

SAR PROCESSING@SCALE DELIVERING INSIGHTS-AS-A-SERVICE

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MAY 5TH, 2023

NV5

NV5 Global, Inc.
provides professional
and technical
engineering and
consulting services

Operates in all over
the United States and
with >100 offices
worldwide

NV5 Geospatial
provides end-to-end
solutions and
services in the
geospatial domain

FORTUNE 100
Fastest Growing
Company
(2017-2021)

NV5 GEOSPATIAL
Beyond engineering

CORE TECHNOLOGY

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We have more than 30 years of experience developing scientifically proven solutions using cutting-edge technology. Today, organizations across industries use our in-depth knowledge of advanced geospatial analytics, machine learning, and remotely sensed data to make better decisions.

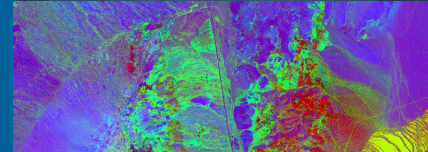
ENVI®



ENVI® SARscape®



ENVI Insight



ENVI Connect



ENVI DL™



Helios®



IDL®



Jagwire™



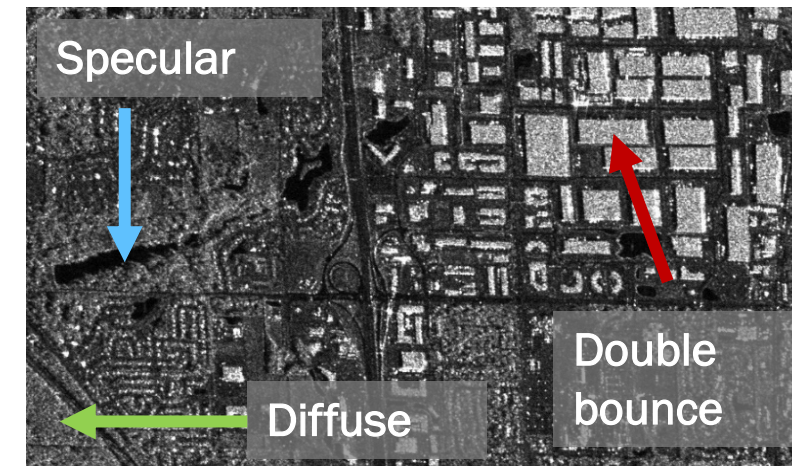


Radar sensor

- Emits own radiation
- Microwave
- One channel
- Day / night
- See through clouds

Sensitivity to surface parameters

- Roughness
- Geometric shape
- Water content
- ...



SAR IS AN IDEAL INSTRUMENT FOR REGULAR MONITORING

SAR Ship Detection

Sentinel-1 SAR Images Show Buildup of Marine Traffic at Suez Canal

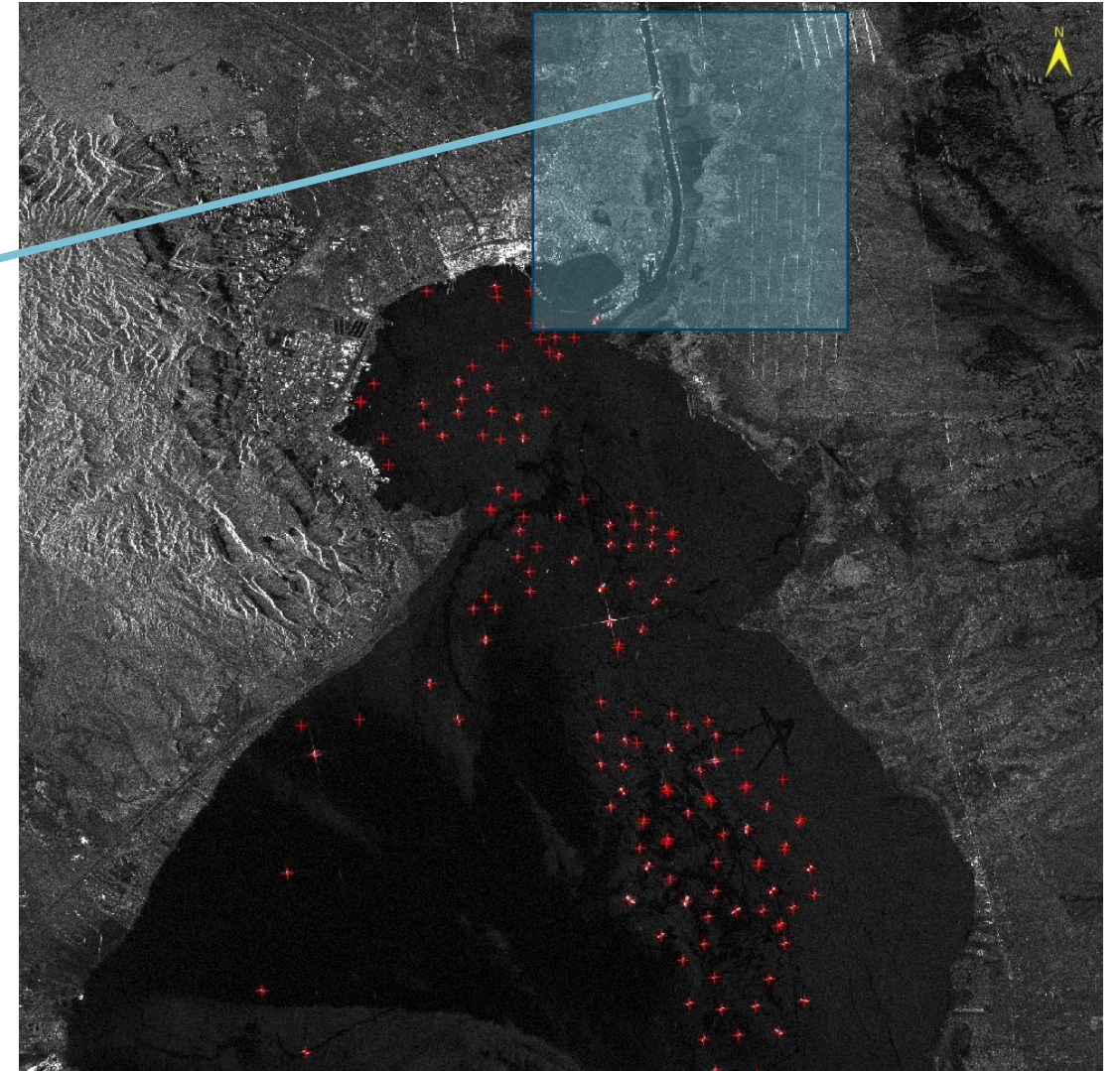


Southern entry of Suez Canal

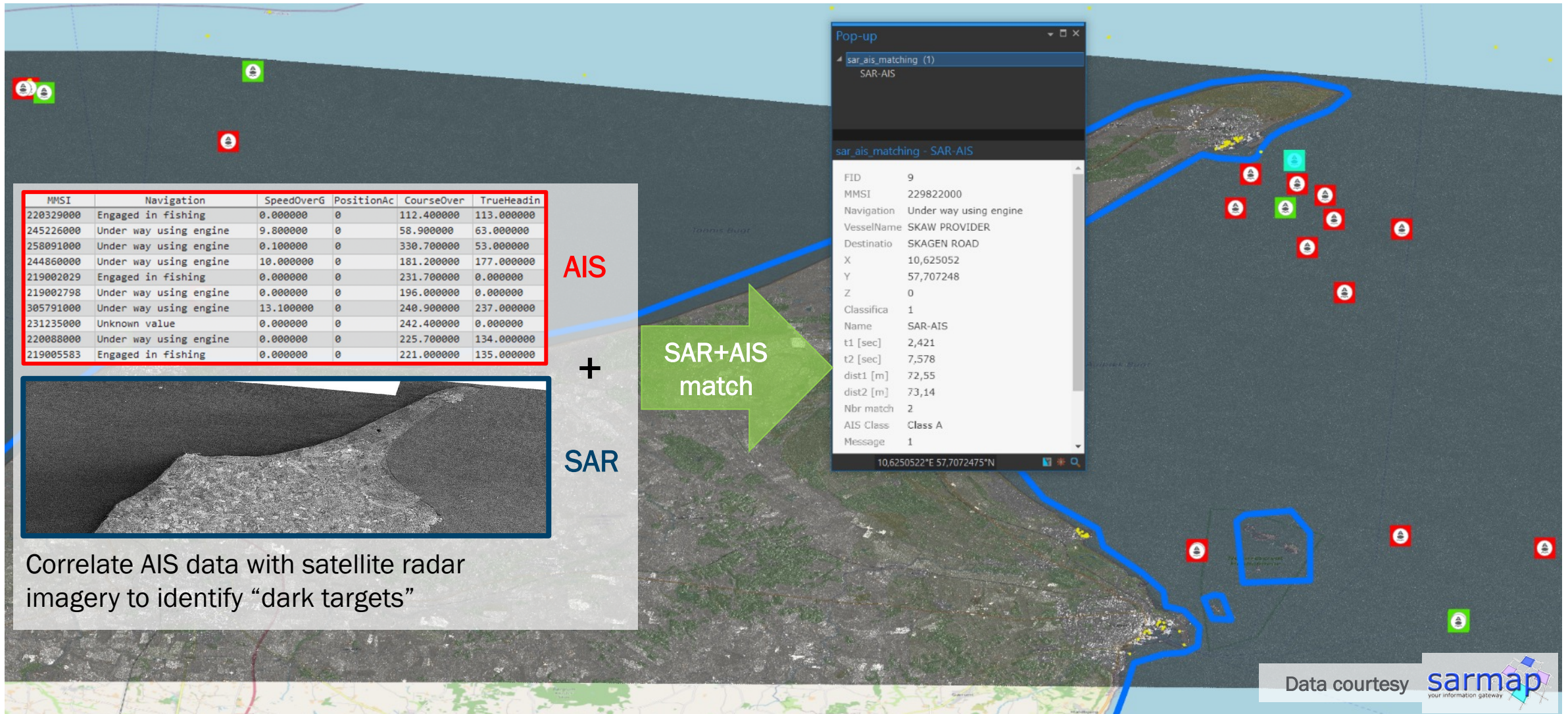
21st March 2021:
67 ships detected from Sentinel-1 data

