

REMOTE SENSING LABORATORY

<http://www.survey.ntua.gr/en/rslab>

Demetre Argialas
Director

Lia Karathanasi

Konstantinos
Karantzalos



RSLab

Remote Sensing Laboratory
National Technical University of Athens

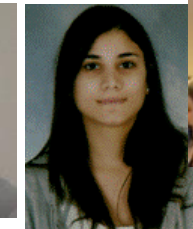


✓ Sensing ✓ Analytics ✓ Monitoring





People



- ✓ Common goals
- ✓ Complementary skills, interests, synergy
- ✓ Always nice, smooth and close co-operation

Faculty

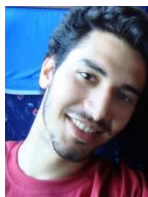
- ❖ Prof. Argialas
- ❖ Prof. Karathanassi
- ❖ As. Prof. Karantzalos
- ❖ Em. Prof. Rokos

Educational Personnel

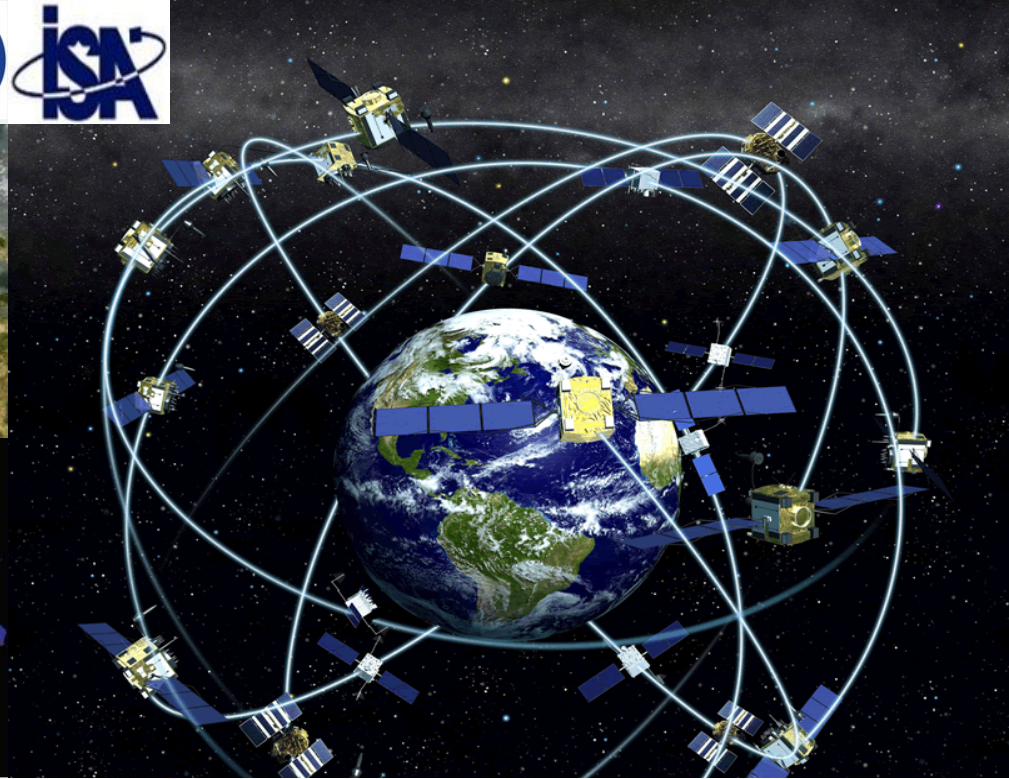
- ❖ V. Andronis
- ❖ C. Iossifides
- ❖ Dr. P. Kolokoussis
- ❖ K. Vassili-Vassiliou

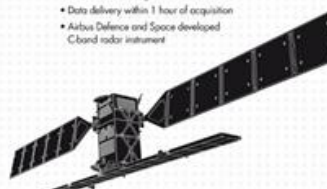





Researchers (PhD, etc)

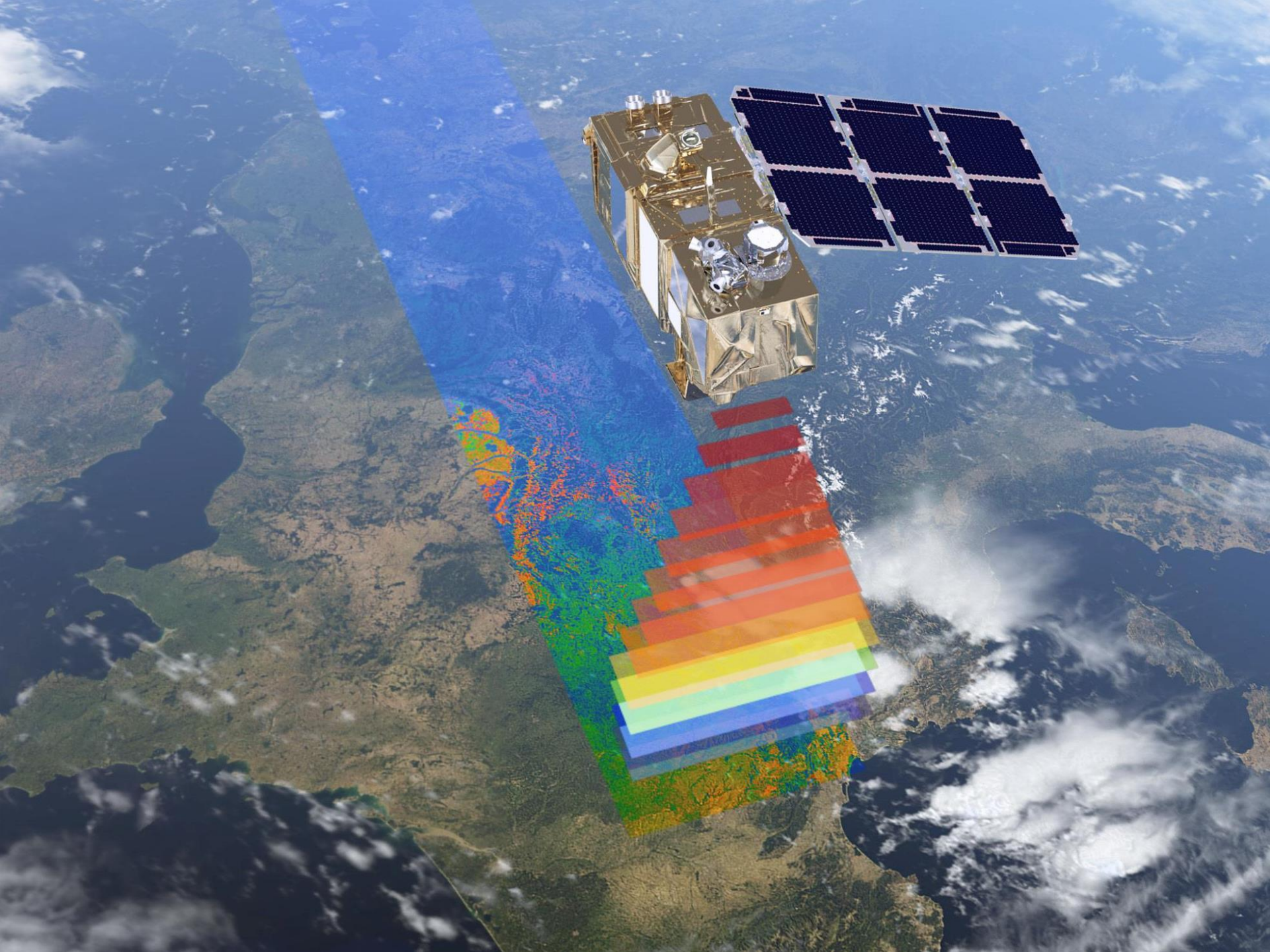
- ❖ M. Dekavalla
- ❖ M. Papadomanolaki
- ❖ A. Sakellari
- ❖ P. Sismanidis
- ❖ A. Vaiopoulos
- ❖ C. Karakizi
- ❖ Z. Kandylakis

