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# ESA Sentinel Applications Platform (SNAP) and the Sentinel Toolboxes

Евген Газетов, ОНУ

Липень, 2022

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ΠΑΝΕΠΙΣΤΗΜΙΟ  
ΘΡΑΚΗΣ | DEMOCRITUS  
UNIVERSITY  
OF THRACE

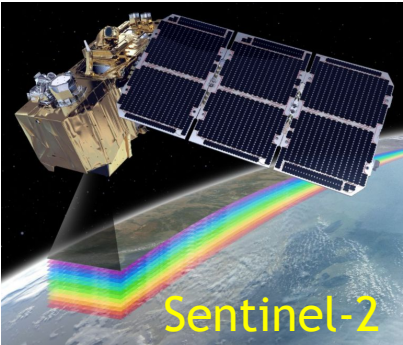
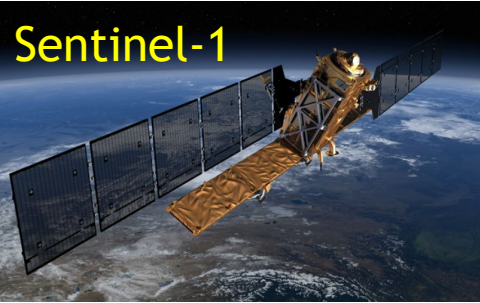


  
GREEN  
ALTERNATIVE



# ВСтуп

## Sentinel-1



## Sentinel-2



## Sentinel-3



User Developed Plugins

ESA Polarimetric SAR Data Processing and Educational Tool



Michael Foumelis (2017) SENTINEL DATA ACCESS & PROCESSING TOOLS. 7th ESA Advanced Training Course on Land Remote Sensing, Szent István University, Gödöllő, Hungary 4-9 September 2017

# Вступ



# Инструменти

## SNAP SAR Toolbox

### →S1TBX:

- ✓ Support the large archive of data from ESA SAR missions including SENTINEL-1, ERS-1 & 2 and ENVISAT, as well as third party SAR data from ALOS PALSAR, TerraSAR-X, COSMO-SkyMed and RADARSAT-2.

### Evolution of ESA's NEST SAR Toolbox

#### **Maintain and enhance existing functionality from NEST**

- Calibration
- Speckle Filtering
- Terrain Correction
- Ellipsoid Correction
- SAR Simulation
- Mosaicking
- Re-projection
- Co-registration
- Interferometry

#### **Continue to support ESA and TPM**

- SENTINEL-1
- ENVISAT ASAR
- ERS-1 & 2
- RADARSAT-2
- TerraSAR-X/TanDEM-X
- ALOS PALSAR
- COSMO-Skymed

## → S2TBX:

- ✓ Exploitation of high resolution optical data
- ✓ Sentinel-2, Envisat (MERIS & AATSR), ERS (ATSR), as well as third party data from RapidEye, SPOT, MODIS (Aqua and Terra), Landsat (TM), ALOS (AVNIR & PRISM) and others

## Sentinel-2 Toolbox

### Overview

#### The SNAP extension for HR data

#### Sentinel-2 data readers: L1B, L1C, L2A

#### Multi-mission: new land-products readers

- ✓ Landsat, Spot 1-7, RapidEye, Deimos
- ✓ More to come in the future: UK-DMC, Ingenio/SEOSAT, EnMAP

#### Sentinel-2 oriented scientific processors

- ✓ Sen2Cor: Atmospheric correction for S2-MSI L1C
- ✓ Sen2Three: multi-temporal synthesis of L1C/L2A
- ✓ L2B processor: biophysical products from L2A
- ✓ Radiometric Indices
- ✓ Water processors (FLH/MCI)
- ✓ Deforestation detection processor

Fabrizio Ramoino (2017) ESA SNAP Sensinel-2 Tools. 7th ESA Advanced Training Course on Land Remote Sensing, Szent István University, Gödöllő, Hungary 4-9 September 2017

# Инструменти

**Radiometric indices are quantitative measures of features that are obtained by combining several spectral bands**

## Vegetation indices

- DVI, RVI, PVI
- NDVI, WdVI, TNDVI, GNDVI
- SAVI, TSAVI, MSAVI, MSAVI2
- GEMI
- ARVI
- NDI45
- MTCI, MCARI, PSSRa
- S2REP, REIP, IRECI