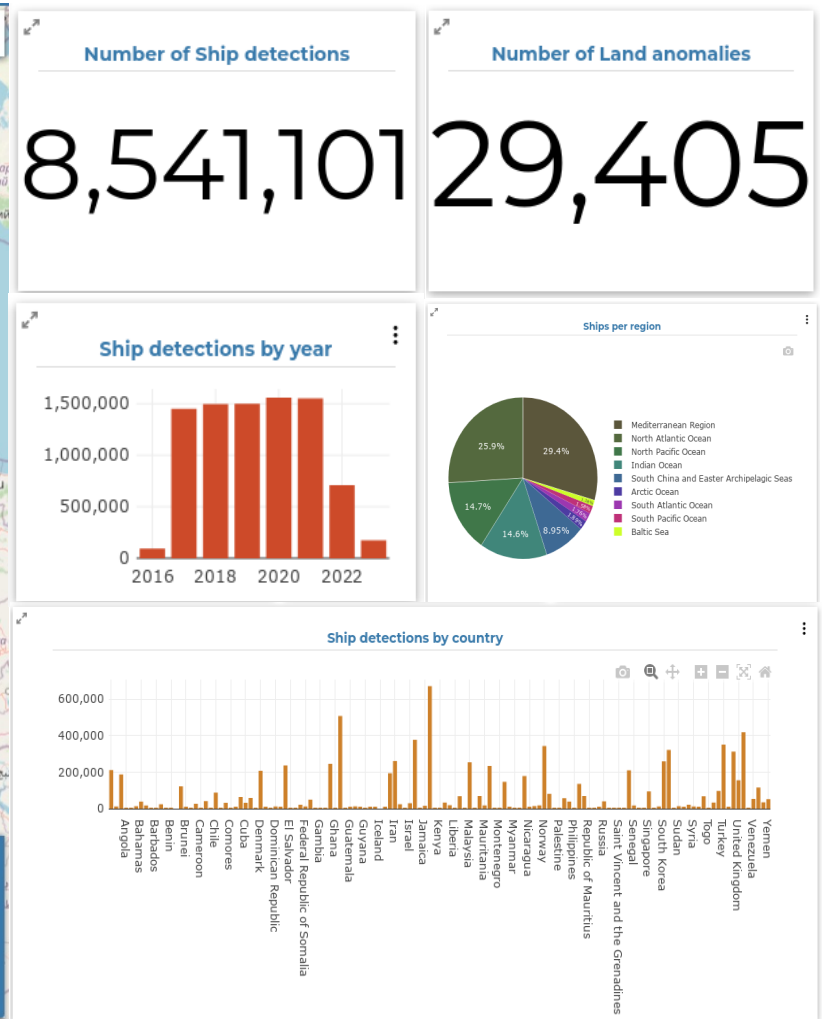
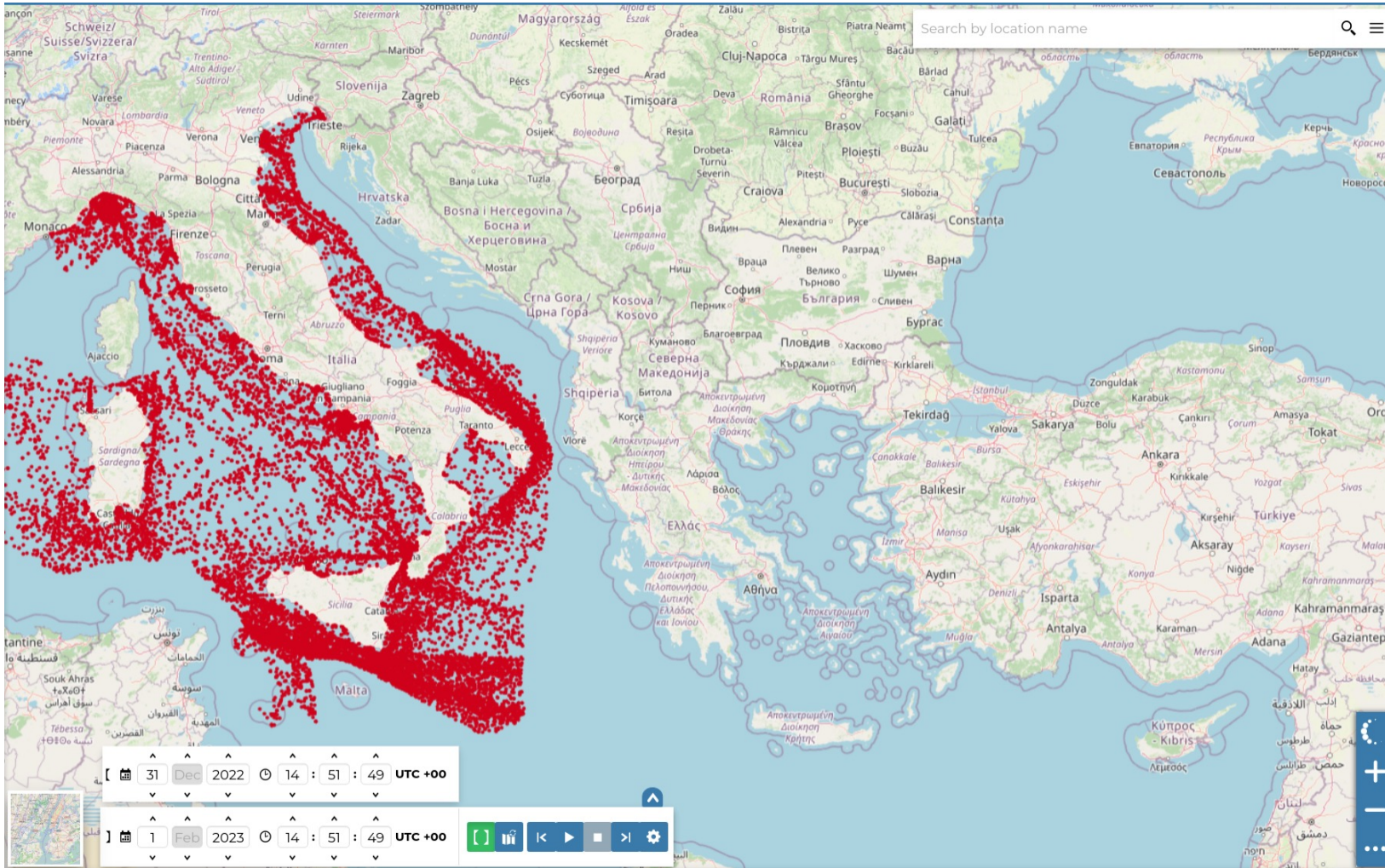
24th March 2021:
108 ships detected from Sentinel-1 data

25th March 2021:
151 ships detected from Sentinel-1 data




MONITORING GROUND ACTIVITIES – SHIP DETECTION & AIS

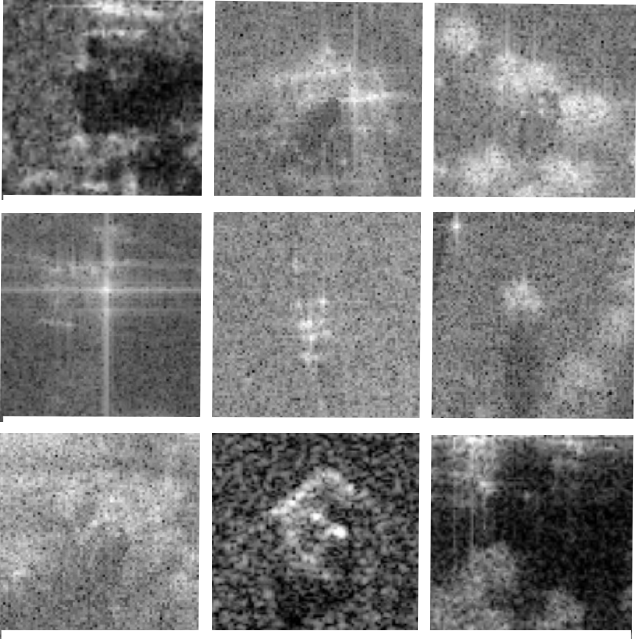







“SEEING” OBJECTS IN SAR

The SAR reCAPTCHA!