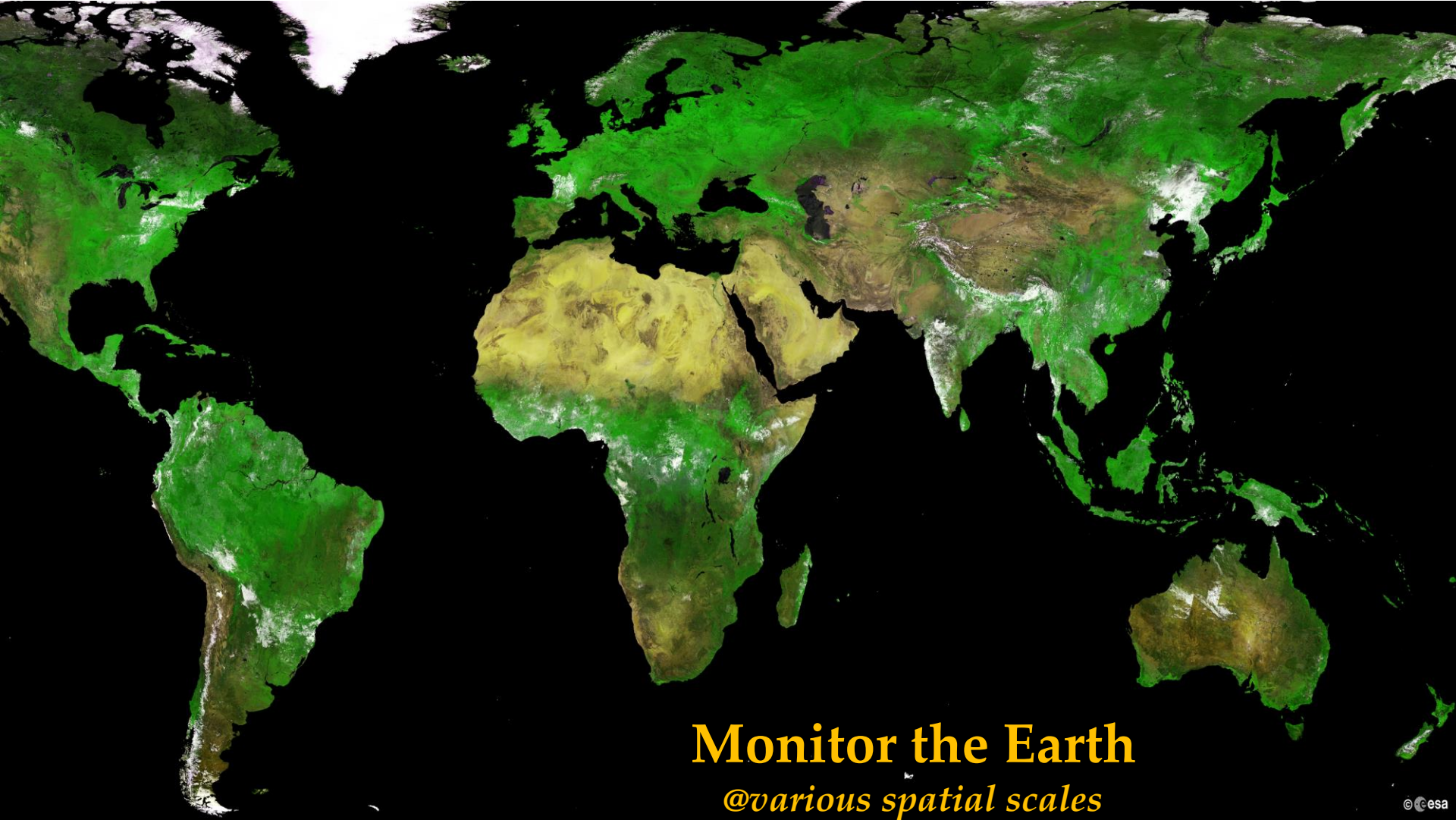


Remote Sensing Platforms

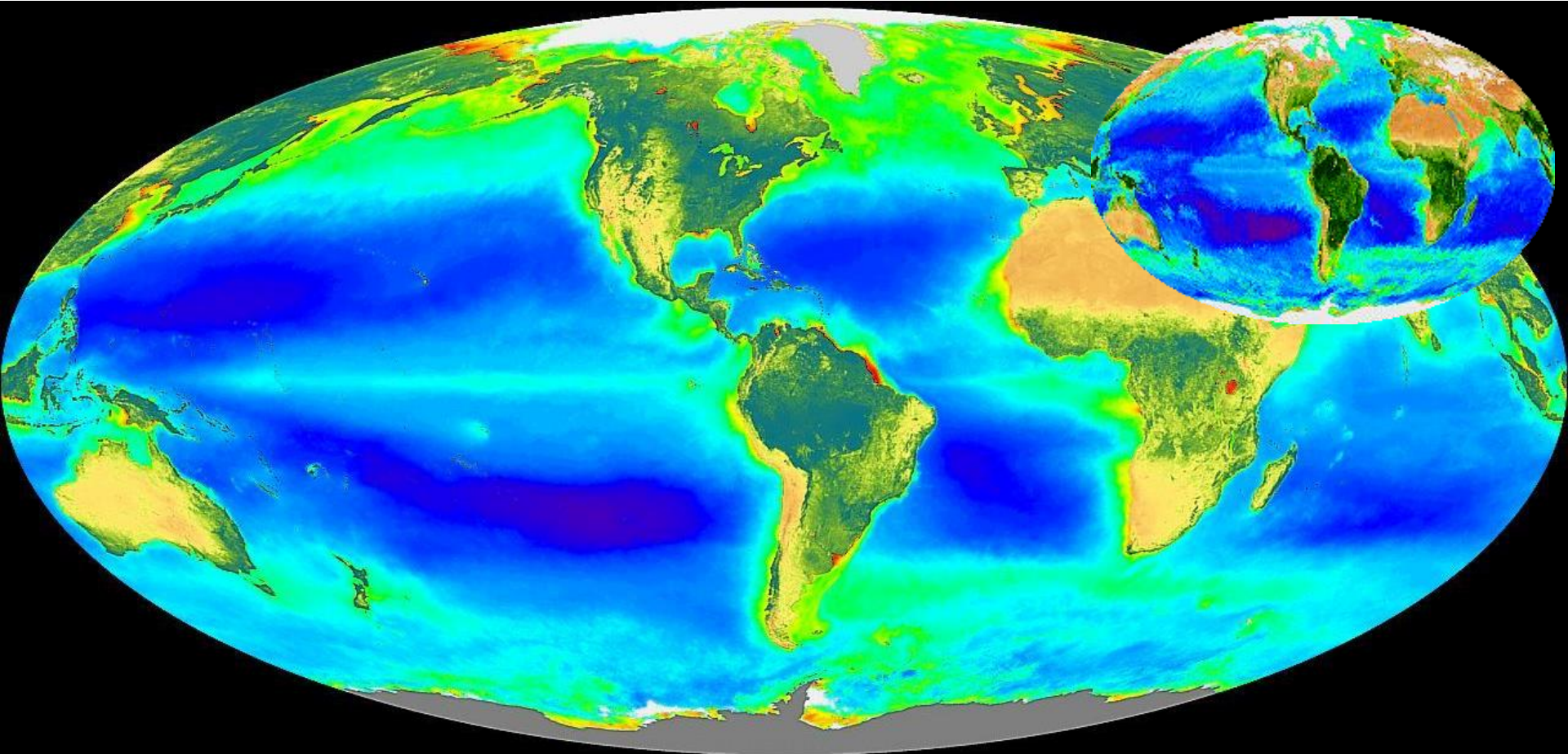


SENTINEL-1A/1B	SENTINEL-2A/2B	SENTINEL-3A/3B	SENTINEL-5P	SENTINEL-4	SENTINEL-5
<ul style="list-style-type: none"> All-weather, day-and-night radar imaging satellite for land and ocean services Able to "see" through clouds and rain Data delivery within 1 hour of acquisition Airbus Defence and Space developed C-band radar instrument 	<ul style="list-style-type: none"> Medium Res Multispectral optical satellite for observation of land, vegetation and water 13 spectral bands with 10, 20 or 60m resolution and 290km swath width Global coverage of the Earth's land surface every 5 days Airbus Defence and Space prime contractor for satellites and instruments 	<ul style="list-style-type: none"> Measures sea-surface topography with a resolution of 300 m, sea and land surface temperature and colour with a resolution of 1 km Measures water vapour, cloud water content and thermal radiation emitted by the Earth Determines global sea surface temperatures with an accuracy greater than 0.3 K Airbus Defence and Space supplies Microwave Radiometer 	<ul style="list-style-type: none"> Global observation of key atmospheric constituents, including ozone, nitrogen dioxide, sulphur dioxide and other environmental pollutants Improves climate models and weather forecasts Provides data continuously during five-year gap between the retirement of Envisat and the launch of Sentinel-5 Airbus Defence and Space prime contractor for satellites and TROPOMI instruments 	<ul style="list-style-type: none"> Provides hourly updates on air quality with data on atmospheric aerosol and trace gas concentrations Spatial sampling is 8 km and spectral resolution between 0.12 nm and 0.5 nm Airbus Defence and Space prime contractor for spectrometer Carried aboard EUMETSAT's Meteosat Third Generation (MTG) satellites 	<ul style="list-style-type: none"> Measures air quality and solar radiation, monitors stratospheric ozone and the climate Global coverage of Earth's atmosphere with an unprecedented spatial resolution Airbus Defence and Space prime contractor for instrument Carried aboard EUMETSAT's MetOp Second Generation satellites
 <p>2014: Sentinel-1A 2015: Sentinel-1B</p>	 <p>2014: Sentinel-2A 2015: Sentinel-2B</p>	 <p>2014: Sentinel-3A 2015: Sentinel-3B</p>	 <p>2015: Sentinel-5P</p>	 <p>2020: Sentinel-4 with Meteosat-TG</p>	 <p>2020: Sentinel-5 with MetOp-SG</p>





Monitor the Earth
@various spatial scales



