# 10TH ADVANCED TRAINING COURSE ON LAND REMOTE SENSING

# **Introduction** Magdalena Fitrzyk RSAC c/o ESA

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→ THE EUROPEAN SPACE AGENCY

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## Contents: ESA EO and Copernicus data access



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- Access via EO-CAT
- Other data access mechanism examples (free and restricted)
- EEs access, AOs and visualization tool

### **Copernicus Sentinels Data**

### Access to Copernicus Sentinels Data (focusing on Copernicus hub)

- Data Policy and use typologies (focusing on scientific users)
- Sentinel Data data hub (registration, search and download)
- Sentinel 3 and EUMETSAT CODA hub
- DIAS and other hubs to access Sentinels data

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### Earth Observation at ESA





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### Heritage Mission: ERS



The European Remote Sensing satellite ERS-1, launched in 1991, carried a comprehensive payload including an imaging synthetic aperture radar, a radar altimeter and other powerful instruments to measure ocean surface temperature and winds at sea. ERS-2, which overlapped with ERS-1, was launched in 1995 with an additional sensor for atmospheric ozone research.

#### Instruments:

Active Microwave Instrument (AMI)

The Active Microwave Instrument is the largest onboard system and combines the functions of a Synthetic Aperture Radar (SAR)

#### Radar Altimeter (RA)

This measures variations in the satellite's height above sea level and ice with an accuracy of a few centimetres and helps provide data to know the satellite's exact orbital position AATSR (Advanced Along Track Scanning Radiometer)

Along-Track Scanning Radiometer (ATSR) The ATSR consists of two instruments, an Imaging Infrared Radiometer (IIR) and a passive Microwave Sounder (MS).

Global Ozone Monitoring Experiment (GOME) In the light of the increasing concern about atmospheric ozone levels, the GOME instrument was added to the ERS-2 payload. GOMOS (Global Ozone Monitoring by Occultation of Stars)



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### Heritage Mission Envisat



Envisat had 10 instruments to provide continuous observation and monitoring of Earth's land, atmosphere, oceans and ice caps was the largest Earth observation spacecraft ever built

#### Instruments:

ASAR (Advanced Synthetic Aperture Radar)

MERIS (Medium Resolution Imaging Spectrometer)

AATSR (Advanced Along Track Scanning Radiometer)

SCIAMACHY (an imaging spectrometer whose primary mission objective was to perform global measurements of trace gases in the troposphere and stratosphere)

RA-2 (Radar Altimeter, an instrument determining the two-way delay of the radar echo from Earth's surface)

GOMOS (Global Ozone Monitoring by Occultation of Stars)

MWR (Microwave Radiometer) DORIS (Doppler Orbitography and Radio Positioning Integrated by Satellite) LRR (Laser Retro Reflector) MIPAS (Michelson Interferometer for Passive Atmospheric)



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# Earth Explorers (EEs) overview (Scientific Missions) 1/2 @esa

### SMOS

The Soil Moisture and Ocean Salinity (SMOS) mission, launched on 2 November 2009, is exploiting an innovative twodimensional interferometer to acquire brightness temperature observations at L-band (1.4 GHz). These observations translate into information on the moisture held in soil and salinity in the surface layers of the oceans, which are needed to further our understanding of Earth's water cycle (still in operation)

### GOCE

The Gravity field and steady-state Ocean Circulation Explorer (GOCE) was launched on 17 March 2009 and ended on 11 November 2013. GOCE provided high spatial resolution gravity-gradient data to improve global and regional models of Earth's gravity field and geoid

### CryoSat

CryoSat, launched on 8 April 2010, is measuring fluctuations in the thickness of ice on both land and sea determine how Earth's ice is changing. This information is leading to a better understanding of the relationship between ice and global climate. CryoSat carries an innovative SAR/interferometric radar altimeter (still in operation)

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# Earth Explorers (EEs) overview (Scientific Missions) 2/2 @esa

### Swarm

Swarm, launched on 22 November 2013, is providing the best-ever survey of the geomagnetic field and its temporal evolution. The geomagnetic models resulting from the mission will provide new insights into Earth's interior. This information will lead to a better understanding of atmospheric processes, and also have practical applications in areas such as space weather and radiation hazards (still in operation)