Select all images with 

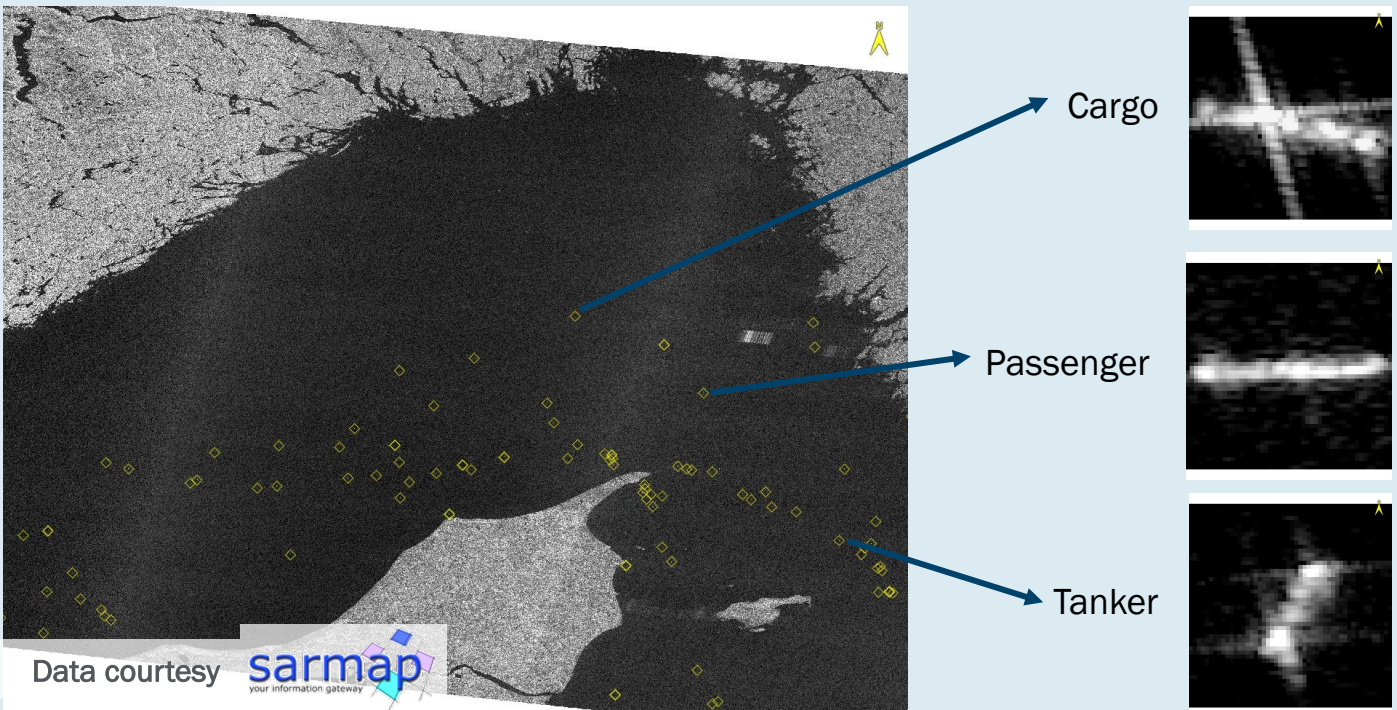




Want an easier challenge?

[Verify](#) Privacy - Terms

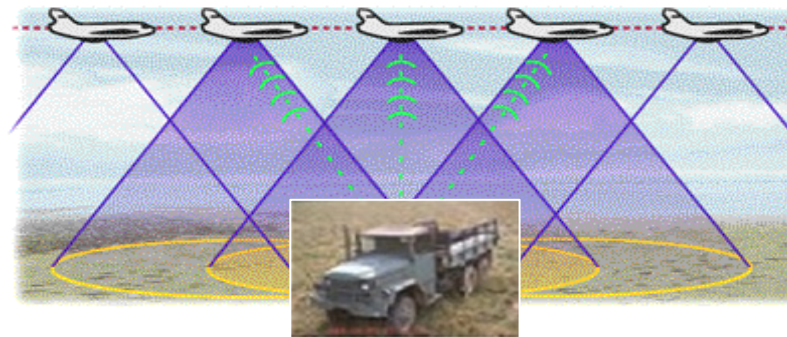


Cargo

Passenger

Tanker

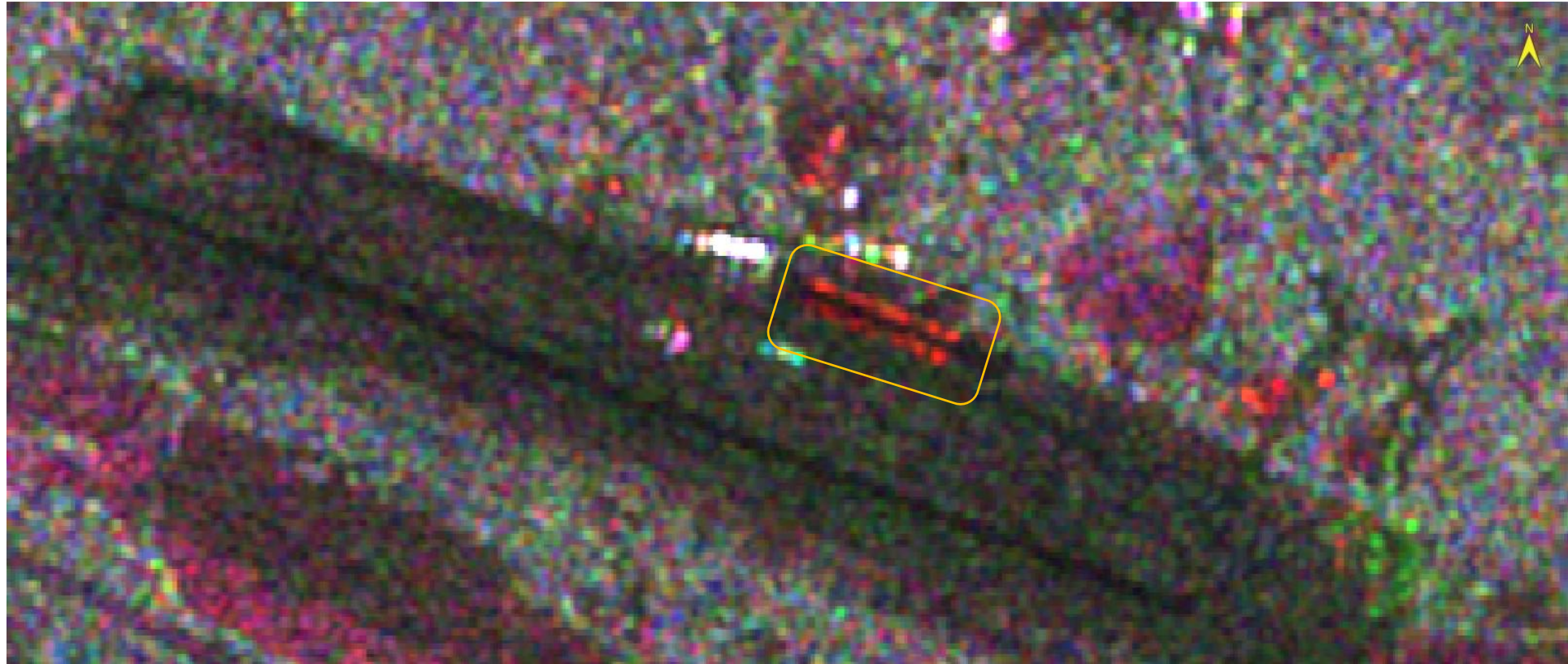
Data courtesy **sarmap**
your information gateway



What's the best way for a CNN to "see" objects in SAR?

RUSSIAN AIRBASE ACTIVITY FROM SENTINEL-1 SAR – JAN / FEB 2022

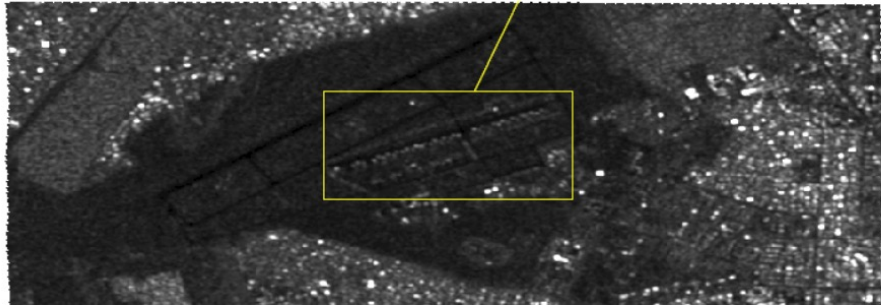
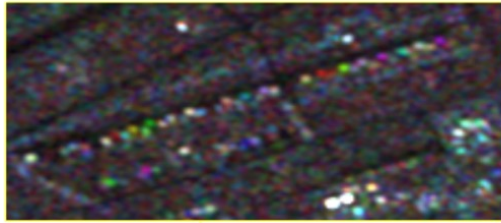
Luninets Airport (Belarus), Sentinel-1A false color composite (no speckle filtering)



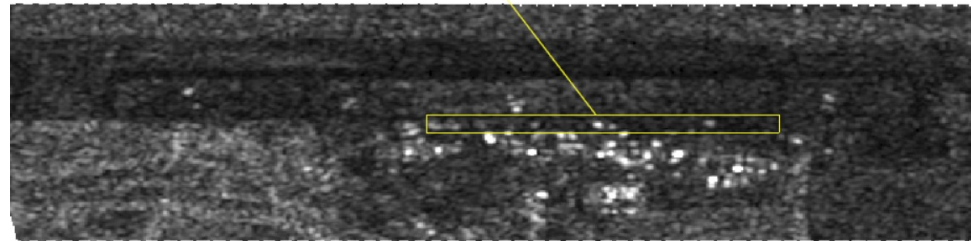
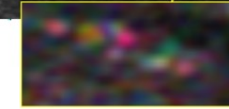
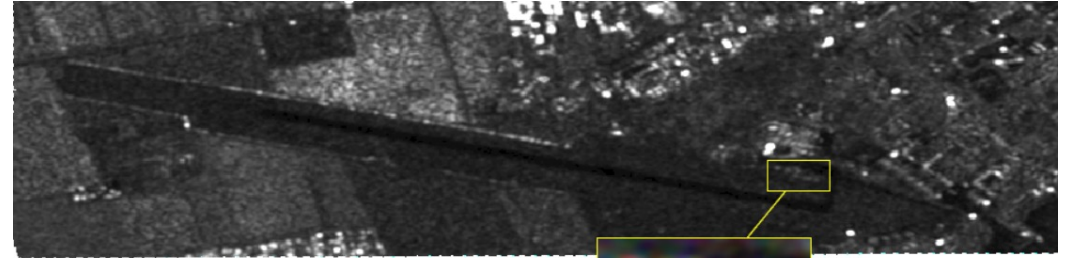
21 February, 28 January, 16 January 2022