>0.1 .02 .05 .1 .2 .3 .5 1 2 3 5 10 15 20 30 50
Ocean: Chlorophyll *a* Concentration (mg/m³)

Maximum Minimum
Land: Normalized Difference Land Vegetation Index

Scientific Field & Research Interests (1/3)



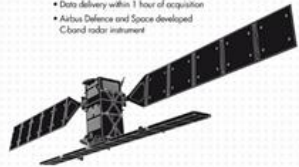
Core Expertise:

✓ Platforms



SENTINEL-1A/1B

- All-weather, day-and-night radar imaging satellite for land and ocean services
- Able to "see" through clouds and rain
- Daily delivery within 1 hour of acquisition
- Airbus Defence and Space developed C-band radar instrument



2014: Sentinel-1A
2015: Sentinel-1B

SENTINEL-2A/2B

- Medium Res Multispectral optical satellite for observation of land, vegetation and water
- 13 spectral bands with 10, 20 or 60 m re and 290km swath width
- Global coverage of the Earth's land surface every 5 days
- Airbus Defence and Space prime contractor for satellites and instruments



2014: Sentinel-2A
2015: Sentinel-2B

SENTINEL-3A/3B

- Measures sea-surface topography with a resolution of 300m, sea and land surface temperature and colour with a resolution of 1km



2014: Sentinel-3A
2015: Sentinel-3B

SENTINEL-5P

- Global observation of key atmospheric constituents, including ozone, nitrogen dioxide, sulphur dioxide and other environmental pollutants
- Improves climate models and weather forecasts
- Provides data continuously during lifetime gap between the retirement of Envisat and the launch of Sentinel-5
- Airbus Defence and Space prime contractor for satellite and TROPOMI instrument



2015: Sentinel-5P

SENTINEL-4

- Provides hourly updates on air quality with data on atmospheric aerosol and trace gas concentrations
- Spatial sampling is 8km and spectral resolution between 0.12 nm and 0.5 nm
- Airbus Defence and Space prime contractor for spectrometer
- Carried aboard EUMETSAT's Meteosat Third Generation (MTG) satellite



2020: Sentinel-4 with Meteosat-TG

SENTINEL-5

- Measures air quality and solar radiation, monitors stratospheric ozone and the climate
- Global coverage of Earth's atmosphere with an unprecedented spatial resolution
- Airbus Defence and Space prime contractor for instruments
- Carried aboard EUMETSAT's MetOp Second Generation satellite



2020: Sentinel-5 with MetOp-SG

PLANET LABS

Scientific Field & Research Interests (1/3)

Core Expertise:

- ✓ **Sensors:** Multispectral, Hyperspectral, SWIR, Thermal, Lidar
Push-broom/line-scanning & Snapshot/Frame/Video



Cooperation with industry

ximea

3D-ONE

FLIR

Xenics
Infrared Solutions

Headwall
PHOTONICS

imec

Scientific Field & Research Interests (1/3)