### Aeolus

The prime aim of the Atmospheric Dynamics Mission is to demonstrate measurements of vertical wind profiles from space. The mission employs a high-performance Doppler wind lidar based on direct-detection interferometric techniques. ADM-Aeolus was launched in August 2018 (still in operation)

### Coming soon: EARTHCARE (2022) ,BIOMASS (2022), FLEX etc.

Full information on EEs at

https://www.esa.int/Applications/Observing\_the\_Earth/The\_Living\_Planet\_Programme/Earth\_Explorers/About\_Ea rth\_Explorers2

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# ESA EO Third Party Missions (TPM)



ESA uses its multi-mission ground systems to acquire, process, distribute and archive data from other satellites (owned by either public or private entities outside or within Europe) – known as Third Party Missions.

Details of the Third Party Missions currently supported by ESA can be found on: https://earth.esa.int/web/que st/pi-community/apply-fordata/3rd-party

### and

https://earth.esa.int/eogatew ay/search?text=&category=Mi ssions&subFilter=third%20par ty%20missions&sortby=RELE VANCE



PROBA-1 PROBA-1 is a technology demonstration satellite that later became an operational Earth observation mission.



IRS-1C and IRS-1D The Indian Remote Sensing satellites IRS-10

and IRS-1D were identical Earth-imaging satellites operated by the Indian Space.



WorldView-4 WorldView-4 was an imaging and environment-monitoring satellite from DigitalGlobe of the United States, which

Mission - Third Party Missions



**GOSAT Series** 

The GOSAT series is composed of two environment-monitoring satellites developed by JAXA dedicated to the observation of ...



WorldView-1

WorldView-1 helped meet the growing commercial demand for multi-spectral geospatial imagery

Mission - Third Party Missions



Landsat Series

The Landsat series is the world's longest running system of satellites for moderateresolution optical remote sensing for land,...



PAZ

The PAZ (Spanish for "peace") satellite, operates as a constellation alongside TerraSAR-X and TanDEM-X.

Mission - Third Party Missions



WorldView Series

The WorldView constellation are environment monitoring satellites, from DigitalGlobe, have been supplying imagery since 2007.

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### Data Policy







**Earth Explorers** 



# Revised ESA Earth Observation Data Policy ESA/PB-EO(2010)54

- Free datasets (for all data available on Internet)
- Restrained datasets (L0)



Copernicus (GMES ) Data Policy, Joint Principles for Sentinel Data Policy [ESA/PB-EO(2013)30, rev.1] • Free, full and open data policy

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## Keep in mind that...





# EO Sign In registration needed



# (for some TPMs EO Sign In + project proposal)

proposal



# **Copernicus hub self registration**



# **No registration (from June** 2018)

# EO Sign In account Registration & Log in (1/2)



The EO Sign In account allows the PI to access to My Earthnet functionality.

If you **do not** have an EO Sign In account, follow the registration procedure starting from **ESA PI Community** website : <u>https://earth.esa.int/web/guest/pi-community</u>

# <u>Step 1</u> – Click 'Login My Earthnet' button at the top of the page



# **<u>Step 2</u>** - Click the 'Register now' button to proceed with your EO Sign In registration

https://eoiam-idp.eo.esa.int/ 😢 https://eoiam-idp.eo.esa.int/aundpoint/login.do?SSOAuthSes:ADDA4E114DBE65863D5E48833A7D292C5BBCCDB9F77060EC79E3185F2 👻 🔒 ees ropean Space Agency Earth Online o sign in Contact EO Sign In Earth Observation sign in and registration Username Password Remember me on this computer SIGN IN Forgot Username or Password Don't have an account Register Now

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# Accessing ESA Missions (ERS & ENVISAT and ESA TPMs ) through the ESA **EO CAT**



https://eocat.esa.int/sec/#data-services-area

EO-CAT is the ESA EO Catalogue application and is the main visible part of the whole ESA catalog system. EO-CAT is designed to manage end-user Earth Observation services. Using EO Catalogue Services, you can browse the metadata and images of Earth Observation data acquired by various satellites and download data belonging to ESA and ESA TPM collections only with your ESA EO Sign In account



# ESA Missions (ERS & ENVISAT, EEs and ESA TPMs) product details



https://earth.esa.int/eogateway/search?skipDetection=true&text=&category=Data

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This dataset contains all the Landsat 1 to Landsat 5 Multi Spectral Scanner (MSS) high-quality ortho-rectified Level 1 GEO and GTC dataset acquired by ESA over the Fucino, Kiruna (active from April to September only) and Maspalomas (on campaign basis) visibility masks.