RUSSIAN AIRBASE ACTIVITY FROM SENTINEL-1 SAR – JAN / FEB 2022

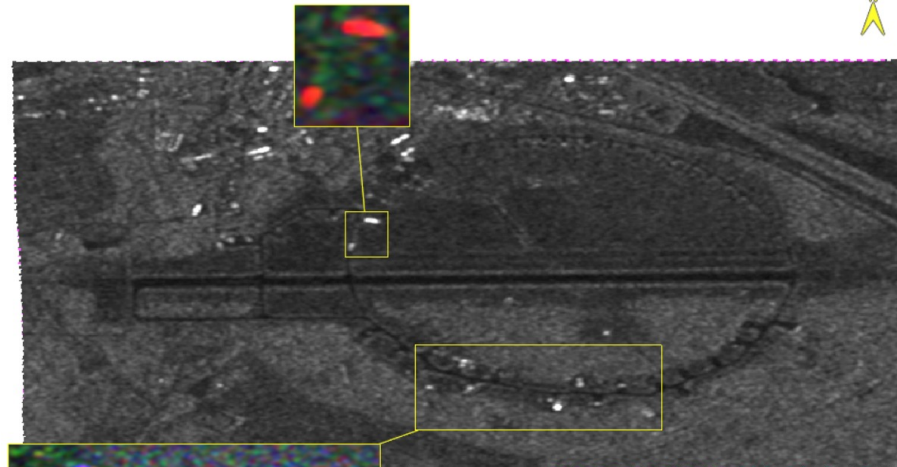
Taganrog,
northern
airbase, Russia



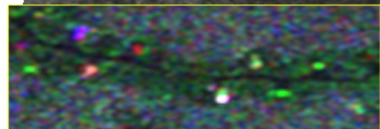
Taganrog,
southern
airbase,
Russia



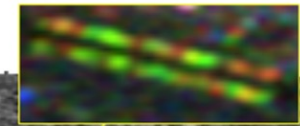
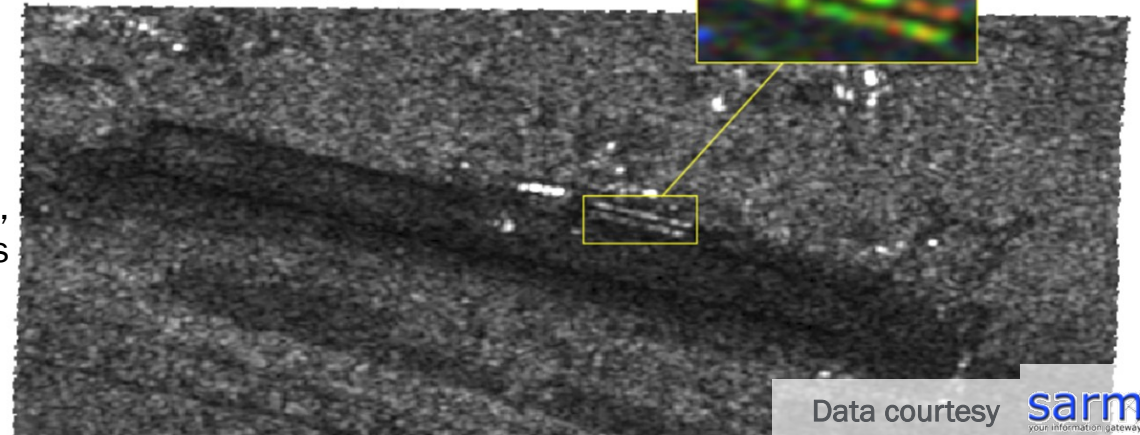
Millerovo,
Russia