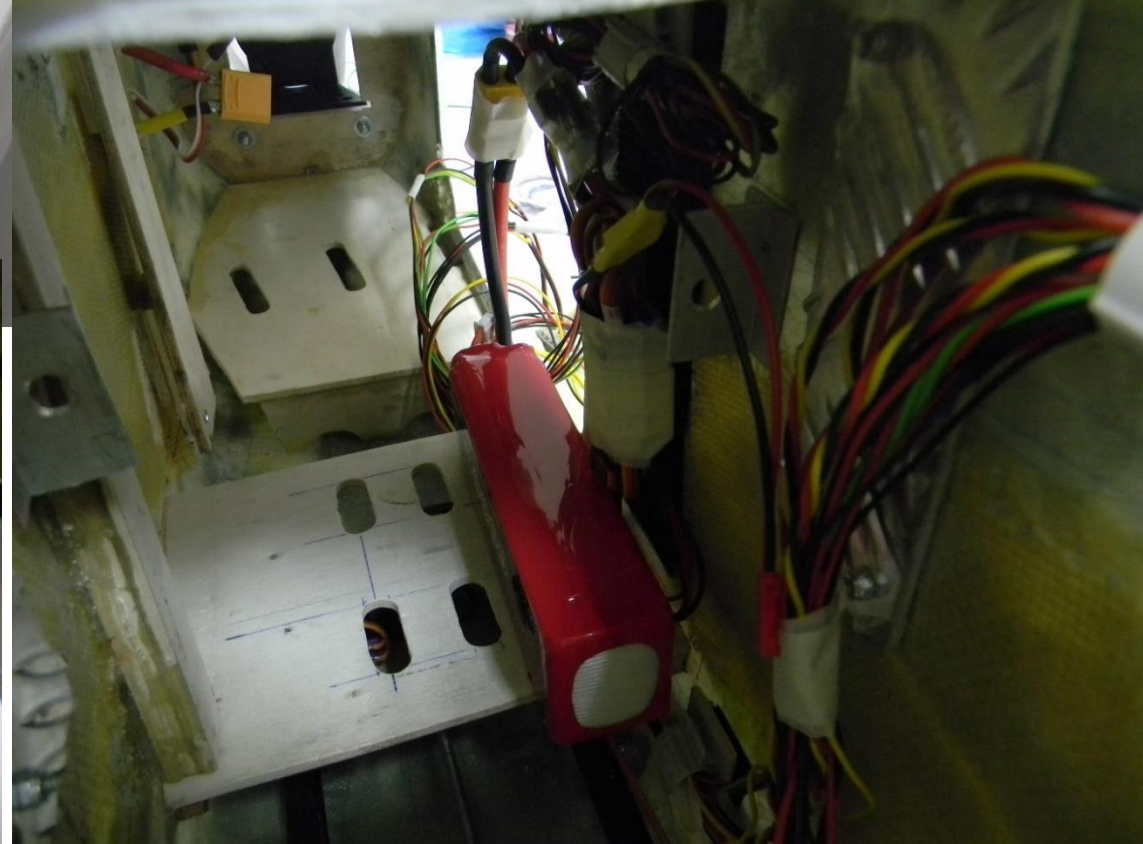
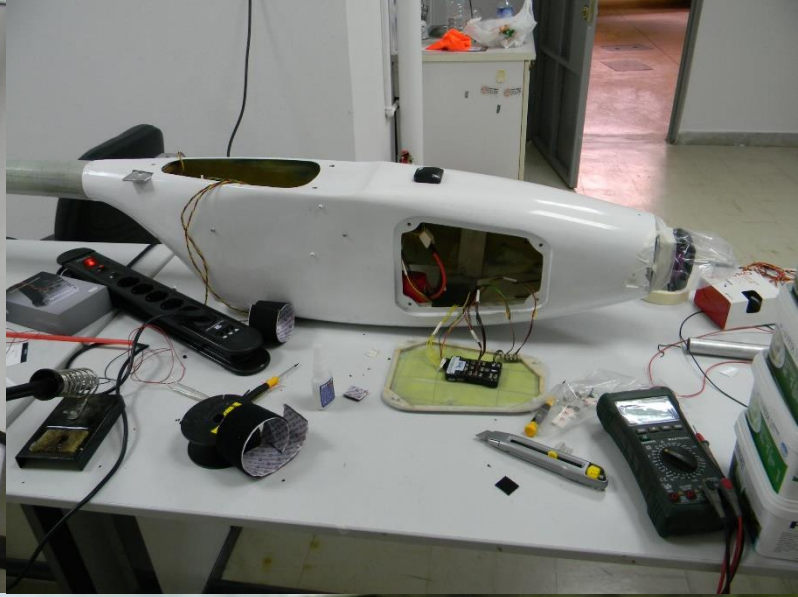
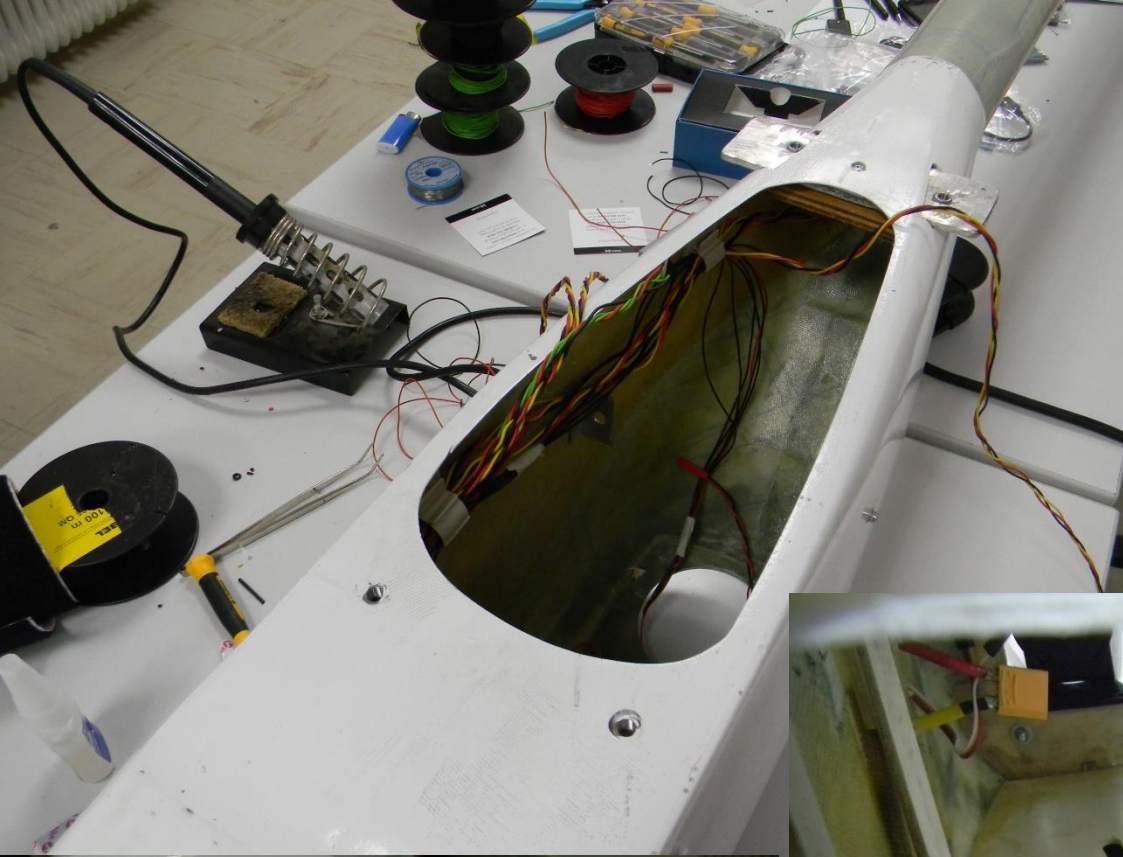
- ✓ Αερομεταφερόμενος υπερφασματικός δέκτης **CASI-550** (ITRES, Canada)
- ✓ Αερομεταφερόμενος θερμικός δέκτης **TABI-320** (ITRES, Canada)
- ✓ Υπερφασματικός δέκτης **Micro-Hyperspectral** VNIR Sensor (Headwall Photonics, USA)
- ✓ Υπερφασματικός δέκτης **IMEC Snapshot** mosaic
- ✓ Θερμική Tau-2 **FLIR**

