIN IN-SITU SENSORS



Figure 1. The iSPEX add-on for the iPhone and a typical image from blue sky observations. The optical design of iSPEX uses the smartphone camera as the detector, and the iSPEX add-on produces a spectrum of the light that entered the slit with sinusoidal bands created by the spectral polarization modulation optics. These bands provide a direct measure of the sky polarization.

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http://educeo.net/pilots/







ITTs in preparation - Contracts to be awarded in 2015:

SEOM Call	Subject	Cost	ITT Status
S1-4SCI Land	* Land Cover * Vegetation* Snow * Soil Moisture	0.8 M€	Intended 15.155.08 Q4 2015
S2-4SCI Land and Water	Radiometric Validation * Atmospheric Corr. & Cloud * Classification * Multi-temporal Analysis * Coastal & Inland Water * Coral reefs	1.25 M€	Closed AO 1-8216
S3-4SCI Land	* Surface-Atmosphere retrievals * Fire * Snow Albedo * NPP	0.75 M€	in preparation Q4 2015
S5P-4SCI Atmosphere	* Volcanoes* Synergies UV-IR* Fluorescence & Cloud properties* Air Quality	0.8 M€	in preparation Q4 2015
	Total	3,6 M€	

Training Next generation EO Scientists: advanced courses

cesa



- EO Summer School 4-14 Aug 2014, ESRIN 200 applications; 70 selected
- Land Remote Sensing 8-12 Sep 2014, Valencia (E) 173 applicants, 70 selected
- Radar Polarimetry Training, 19-23 Jan 2015, ESRIN 70 Applications, 60 selected
- 240 scientists trained Ocean Remote Sensing, 7-11 September 2015 IFREMER France http://seom.esa.int/oceantrainingcourse2015/
- Land Remote Sensing 14-18 September 2015, UASMV, Bucharest ROMANIA http://seom.esa.int/landtraining2015/

Cesa

→ 6th ESA ADVANCED TRAINING COURSE **ON LAND REMOTE SENSING**

seom

scientific exploitation

of operational missions

Application CLOSED 01 May 2015

14-18 September 2015 | University of Agronomic Science and Veterinary Medicine Bucharest | Bucharest, Roman

The ESA Living Planet Fellowship Scientific Exploitation of the Sentinels:

Call for Research Proposals (closed 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	п
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 NO2 at hIgh Latitudes for Monitoring Air quality: preparing for TROPOMI data exploitation	Iolanda	Ialongo	Finnish Meterological Institute	FIN

Semicon Second Scientific exploitation of operational missions

Promoting EO Science and Results :

Open EO Science 2.0





HOW TO RESPOND? ESA contribution to EO Open Science 2.0

EO SCIENCE 2.0





- Open data access, Open Publications,
- Virtual Living Labs,
- Data Intensive science, Cloud-based data analytics,
- Crowdsourcing & Citizens science activities,
- App camps, Hackhathons,
- Open Source Toolboxes, workflows for processing,
- Advanced training of new class of data scientist,
- E-learning, MOOC
- Scientific outreacheonency social media,

in preparation for EOEP 5 EO Open science 2.0 conference ESRIN 12-14 October



www.eoscience20.org

Application deadline 19 June 2015

TOPICS FOR ABSTRACT AND EXHIBITIONS



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- 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)
- 7. Preparation for future in scientific exploitation

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-> EO Science 2.0
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