Seshcha, Russia

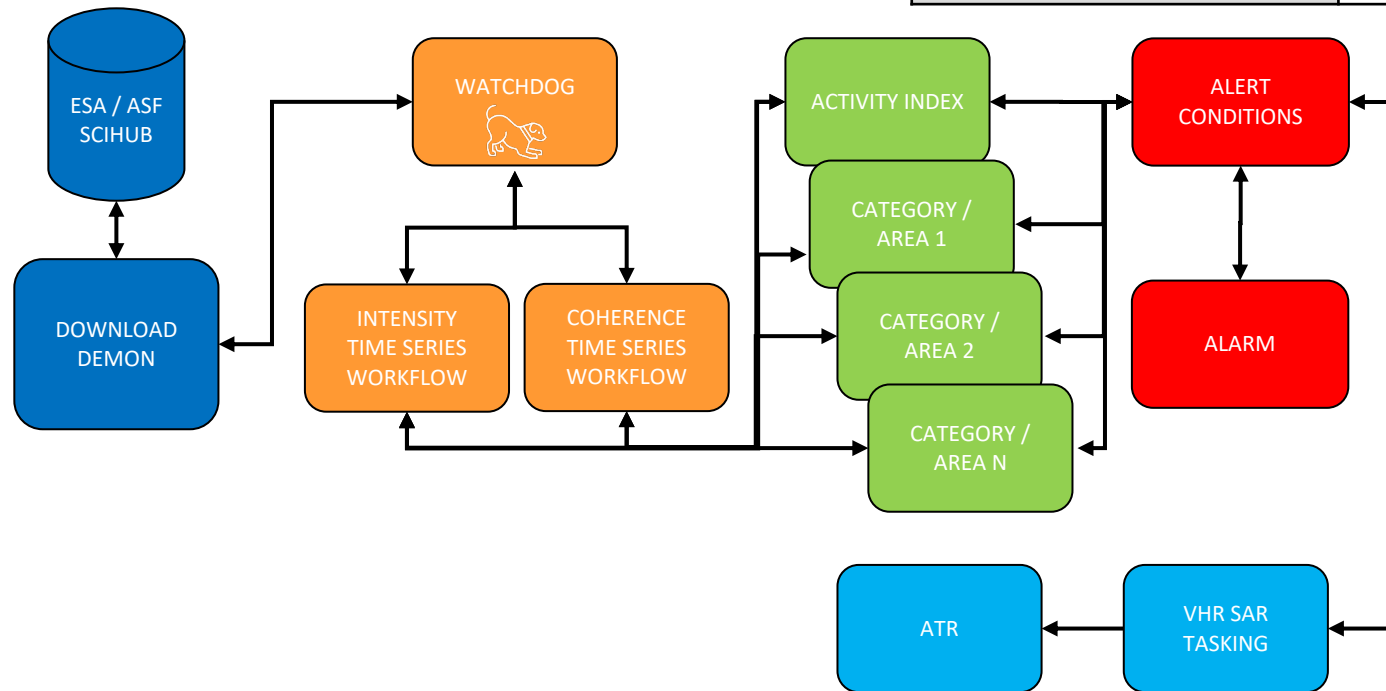


Luninets,
Belarus



AUTOMATIC INTENSITY TIME SERIES ANALYSIS

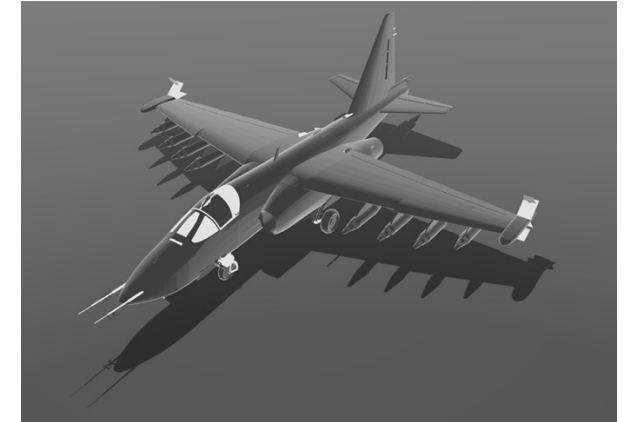
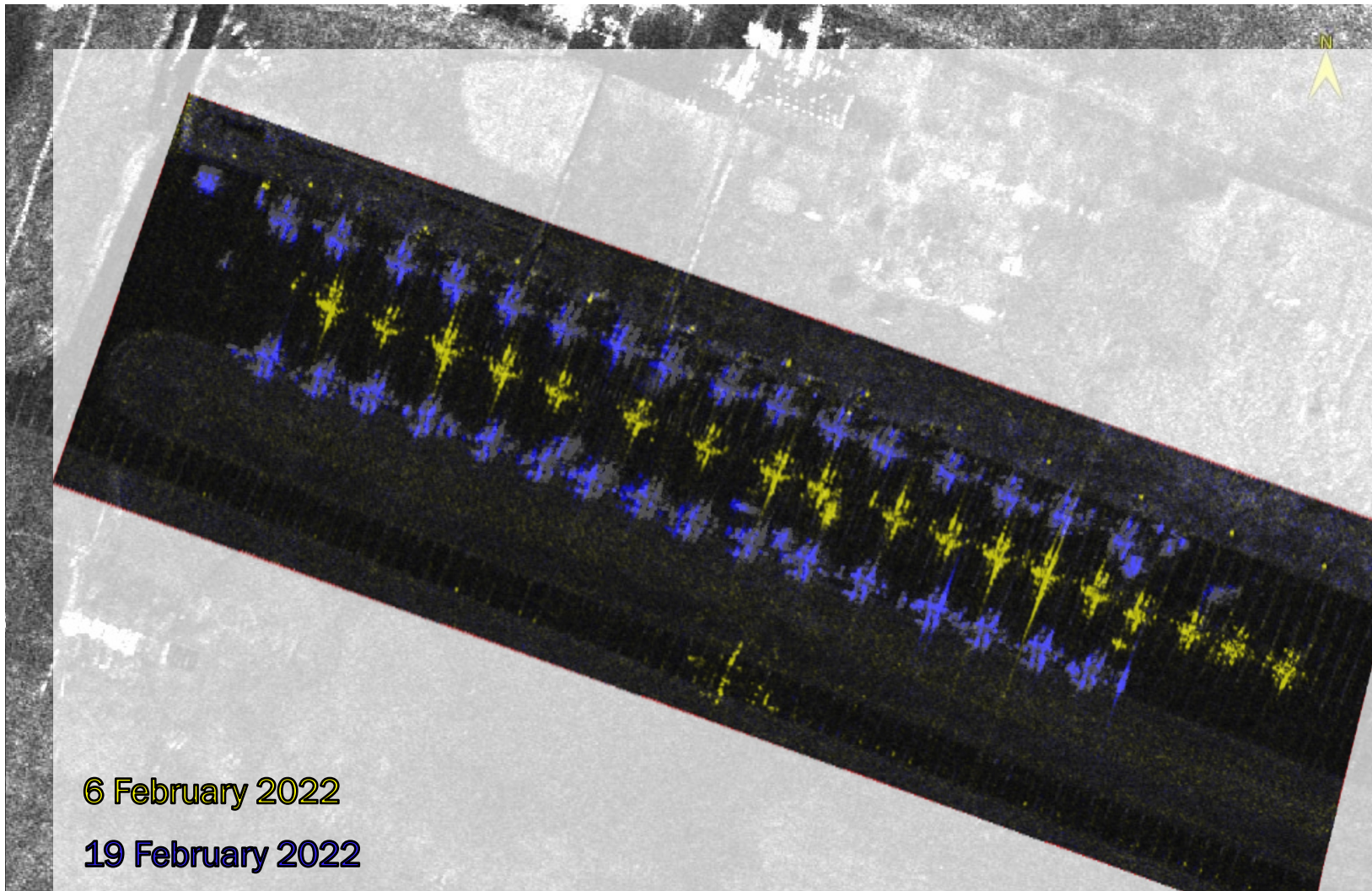
Watchdog V. 2.0



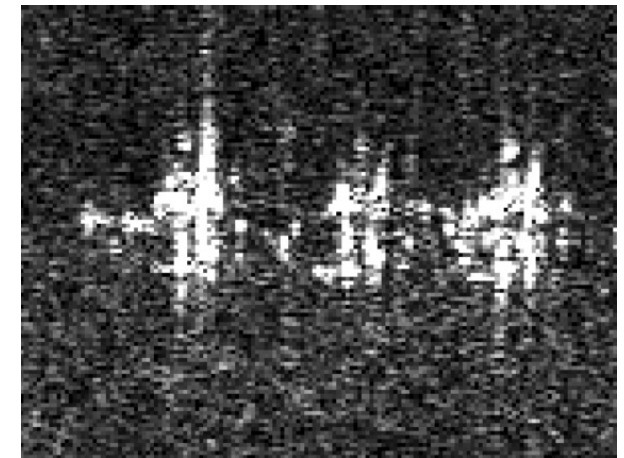
Activity index(es)	s ⁰ image 2	s ⁰ image 2
s ⁰ image 1	Low Low	Low High
s ⁰ image 1	High Low	High High

RUSSIAN AIRBASE ACTIVITY – JAN / FEB 2022

Luninets Airport (Belarus), Capella Space, 19 February 2022



SU-25 3D Model

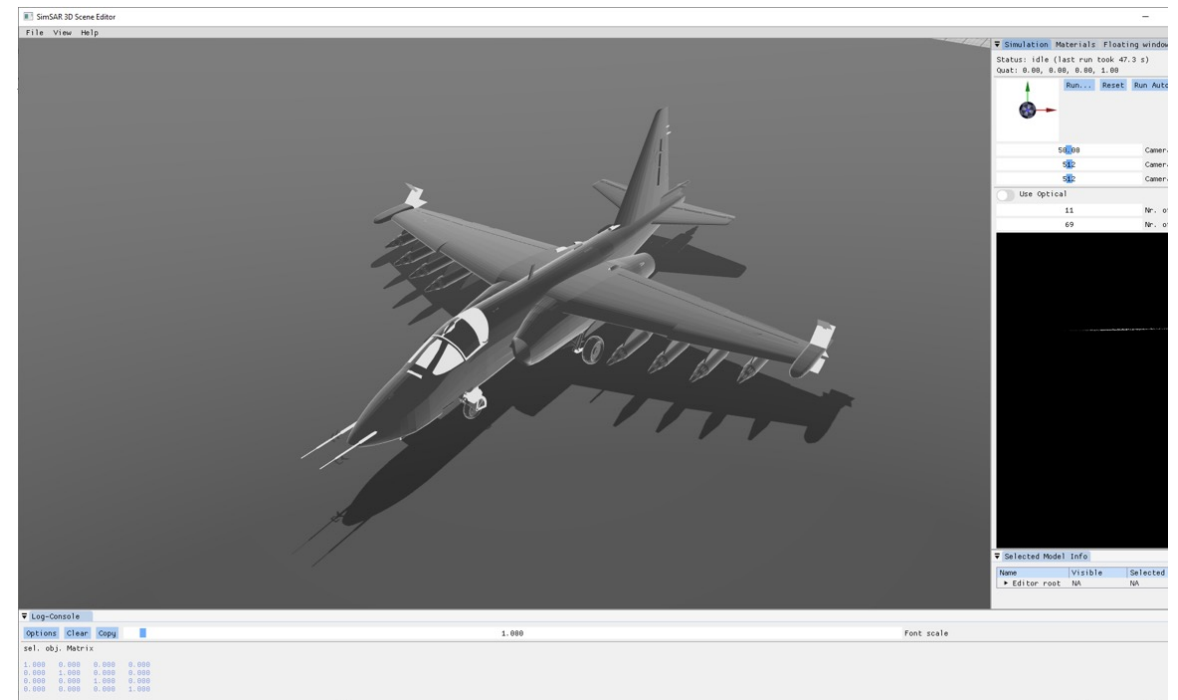


Capella Space imagery

Data courtesy  sarmap
your information gateway

SAR BASED SIMULATION AND OBJECT IDENTIFICATION

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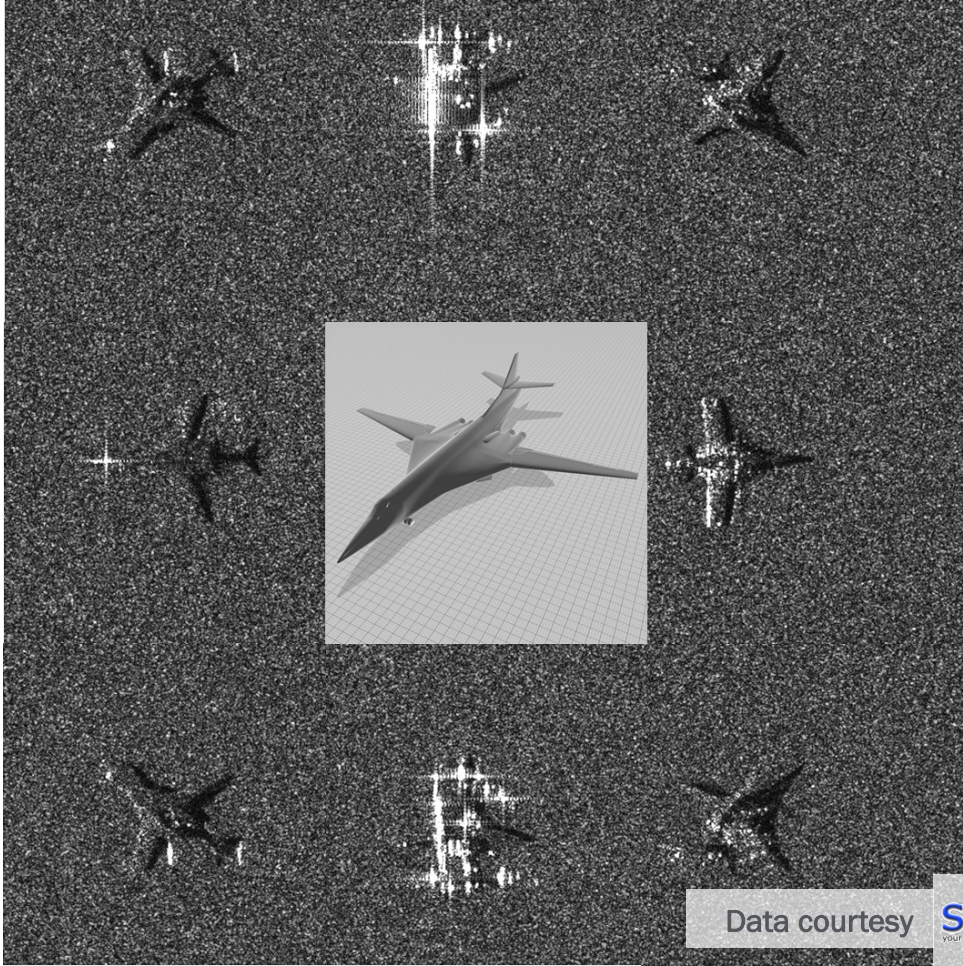