- ✓ Onyxstar BAT-F8 8copter (**Altigator**, Belgium)
- ✓ Αερομεταφερόμενο σύστημα πλοήγησης Applanix POS/AV 410 (**Applanix**, Canada)
- ✓ Αερομεταφερόμενο σύστημα πλοήγησης CMIGITS III (**Systron** Donner, USA)

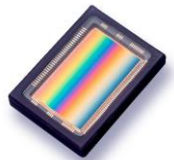
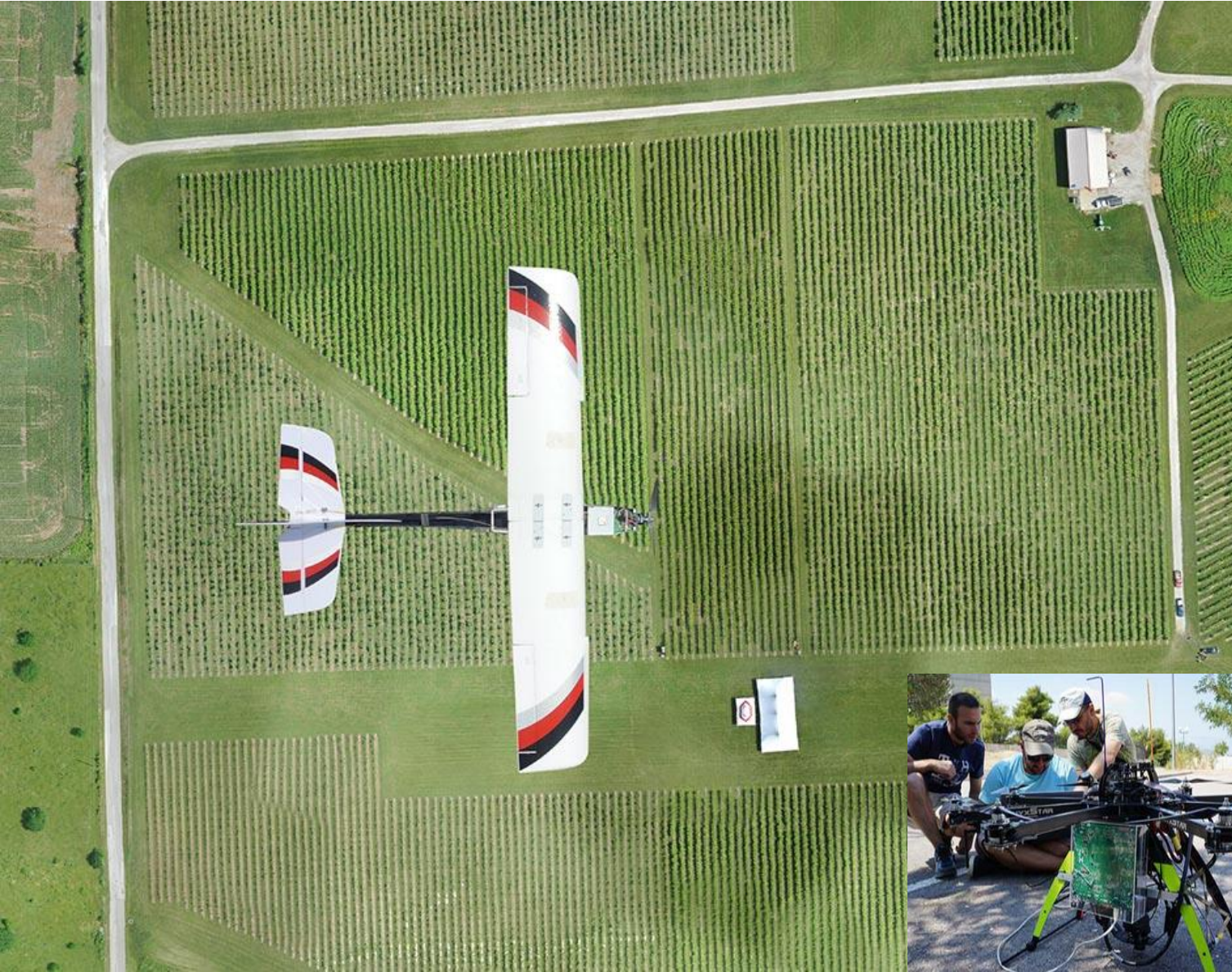


κτίριο Λαμπδαρίου





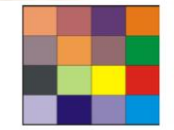
Remote Sensing Platforms



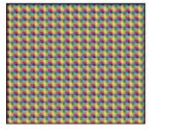
Continuous Line-scan



Custom Line-scan



Snapshot Tiled



Snapshot Bayer Mosaic



Ground/ Terrestrial Platforms



Scientific Field & Research Interests (2/3)

Methods & techniques:

- Atmospheric, Radiometric and Geometric corrections
- Multi-modal and Multi-temporal image fusion, integration
- Object detection & pattern recognition in 2D and 3D
- Data Segmentation and Classification
- Object-based data analysis
- Spectral unmixing methods
- Terrain analysis, scene modeling, model-based analysis
- SAR Interferometry

Scientific Field & Research Interests (3/3)

Applications:

- Forestry, vegetation, biodiversity studies
- Agriculture and precision agriculture
- Hydrology, oceanography, coastal zone management
- Atmospheric and weather studies
- Geology and geomorphology studies
- Monitoring and management of land and water resources
- Land use, human impact and ecosystem analyses
- Disaster monitoring, mitigation and damage assessment
- Infrastructure, transportation and communications studies
- Earth Observation activities to support sustainable and integrated development
- GIS, web-based applications, geospatial database update
- Open-source and open-data services

Research – Publications

(last 5 years)

- ✓ approx. 3 journal papers per year
- ✓ approx. 6 conference papers per year

30 peer-reviewed Journals/Book Chapters

- on Change Detection
- on Hyperspectral Data Processing
- on Object-based Image Analysis
- on Scale Space Filtering
- on Spectral Unmixing
- on Automatic Object Detection
- on Model-based Detection
- on Hyperspectral & Thermal Fusion
- on Urban-Peri Urban Monitoring
- on Oil-Spills
- on Man-Made/ Building Detection
- on Geomorphology
- on Coastal Zones/ Springs
- on Roads, Asphalt Condition
- on SAR Interferometry