The acquired Landsat MSS scene covers approximately 183 x 172.8 km. A standard full scene is nominally centred on the intersection between a path and row (the actual image centre can vary by up to 200 m). The altitude changed

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# Accessing ESA Missions (ERS & ENVISAT, EEs and ESA TPMs ) – **ASAR L1** data



account needed

https://earth.esa.int/eogateway/catalog/envisat-asar-im-single-look-complex-I1asa\_ims\_1p-?text=ASAR+L1

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		Description			Details			Related Datas	sets	

DESCRIPTION

#### ▲ HOW TO ACCESS THIS DATA

Users can freely access the collection using the below links and will be requested to log in (new users must first register an account) to ESA EO Sign In to download the products.

ESA internal users can use their ESAAD account.

Data is available on EOCAT

Data is available on the ESA Online Dissemination System upon user registration



# DATA SERVICE REQUEST for ERS & ENVISAT SAR and ASAR L0 Data esa Download and for some ESA TPM (DEIMOS-1/2, RADARSAT-1/2)

https://earth.esa.int/web/guest/pi-community/apply-for-data/service-request

		Need	I Help? Contact here	European Space Agency
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Beyond the standard services services related to specific dat DEIMOS-1/2 and RADARSAT- and ESA TPM data can be gra and justify their needs within a Data Service Requests can b	for ESA (A)SAR data access which are availa a and some ESA TPM data (including (A)SAR 1/2 data) or to specific level of performances inted by ESA, within technical, financial or lega <b>Data Service Request</b> . we submitted at any time, using the submission uple of weeks	ble to any user, some specific L0, COSMO-SkyMed ESA collection, are available. Such specific services al constraints, to users who describe hink below. ESA's reply to the request	Frecommunity Home Results Apply for Data Fast Registration Full Proposal Service Request Campaigns AO's 3rd Party	
is usually provided within a co			Toolboxes	

Data access guides: ESA;TPM

# Third Party Mission Data Access via ESA



### Some specific TPM restricted access (available for free with a limited quota assigned to ESA): EO Sign In and then Project proposal submission

PI Community

Search Results and Projects Apply for Data

Related Content

PI Community Home

Fast Registration

Service Request

Full Proposal

Campaigns

3rd Party

Toolboxes

MyEarthnet

ESA T&C

TPM T&C EOLI-SA Catalogue

List of free datasets

ESA data Policy

Other Catalogues

Training

Events

News

AO's

Results



In The PI Community website at : https://earth.esa.int/web/guest/picommunity/apply-for-data/3rd-party You will find the list of all info areas for each of the active TPM reporting access conditions and terms of applicability. For some of them only a limited quota can be assigned to each proposal

C https://earth.esa.int/web/guest/pi-community/apply-for-data/3rd-party



- Third Party Missions Third Party Missions



ESA is offering free online access to the EO community, to JERS-1 Synthetic Aperture Radar and Optical data, acquired systematically, based on an agreement between ESA and NASDA The following product types are available:

- JERS-1 SAR Level 1 Precision Image (JSA PRI 1P)
- JERS-1 SAR Level 1 Single Look Complex Image (JSA\_SLC\_1P)
- JERS-1 Optical VNIR Level 1 System Corrected Products (OPS\_SYC\_1P)

Access is granted immediately to all users after fast registration

Any publication of results obtained from the use of ESA JERS-1 data shall be accompanied by an appropriate credit to JAXA, as follows: "© JAXA (year of acquisition)". Further information can be found in the ESA TPM Terms & Conditions.