- Presence of Russian Su-25 Frogfoot ground attack airplanes in the Luninets airbase in Belarus as seen on February 22, 2022, from Capella SAR images at 0.5 m
- 3D model of the Frogfoot airplane to derive SAR images with different angular parameters for training Deep Learning Models

Data courtesy  sarmap
your information gateway

SAR BASED SIMULATION AND OBJECT IDENTIFICATION

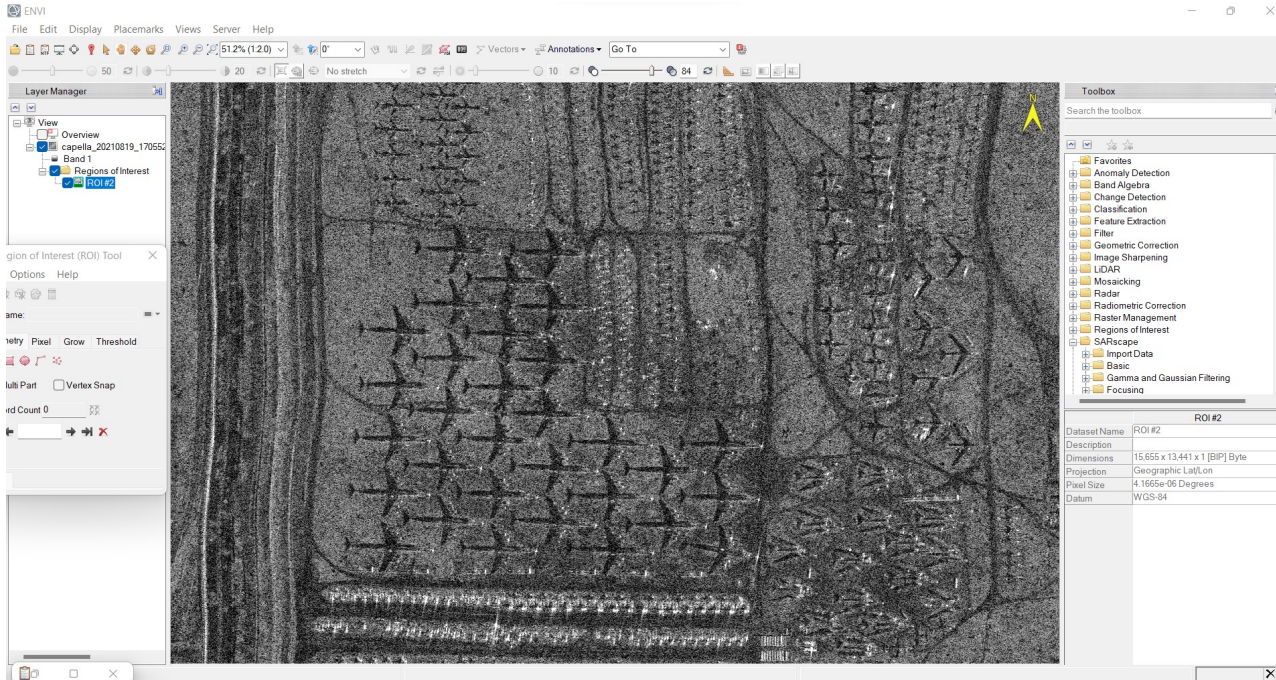
TU-160 Bomber



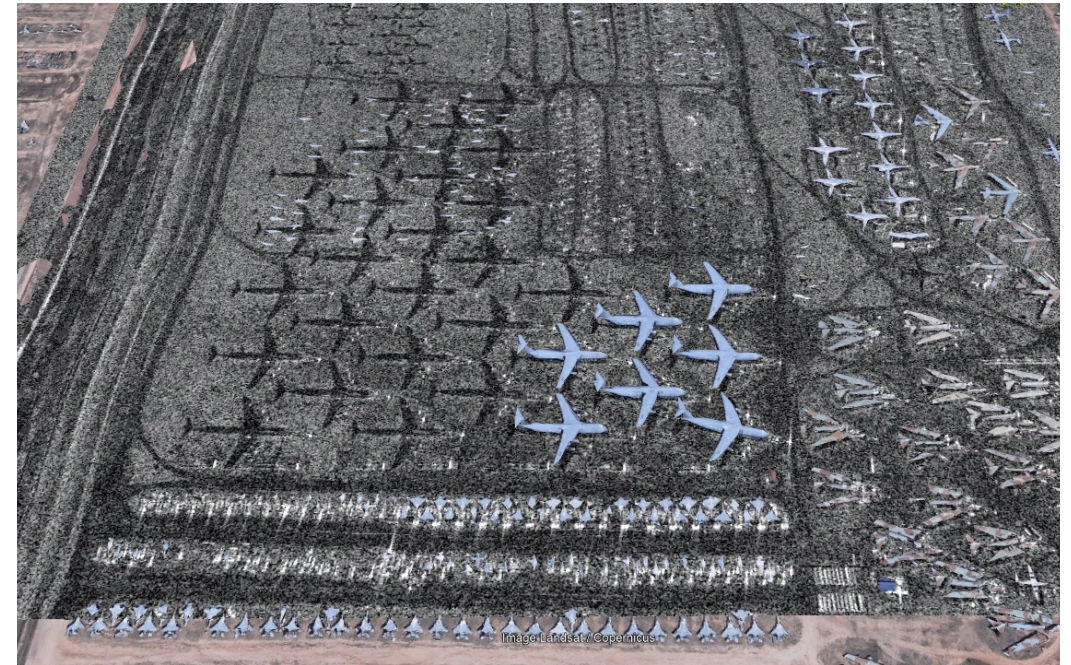
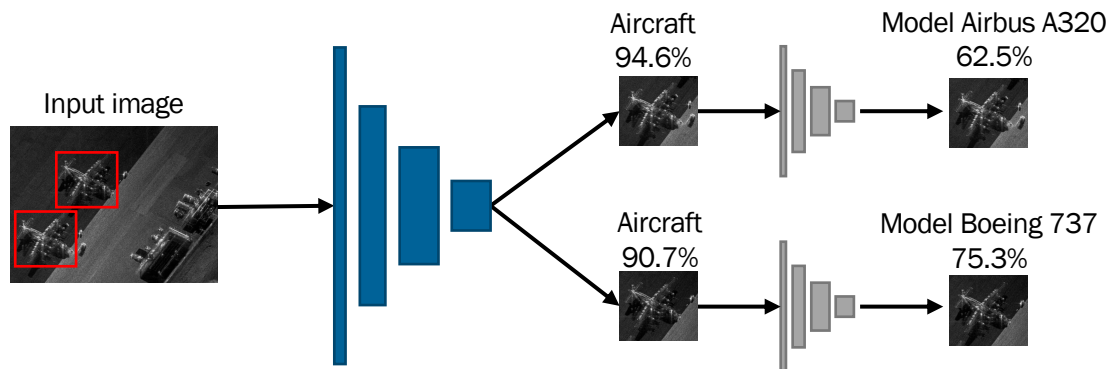
Data courtesy  sarmap
your information gateway