32 Conference Publications (peer-reviewed & not)

Funding

- ✓ approx. 100K per year
- ✓ 4 projects directly funding PhD Theses

Recent Research projects

- **SEO-DWARF**: "Semantic EO Data WEB Alert and Retrieval Framework", H2020-MSCA-RISE-2015, Budget 1.584.000 €, 2015-2018.
- **LandMAP**: Multitemporal Land Use/ Land Cover Mapping at a National Scale from High Resolution Satellite Data with Deep Learning, IKY-Fellowships of Excellence – Siemens, 2016-2018
- **UrbanMonitor**: "Automatic Detection and Modelling of 2D and 3D Changes in the Urban Environment from Multi-Modal, Multi-Temporal Remote Sensing Data", European Social Fund (75%) and National Resources (25%), Budget: 600.000€, 2012 - 2015.
- **TeleKyoto**: "Vegetation Mapping and Biomass Estimation with Modern Remote Sensing Methods in Order to Fulfil the Country's Obligations Under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol", European Social Fund (75%) and National Resources (25 %), Budget: 600.000€, 2012 - 2015.
- **GNORASI**: "Knowledge and processing algorithms data-flow development tool for remote sensing data management", European Social Fund (75%) and National Resources (25%), Budget: 493.176€, 2010 - 2013.

Important funding increase (>30%) during the last 5 years

Equipment



- ✓ Airborne (Airplanes, UAVs)
& Field campaigns

Sensors

- VNIR Spectrographic Imaging System CASI-550 (ITRES, Canada)
- Thermal Imaging System TABI-320 (ITRES, Canada)
- Micro-Hyperspectral VNIR Sensor (Headwall Photonics, USA)

Platforms/Instruments

- MultiCopter Onyxstar BAT-F8 (Altigator, Belgium)
- Airborne GPS/IMU navigation system Applanix POS/AV 410 (Applanix, Canada)
- Airborne GPS/IMU navigation system CMIGITS III (Systron Donner, USA)

Field Instruments/ Proximate Sensors

- GER 1500 Spectroradiometer
- Soil moisture sensor Decagon 5TE (water content, electric cond., temp.)
- Thermal camera Trotec IC60

 OSGeoLive



in-house software
open source



Collaborations & Mobility



✓ with high level EU institutes

In EU Research Projects (currently)

- Ecole Centrale de Paris, France
- Ecole de Ponts ParisTech, ENPC, France
- Oxford University, UK
- Imperial College London, UK
- Kingston University, UK
- National Research Council, CNR-ISTI, Italy
- Nansen Environmental and Remote Sensing Center, Portugal
- Joint Research Center, IPSC, EU
- + SMEs



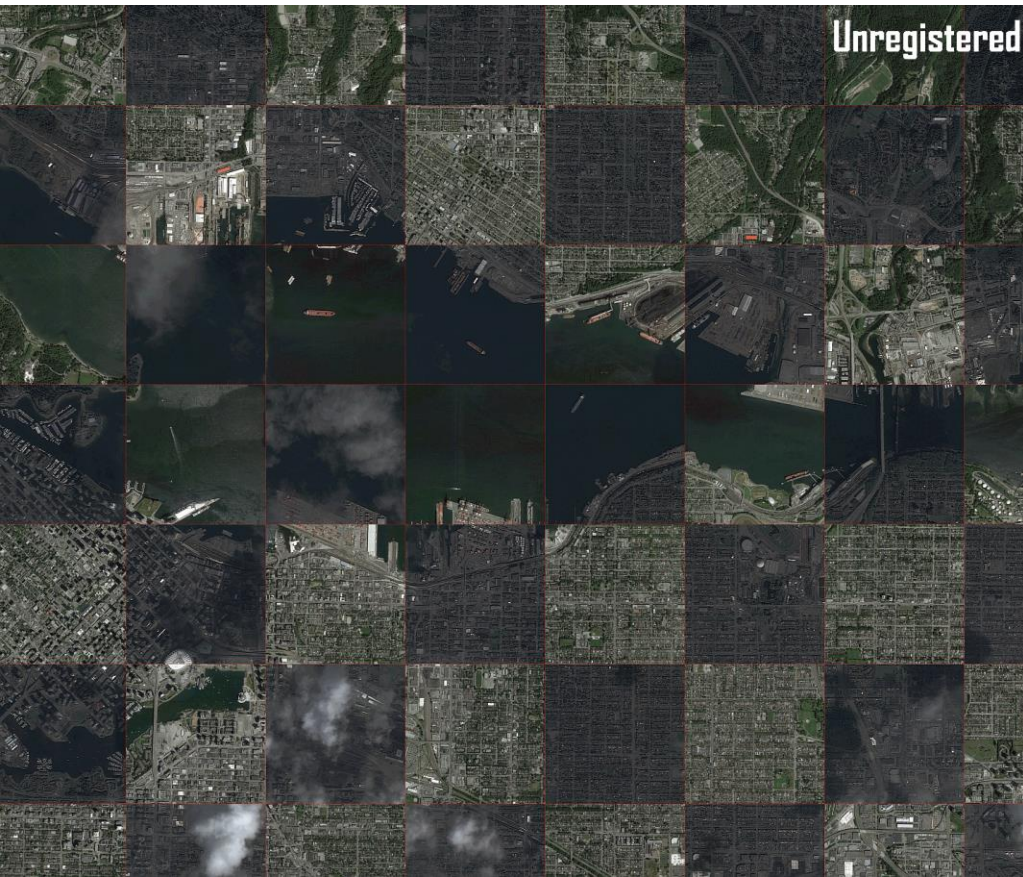
Greek Collaborator (currently)