#### Read more

#### Resourcesat-1/2

ESA is offering free of charge, for scientific research and application development, access to Resourcesat-1 (formerly IRS-P6) archive and Resourcesat-2 archive & new acqs data. These products are available as part of the GAF Indian Satellite Imagery products from the following sensors:

· LISS-IV (Green, Red, NIR bands, 5.8m res.) - High res. multi-spectral . LISS-III (Green, Red, NIR and SWIR bands, 23/70m res.) - Linear Imaging Self

### Example PLEIADES access info page



- Fast register (PLEIADES ESA archive)
- Submit a project proposal (PLEIADES full archive & Tasking, on-demand)

#### Additional information:

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Pléiades 1A launched end of 2011 and Pléiades 1B launched end of 2012 compose the Pleiades constellation. The identical twin satellites deliver very-high-resolution optical (up to 0.5m resolution Pancromatic and Colour and 2 m Multispectral) and offer a daily revisit capability to any point on the globe. The swath width is of about 20 km (footprint at nadir)

The list of available data can be retrieved using the Geostore catalogue

Visit the ESA TPM area of this Website to get information about all the Third Party Missions data available and their conditions of use.

- TPM T&C
- Other Catalogues



## Project proposal for some specific TPM restricted



Some TPMs access is available for free **with a limited quota assigned** by ESA after project proposal evaluation ): register for EO Sign In and then submit a Project proposal



For further detail on the project proposal submission process refer to the general guidelines for available at:

https://earth.esa.int/files/guidelines

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# Summing up flow for ESA TPMs





Submit Proposal/DSR to ESA and waiting (~2weeks) for outcome and quota assignment

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# ESA Announcement of Opportunities :

registration

(prerequisite)



### - Open Opportunities for Researchers

#### Aeolus Cal/Val



ESA is pleased to announce the reopening of the Announcement of Opportunity (AO) call for the Aeolus

#### S5PVT



Nithin the framework of its Copernicus missions, ESA is pleased to announce the Sentinel-5 Precursor Calibration and Validation Team Call

OSEO



The Open Science Earth Observation (OSEO) call offers to scientists the opportunity to exploit at no cost a full archive of optical EO data for science. applications and technological

innovation, by offering services which exploit state of the art ICT.

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The S3VT call is open to relevant and interested groups and individuals worldwide: group responses are particularly welcome.

G-POD



ESA is offering all scientists with the possibility to perform bulk processing exploiting the large ESA Earth-observation archive together with ESA available GRID computing and dynamic storage resources.

# **EO Sign In**

ESA issues research announcements at regular intervals (e.g. for new Missions or specific agreement with other Agencies) Open opportunities for Researchers . Also in this case a project proposal is needed under a pre defined scheme and to submit it you need EO Sign In account.

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# Copernicus (Sentinels) Data Policy



### **Copernicus Data Policy for Sentinels Missions**

- **D** The Copernicus data policy is adopted via a Delegated Regulation
- This policy promotes the access, use and sharing of Copernicus information and data on a full, free and open basis
- One of the main objectives is to support downstream segment and research, technology and innovation communities
- The European research institutes will be able to make the best use of these data to create innovative applications and services

Sentinel Data Policy = full and open access to Sentinel data to all users

In practical terms

- Anybody can (has the right to) access acquired Sentinel data
- Licenses for the Sentinel data are free of charge
- Online access with users registration including acceptation of T&C\*

\* TERMS AND CONDITIONS FOR THE USE AND DISTRIBUTION OF SENTINEL DATA available online on the Sentinel website

(https://sentinel.esa.int/documents/247904/690755/Sentinel\_Data\_Legal\_Notice)

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# Copernicus Open Access Hub: Sentinels



User self-registration
Geographical search
Catalogue query
Product Browse
Download

https://scihub.copernicus.eu/



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# Copernicus Open Access Data Hub



### Once completed registration you can log in and use the "Advanced search" criteria, start use Sentinel hub interface to

search and download sentinels data.

Search criteria available:

- Draw region of interest •
- Full text search .
- Advanced search (prod, . type,acqu.dates..)

### Sentinels Scientific Data Hub

The Sentinels Scientific Data Hub is a web based system designed to provide EO data users with distributed mirror archives and bulk dissemination capabilities for the Sentinels products.