AUTOMATIC TARGET DETECTION / RECOGNITION WORKFLOW

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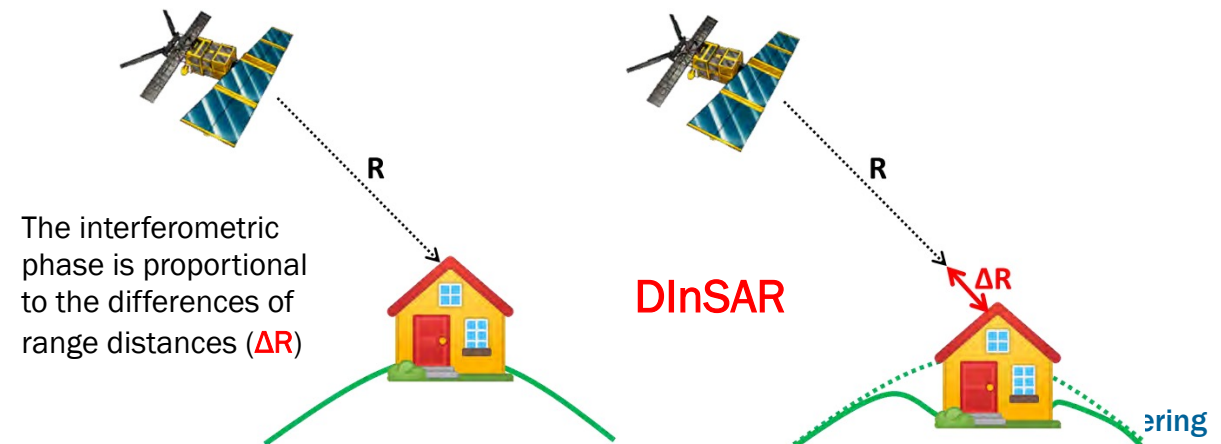
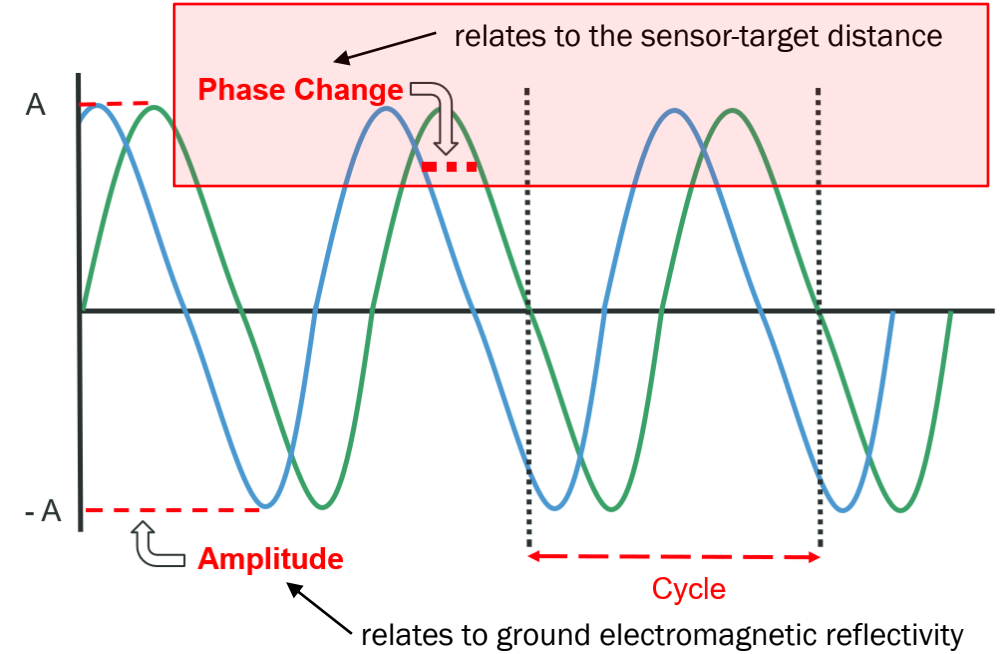
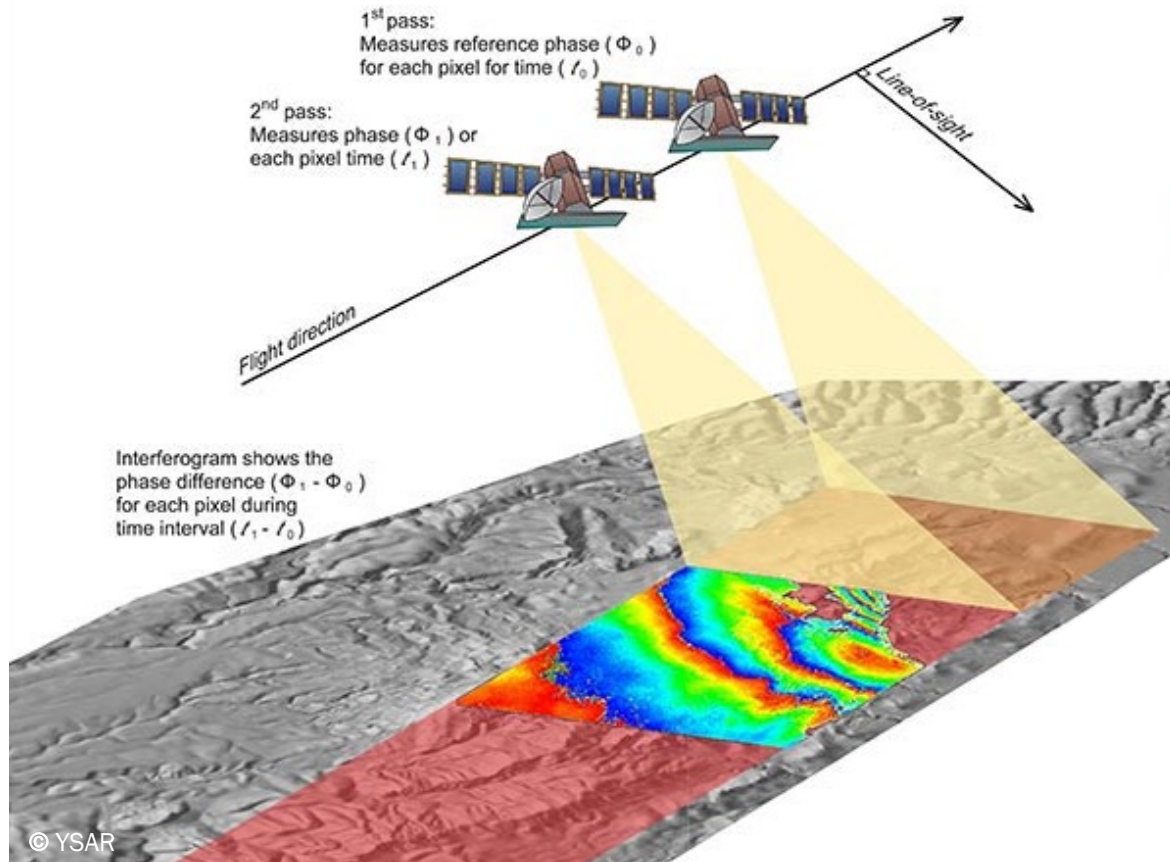


- **Detection expected output:** a bounding box containing each and every object of a specific type (e.g. aircraft) inside the current image.
- **Classification expected output:** for each bounding box, a label identifying the class inside the specific type.



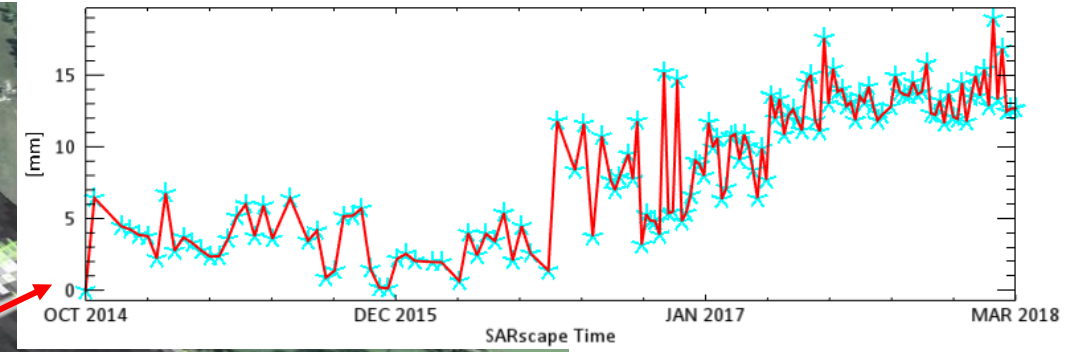
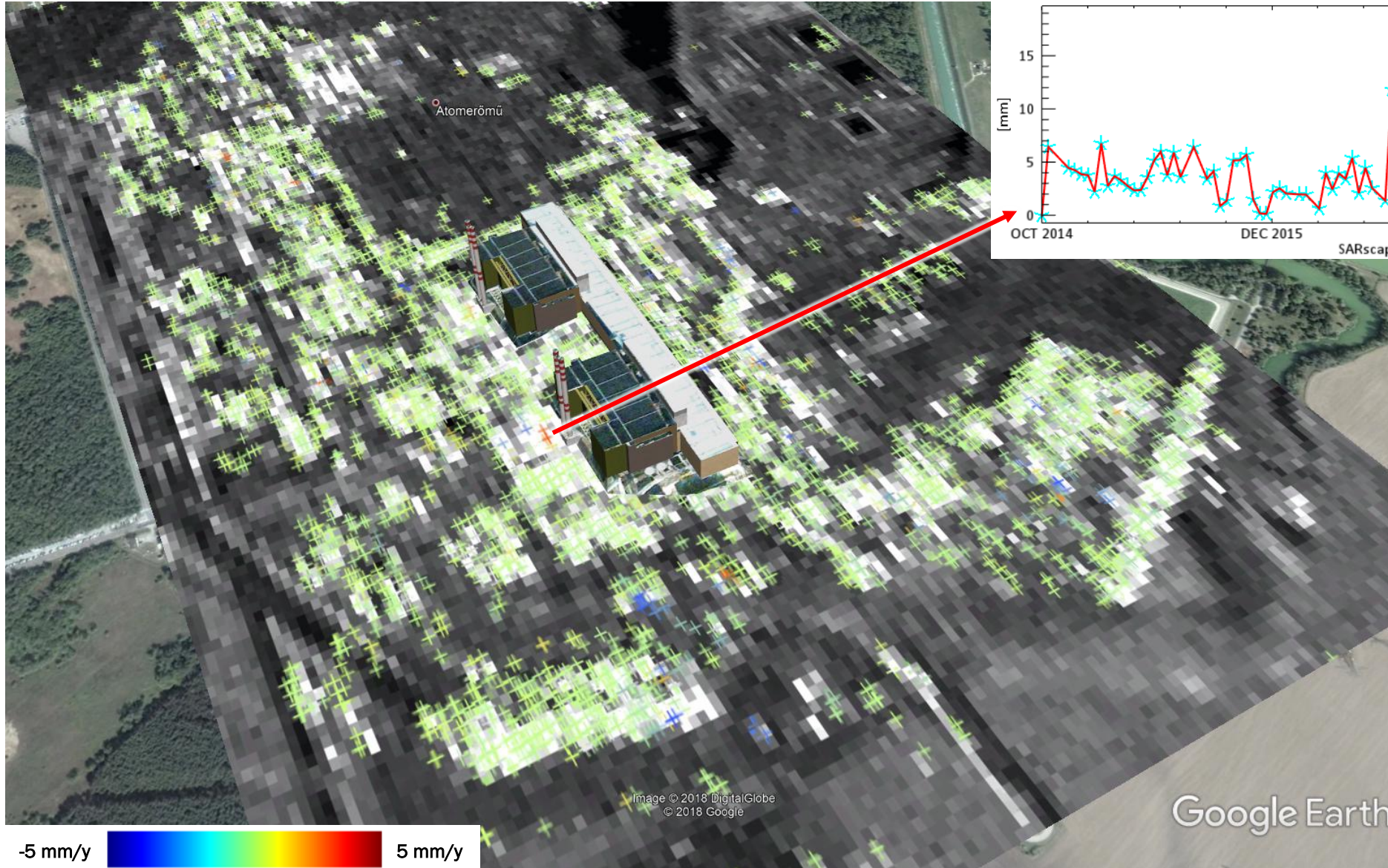
SAR INTERFEROMETRY