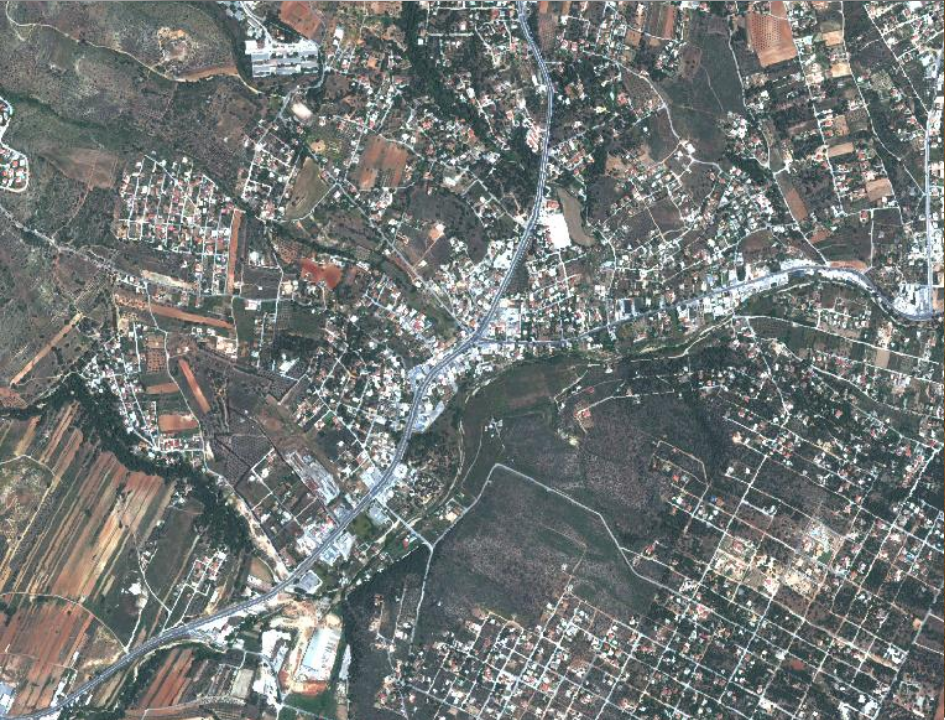
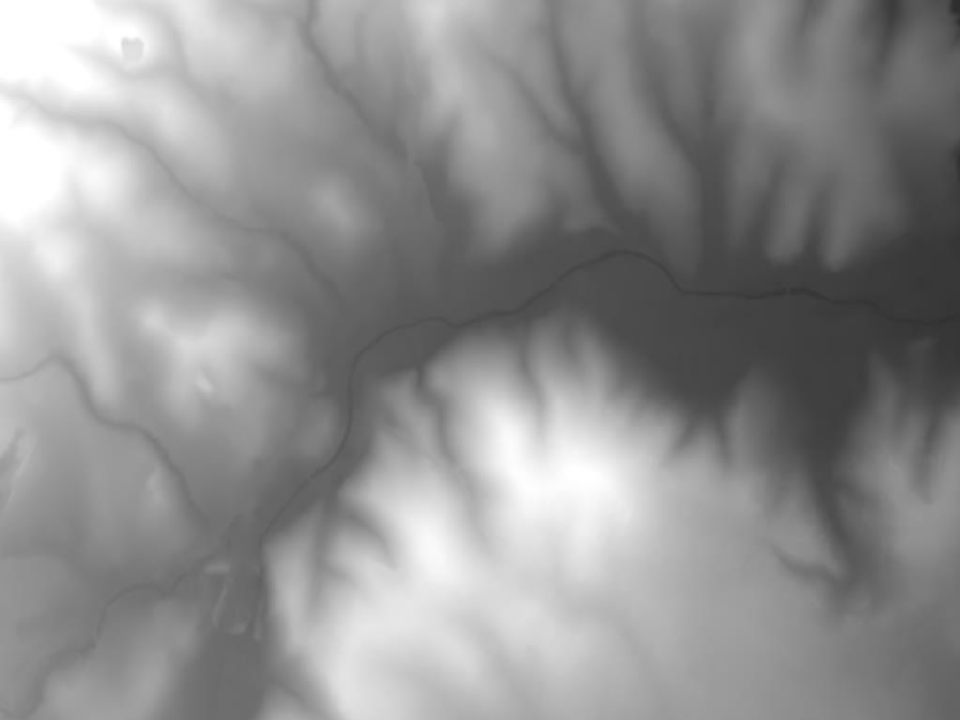
- 6 Universities/ Research Institutions
- 5 SME's
- Public Sector



RSLab's recent published research results

2nd place @
2016 IEEE GRSS Data Fusion Contest
*"Simultaneous Registration, Segmentation and
Change Detection from Satellite Image Pairs".*

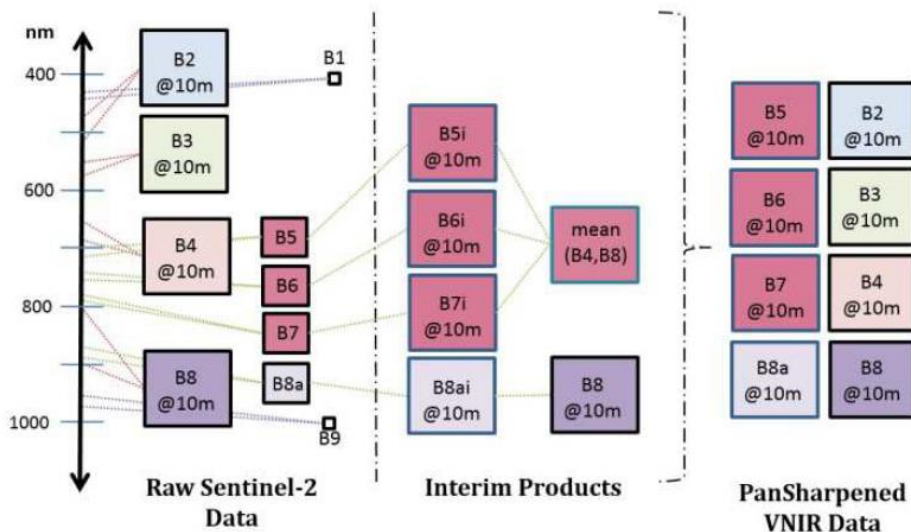




RSLab's recent published research results

Best Poster Award

@ISPRS Congress 2016 for the paper
"Pansharpener on the Narrow VNIR and SWIR Spectral Bands of Sentinel-2"



RSLab's recent published research results



**Best Paper Award
@IEEE WHISPERS'15
for the paper**

**"Multiple Object Tracking with
Background Estimation in
Hyperspectral Video Sequences**

RSLab's recent published research results



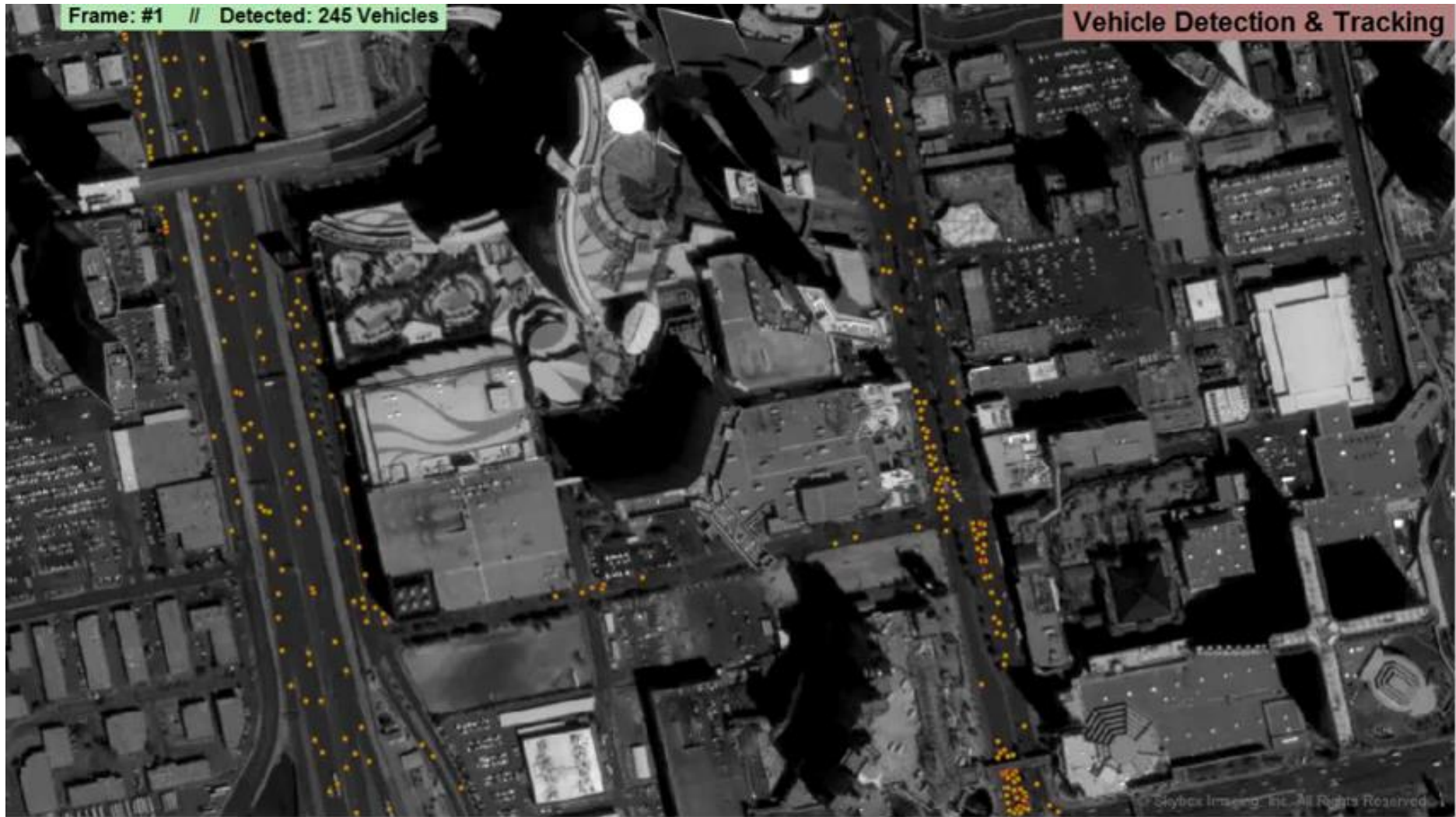
**Best Poster Award
@IEEE IGRASS'15
for the paper**