Terms of Sentinels Scientific Data Hub portal and Data supply conditions

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<ul> <li>» Sensing period From:</li> <li>» Ingestion period From:</li> <li>Mission: Sentinel-1</li> </ul>	to: 🖬	128 BD FIIA Norge 127 AC Suomi 137 E Sverige FII3 146 Z Sverige FII3	RUNO
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Full details on Sentinels at: https://sentinel.esa.int/

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# **Copernicus Open Access Hub**





Copernicus Open Access API Hub

Sentinels data are distributed using a **SENTINEL-specific variation of the Standard Archive Format for Europe** (SAFE) format

SAR-C S1A IW SLC 1SDV 20160629T050314 20160629T050341 011921 0125CC 5BF3 Download URL: https://scihub.copernicus.eu/dhus/odata/v1/Products('16786ffb-94d8-413a-8304-084a1f0cde62')/\$v Mission: Sentinel-1; Instrument: SAR-C; Sensing Date: 2016-06-29T05:03:14.111Z; Size: 7.63 GB C

Select product of you interest and use the icons to (the circled red icons) : Zoom in the map, view product details \*, move it in the 'Cart', "Download product"

Click and download, shopping cart, batch download. A maximum of 2 concurrent downloads per user is allowed in order to ensure a download capacity for all users.

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# **Copernicus Open Access Hub**



\* View product details is an online inspection of the searched products by browsing and pre-viewing the product metadata and measurements without downloading it. A preview panel displays information on the product contents and structure.

S1A IW SLC 1SDV 20160629T050338 20160629T050406 011921 0125CC B765 onemicus eu/dhus/odata/v1/Products//c5f8298f-f985-4945-bf7b-5f724985316b')/\$value LTA (Long Term Archive) Access Starting from 10 September 2018, the oldest and least used Sentinel-1A and B data have started to be removed from the online archive. On Q3 2019, part of the Sentinel-2 and Sentinel-3 products will also be removed. Products retrieval is still possible via the Data Hubs that take care to manage the requests to the Long Term Archives (LTA) and to restore the products online. The product catalogues of the Data Hub services continue to provide access to the full set of data, searchable via the Graphical User Interfaces as well as the OData and OpenSearch APIs. Data that are no longer online are flagged as "offline". An attempt at downloading these "offline" products, will trigger their retrieval from the LTA. After a while, the requested products will be available for download through the original URL The Data Hub Graphical User Interface (GUI) can be used to identify and order offline products. Further instructions on how to manage these products are available here. FIIename: STA TW SLC TSDV 201000231000330 201000231000400 011321 012000 D105.SAFE measurement Identifier: S1A\_IW\_SLC\_\_1SDV\_20160629T050338\_20160629T050406\_011921\_0125CC\_B76 Instrument: SAR-C preview Mode<sup>•</sup> IW support Satellite: Sentinel-1 S1A\_IW\_SLC\_\_1SDV\_20160629T050338\_20160629T050406\_011921\_0125CC\_B765.SAFE-report-Size: 7.93 GB 20160629T072914 pd 💼 manifest.safe ✓ Product ✓ Platform Æ X  $(\rightarrow)$ 

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# API Hub : access point for API users with no graphical interface

esa

**APIs And Batch Scripting.** The Data Hub exposes two dedicated Application Program Interfaces (API) for browsing and accessing the EO data stored in the rolling archive. The APIs are:

Open Data Protocol (OData)

### Open Search (Solr)

The OData interface is a data access protocol built on core protocols like HTTP and commonly accepted methodologies like REST that can be handled by a large set of client tools as simple as common web browsers, download-managers or computer programs such as <u>cURL</u> or <u>Wget</u>.

OpenSearch is a set of technologies that allow publishing of search results in a standard and accessible format. OpenSearch is RESTful technology and complementary to the OData. In fact, OpenSearch can be used to complementary serve as the query aspect of OData, which provides a way to access identified or located results and download them.