## Soil indices

- BI
- BI2
- RI
- GEMI

## Water indices

- NDWI
- NDWI2
- MNDWI
- NDPI
- NDTI

## Ocean and Land Colour Instrument: OLCI

Swath	1 440 km
SSI at SSP (km)	300 m
Calibration	MERIS type calibration arrangement with spectral calibration using a doped Erbium diffuser plate, PTFE diffuser plate and dark current plate viewed approximately every 2 weeks at the South Pole ecliptic. Spare diffuser plate viewed periodically for calibration degradation monitoring
Detectors	ENVISAT MERIS heritage back-illuminated CCD55-20 frame-transfer imaging device (780 columns by 576 row array of 22.5 $\mu$ m square active elements).
Optical scanning design	Push-broom sensor. Five cameras recurrent from MERIS dedicated Scrambling Window Assembly (SWA) supporting five Video Acquisition Modules (VAM) for analogue to digital conversion
Spectral resolution	1.25 nm (MERIS heritage), 21 bands.
Radiometric accuracy	< 2% with reference to the sun for the 400-900 nm waveband and < 5% with reference to the sun for wavebands > 900 nm. 0.1% stability for radiometric accuracy over each orbit and 0.5% relative accuracy for the calibration diffuser BRDF.
Radiometric resolution	< 0.03 W m <sup>-2</sup> sr <sup>-1</sup> mm <sup>-1</sup> (MERIS baseline)
Mass	150 kg
Size	1.3 m <sup>3</sup>
Design lifetime	7.5 years

MERIS Bands	$\lambda$ center	Width
<b>Yellow substance/detrital pigments</b>	<b>412.5</b>	<b>10</b>
<b>Chl.. Abs. Max</b>	<b>442.5</b>	<b>10</b>
<b>Chl &amp; other pigments</b>	<b>490</b>	<b>10</b>
<b>Susp. Sediments, red tide</b>	<b>510</b>	<b>10</b>
<b>Chl. Abs. Min</b>	<b>560</b>	<b>10</b>
<b>Suspended sediment</b>	<b>620</b>	<b>10</b>
<b>Chl. Abs, Chl. fluorescence</b>	<b>665</b>	<b>10</b>
<b>Chl. fluorescence peak</b>	<b>681.25</b>	<b>7.5</b>
<b>Chl. fluorescence ref., Atm. Corr.</b>	<b>708.75</b>	<b>10</b>
<b>Vegetation, clouds</b>	<b>753.75</b>	<b>7.5</b>
<b>O<sub>2</sub> R-branch abs.</b>	<b>761.25</b>	<b>2.5</b>
<b>O<sub>2</sub> P-branch abs.</b>	<b>778.75</b>	<b>15</b>
<b>Atm corr</b>	<b>865</b>	<b>20</b>
<b>Vegetation, H<sub>2</sub>O vap. Ref.</b>	<b>885</b>	<b>10</b>
<b>H<sub>2</sub>O vap., Land</b>	<b>900</b>	<b>10</b>
New OLCI bands	$\lambda$ center	Width
<b>Aerosol, In-water property</b>	<b>400</b>	<b>15</b>
<b>Fluorescence retrieval</b>	<b>673.75</b>	<b>7.5</b>
<b>Atmospheric parameter</b>	<b>764.375</b>	<b>3.75</b>
<b>Cloud top pressure</b>	<b>767.5</b>	<b>2.5</b>
<b>Atmos./aerosol correction</b>	<b>940</b>	<b>20</b>
<b>Atmos./aerosol correction</b>	<b>1020</b>	<b>40</b>

### → S3TBX:

- ✓ Exploitation of medium resolution optical data
- ✓ Sentinel-3 (OLCI and SLSTR), Envisat (MERIS & AATSR), ERS (ATSR), SMOS as well as third party data from MODIS (Aqua and Terra), Landsat (TM), ALOS (AVNIR & PRISM) and others.

# Платформа SNAP

# 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** (19.10.2020 **15:00 UTC**).

For detailed information about changes made for this release please have a look at the release notes of the different projects: [SNAP](#), [S1TBX](#), [S2TBX](#), [S3TBX](#), [SMOS Box](#), [PROBA-V Toolbox](#)

<https://step.esa.int/main/download/snap-download/>



# Платформа SNAP

File Edit View Analysis Layer Vector Raster Optical Radar Tools Window Help

Search (Ctrl+I)



**Product Explorer**

Repository	Scientific Data Hub
Account	gazetov
Mission	Sentinel2
Satellite	Sentinel-2
Satellite Platform	
Start Date	20-08-2021
End Date	30-08-2021
Product Type	S2MSI2A
Cloud Cover	
Relative Orbit	
Orbit Direction	
Product Name	
UTM Tile	
Area of Interest	