- A SAR image is a set of pixels characterized by both amplitude and phase values
- Through SAR interferometry, it is possible to reconstruct Topography (InSAR) or Land Movement (DInSAR)



STABILITY MONITORING OF INFRASTRUCTURE – NUCLEAR POWER PLANT

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Sentinel-1
Persistent
Scatterers
Interferometry
indicates land
uplift at
nuclear power
plant site

Data courtesy  sarmap
your information gateway

NV5.COM | Beyond Engineering

ENVI INSIGHT | MONITORING TAILINGS DAMS

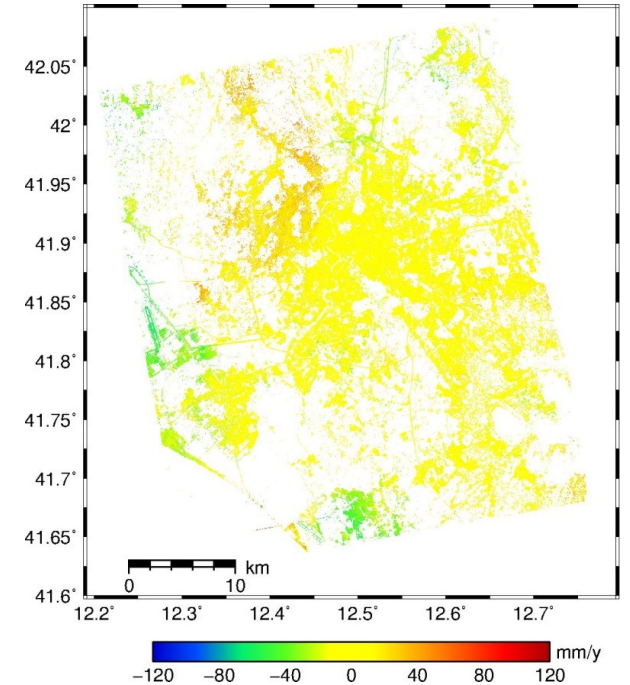
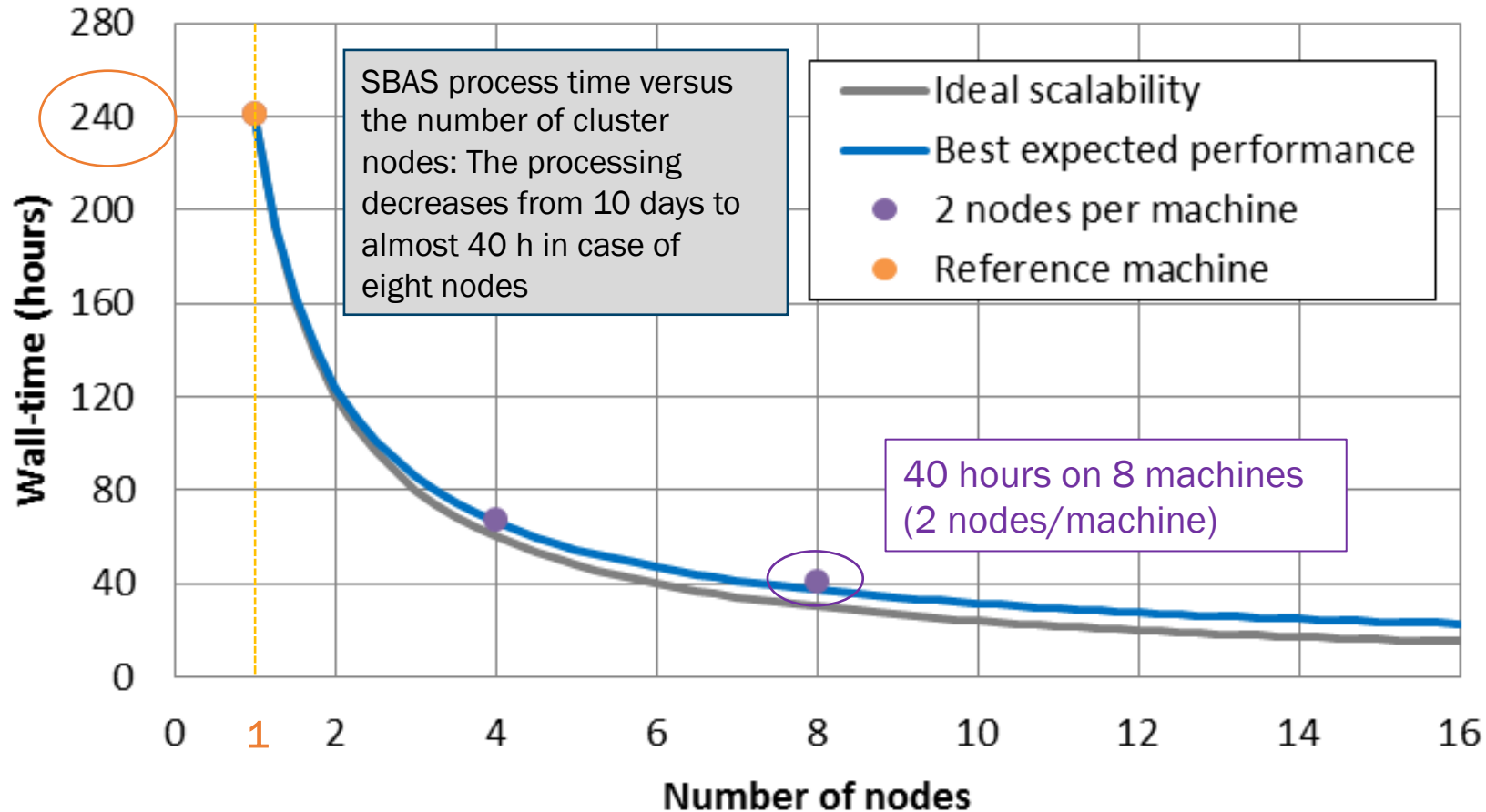


Source: ENVI Insight in Action: Monitoring Tailings Dams:

<https://www.l3harrisgeospatial.com/Learn/Case-Studies/Case-Studies-Detail/ArtMID/10204/ArticleID/24276/ENVI-Insight-in-Action-Monitoring-Tailings-Dams>

10 days on
1 machine!

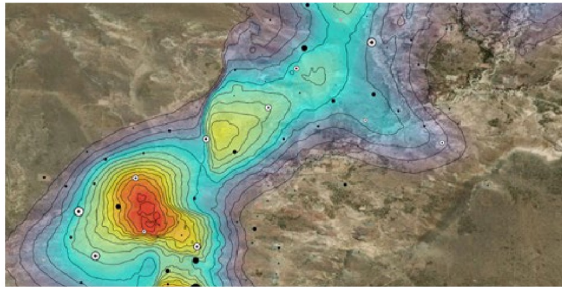
SBAS end-to-end performance



- COSMO-SkyMed 25-image stripmap stack
- 30 km x 40 km urban area (Rome, Italy)
- 150 interferograms
- DEM-assisted co-registration
- 3 x 3 multilooking
- 2D phase unwrapping
- 5 m x 5 m geooding

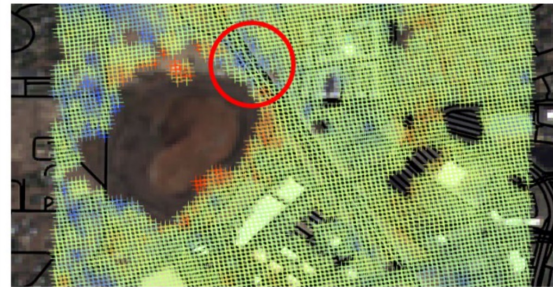
APPLICATIONS OF SYNTHETIC APERTURE RADAR (SAR)

LANDSLIDES



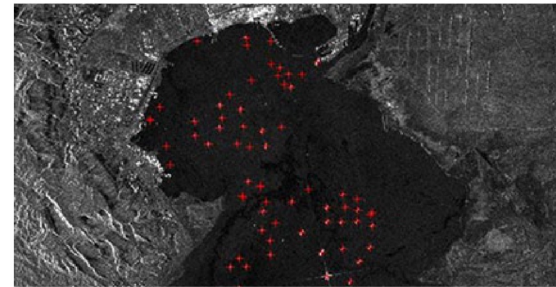
Map and measure surface movement caused by human activity or from natural causes.

SUBSIDENCE



Monitor surface subsidence to understand the effects of tectonic and human activities.

SHIPPING



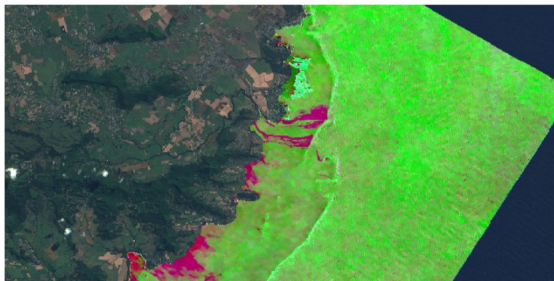
Detect and identify ships (including dark vessels and semi-submersibles) and perform maritime surveillance.

AGRICULTURE



Measure plant health, growth and biomass even in areas with frequent rain and cloud cover.

OIL SPILLS



Detect and monitor oil spills and map their extent.

DEFORESTATION



Monitor and calculate deforestation and forest degradation and analyze the impact.

FLOODING



Gather timely information and calculate flood extent to respond to and mitigate effects from floods.

ACTIVITY MONITORING



Understand activity patterns and changes to the patterns to support Activity Based Intelligence (ABI).

CONTACT DETAILS

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A suite of solutions to fit your needs