C https://scihub.copernicus.eu/twiki/do/view/SciHubWebPortal/APIHubDescription

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home > apihubdescription API Hub API Hub	S-3 PreOpsHub
API Hub is dedicated to users of the scripting interface. The API Hub Access is currently available for all users registered on SciHub. The same user credentials are made valid to access this site within 1 week from the registration on SciHub. Any following modification performed by the user on the SciHub account (e.g. new password, e-mail, country, etc.) is transferred to API Hub within 1 week from the update. The API Hub may be accessed through the URL https://scihub.copernicus.eu/apihub/. This implies that the OpenSearch API is published at https://scihub.copernicus.eu/apihub/search and the OpenData API is published at https://scihub.copernicus.eu/apihub/odata/v1. The API Hub is managed with the same quota restrictions, i.e. a limit of two parallel downloads per user. The site is publishing precisely the same data content as the Scientific Data Hub Sentinel-21.	<b>Sentinel-3 Pre-operational</b> <b>Hub</b> : pre-operational access point for all users to Sentinel- 3 data. Login credentials are s3guest:s3guest .
Sentinel-1 and Sentinel-2 products can be filtered in OpenSearch by using the search key <i>platformanme</i> in combination with the other search criteria: - <i>platformname:Sentinel-1</i> - <i>platformname:Sentinel-2</i> Please refer to the corresponding section of the User Guide for instructions on how to create your own scripts.	

**API Hub** : access point for API users with no graphical interface. All API users regularly downloading the atest data are encouraged to use this access point for a better performance.

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# SENTINEL ONLINE WEBSITE



policy, last scientific resulst and more... https://sentinel.esa.int/web/sentinel/home



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### Access to Sentinel Data in cloud



In addition to the download services, the Sentinel Data Products are available in the Copernicus Data and Information Access Service (DIAS) cloud environments. Each DIAS provides processing resources, tools and complimentary data sources at commercial conditions to further facilitate the access to Sentinel data.



# Sentinel Data Hub (EO Browser)



### https://apps.sentinel-hub.com/eo-browser/



## SNAP toolbox and STEP forum



### step.esa.int/main/download/snap-download/ eesa Q → Science Toolbox Exploitation Platform DOWNLOAD **SNAP Download**

Here you can download the latest installers for SNAP and the Sentinel Toolboxes.

Data provision is available to all users via the Sentinel Data Hub.

#### **Current Version**

The current version is 8.0.0

For detailed information about

### SNAP is free available for download at http://step.esa.int/main/download/ the current version is 8.0 (+updates) We offer three different insta

BX, SMOS Box, PROBA-V Toolbox

each toolbox can be excluded from the NAP and the individual Sentinel Toolboxes

installation. Toolboxes which also support numerous sensors other than Sentinel.

	Windows 64-Bit	Windows 32-Bit	Mac OS X	Unix 64-bit					
	These installers contain the Sentinel-1, Sentinel-2, Sentinel-3 Toolboxes, download size is close to 900MB.								
Sentinel Toolboxes	Main Download	Main Download	Main Download	Main Download					
	Mirror Download	Mirror Download	Mirror Download	Mirror Download					
		These installers contain only the SMOS To Download also the <u>Format Conversion Tool</u> (Ea	olbox, download size is close to 500MB. rth Explorer to NetCDF) and the <u>user manual</u> .						
SMOS Toolbox	Main Download	Main Download	Main Download	Main Download					

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# PolSARpro v6.0 (Biomass Edition) Toolbox



step.esa.int/main/download/polsarpro-v6-0-biomass-edition-toolbox-download/

#### $\equiv$ Q $\rightarrow$ Science Toolbox Exploitation Platform

## PolSAR

The PolSARpro v6.0 (Biomass Edition) Software offers the possibility to handle and convert polarimetric data from a range of well established polarimetric spaceborne missions PolSAR like ALOS-1 / PALSAR-1, ALOS-2 / PALSAR-2, COSMO-Both Window SKYMED, GaoFen-3, RADARSAT-2, RISAT, TerraSAR X, This current v Tandem-X, SENTINEL-1A & B. In order to prepare for the To be informe forthcoming polarimetric spaceborne missions, the PolSARpro functionality. v6.0 (Biomass Edition) Software is expanded to support the following additional data sources: ALOS-4 / PALSAR-3, BIOMASS, SAOCOM, NISAR, NOVASAR-S, RCM / RADARSAT-3, TerraSAR-L etc ...

#### Download:

http://step.esa.int/main/download/polsarpro-v6-0-biomass-editiontoolbox-download/

#### General presentation:

http://step.esa.int/docs/extra/PolSARpro\_v6\_General\_Presentation.pdf

### wnload

n Menu window and run the "check"

#### 



Thank you!

If you have any doubts or questions on a specific ESA or ESA TPM on how to obtain the data contact ESA

> eopi@esa.int eohelp@esa.int