**Navigation** | Colour Manipulation | Uncertainty Visualisation | World View

0°

**Product Library**

Repository: Scientific Data Hub | Account: gazetov | Mission: Sentinel2 | Satellite: Sentinel-2 | Satellite Platform: | Start Date: 20-08-2021 | End Date: 30-08-2021 | Product Type: S2MSI2A | Cloud Cover: | Relative Orbit: | Orbit Direction: | Product Name: | UTM Tile: | Area of Interest:

Products: 5 out of 5 | Sort By: Product Name | Ascending

S2A_MSIL2A_20210820T085601_N0301_R007_T35TQM_20210820T102050	URL: https://apihub.copernicus.eu/apihub/odata/v1/Produ... Mission: Sentinel2 Acquisition date: 20-08-2021 11:56:01 Size: 1.02 GB
S2A_MSIL2A_20210827T084601_N0301_R107_T35TQM_20210827T102802	URL: https://apihub.copernicus.eu/apihub/odata/v1/Produ... Mission: Sentinel2 Acquisition date: 27-08-2021 11:46:01 Size: 495.9 MB
S2A_MSIL2A_20210830T085601_N0301_R007_T35TQM_20210831T164139	URL: https://apihub.copernicus.eu/apihub/odata/v1/Produ... Mission: Sentinel2 Acquisition date: 30-08-2021 11:56:01 Size: 1022.83 MB
S2B_MSIL2A_20210822T084559_N0301_R107_T35TQM_20210822T110737	URL: https://apihub.copernicus.eu/apihub/odata/v1/Produ... Mission: Sentinel2 Acquisition date: 22-08-2021 11:45:59 Size: 536.81 MB
S2B_MSIL2A_20210825T085559_N0301_R007_T35TQM_20210825T120947	URL: https://apihub.copernicus.eu/apihub/odata/v1/Produ... Mission: Sentinel2 Acquisition date: 25-08-2021 11:55:59 Size: 1016.51 MB

Timeline  
 Months | Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Product Library | Layer Manager | Mask Manager

## Found 70 tutorials

SNAP (GENERAL TOOLBOX USAGE)

SENTINEL-1 TOOLBOX (SAR APPLICATIONS)

SENTINEL-2 TOOLBOX (HIGH RESOLUTION OPTICAL APPLICATIONS)

SENTINEL-3 TOOLBOX (MEDIUM RESOLUTION OPTICAL APPLICATIONS)

ESA TRAINING COURSES (ESA TRAINING COURSES)

EXTERNAL RESOURCES (EXTERNAL RESOURCES)

OTHER (OTHER TUTORIALS)

ALL (ALL TUTORIALS)

all categories ▾

Categories

Latest

Top

Category

Topics

Latest

s1tbx



The S1 Toolbox category regroups all threads about the Sentinel-1 Toolbox, as SAR readers or processors.

59 / month

■ Problem Reports ■ Interferometry ■ Polarimetry ■ STaMPS  
■ PyRate ■ snaphu

s2tbx



The S2 Toolbox category regroups all threads about the Sentinel-2 Toolbox as Sentinel-2 product

24 / month



Welcome to the Sentinel Toolbox Exploitation Platform Forum

■ snap



Resizing SNAP Graph Builder

■ snap



The process of interferogram formation is very slow

■ Interferometry



Chlorophyll a concentration for Lake (Water Quality)

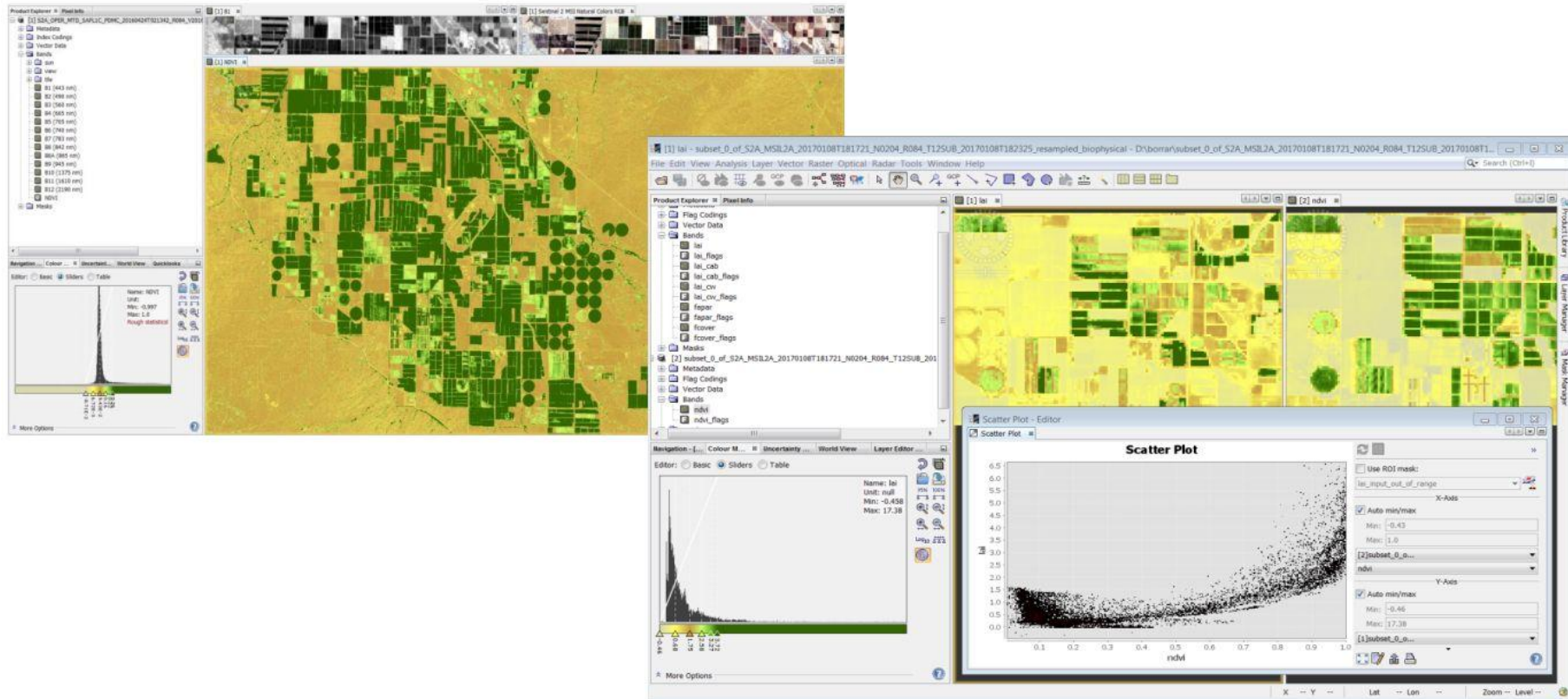
■ s3tbx

<https://forum.step.esa.int>

<https://step.esa.int/main/doc/tutorials/>

# Зразки продуктів SNAP

## S2TBX – Product examples: vegetation monitoring



# Зразки продуктів SNAP

## Sentinel-2 Toolbox

*LAI – Amazon Forest*



# ПІДГОТОВКА ДО ПРАКТИЧНОГО ЗАНЯТТЯ У SNAP

1) Скачати інсталяцію платформи SNAP з Sentinel Toolboxes з сайту (900 MB):

<https://step.esa.int/main/download/snap-download/>

Вимоги до комп'ютера: 4GB пам'яті, 3D graphics card, 32 або 64-бітна Windows, Mac OS X чи Linux.

2) Встановити 9-у версію SNAP і три Toolboxes та GoogleEarth

3) Скачати космічний знімок Sentinel-2 за 22.04.2021 р. (732 MB):

<https://drive.google.com/file/d/1o3DiABlZV8fQRS4dKPmPYlws1c3CT7sq/view?usp=sharing>

4) Розархівувати космічний знімок (767 MB).

5) Скачати і розархівувати шейп-файл:

[https://drive.google.com/file/d/18edynJ2wbsPwupnx8vimg6X-FnlOt\\_PR/view?usp=sharing](https://drive.google.com/file/d/18edynJ2wbsPwupnx8vimg6X-FnlOt_PR/view?usp=sharing)

6) Скачати і підготуватися до практикуму за програмою:

<https://docs.google.com/document/d/1B9CouDgKZMBtqoV8zzEW1ZRWX057SMUH/edit?usp=sharing&oid=113513181147961947467&rtpof=true&sd=true>

# Дякую за увагу!

Одеський національний університет  
ім. І.І. Мечникова, Регіональний центр інтегрованого моніторингу  
і екологічних досліджень,  
7, пров. Маяковського, Одеса, 65082, Україна  
Тел: +380487230120      e-mail: gazetov@gmail.com

Проект «Екологічний моніторинг в басейні Чорного моря з  
використанням продуктів програми Копернікус» (PONTOS)  
e-mail: pontos@onu.edu.ua