**"Building Detection in VHR
Multispectral Data with Deep
Learning Features"**



FIGURE 16. The Symposium Interactive Session Prize Paper Award recipient Maria Vakalopoulou (right) with GRSS President Kamal Sarabandi.

Satellite Video

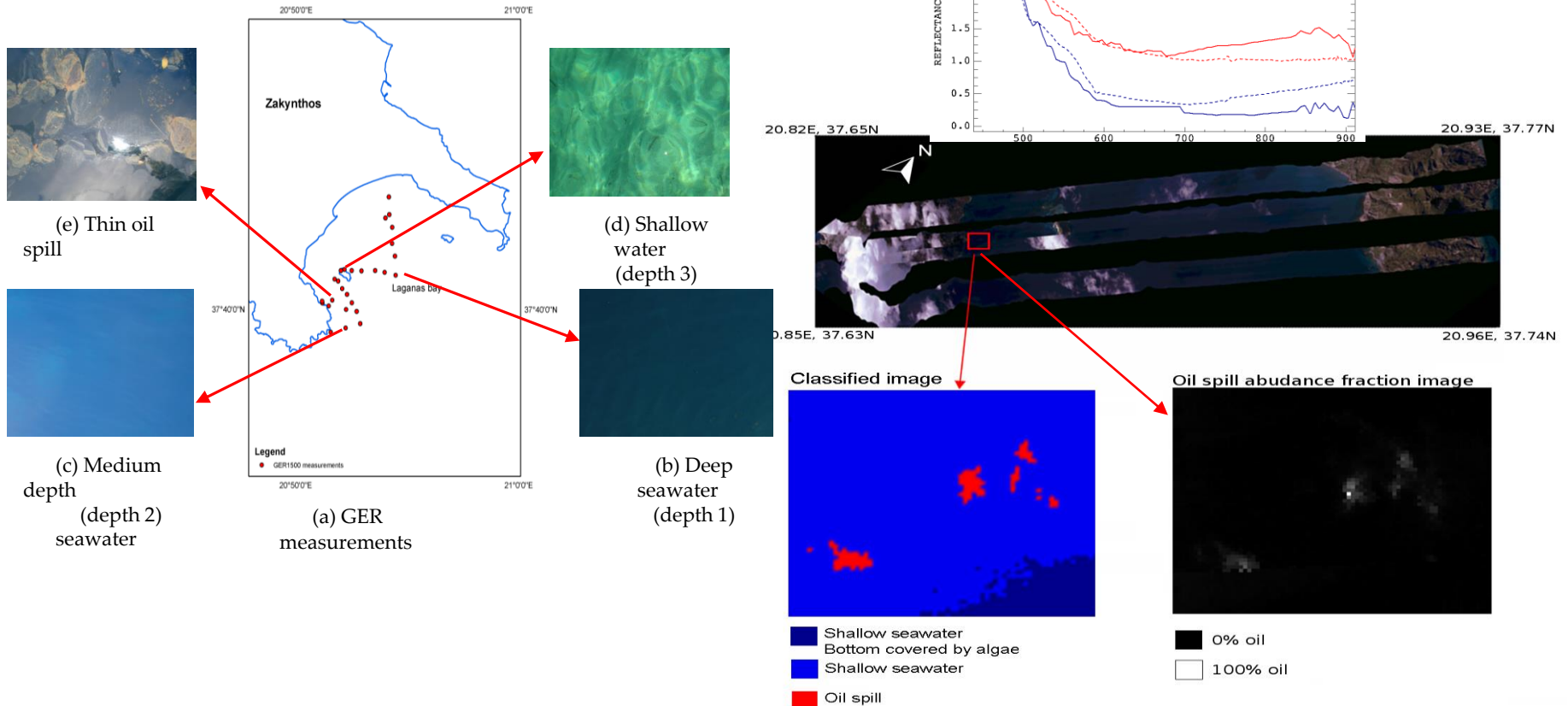


RSLab's recent (2014) published research results

✓ ..selected

“Spectral Unmixing Evaluation for Oil Spill Characterization”,

Karathanassi, 2014

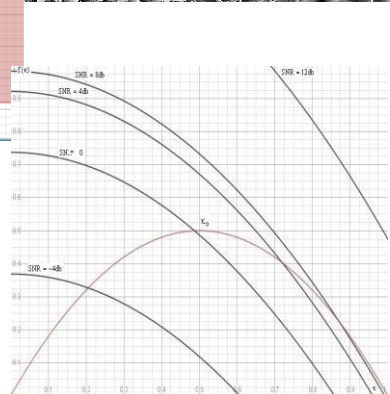
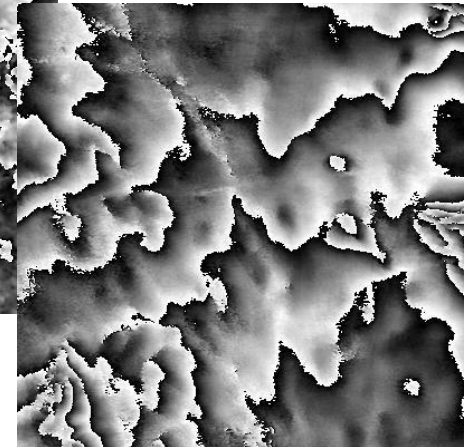
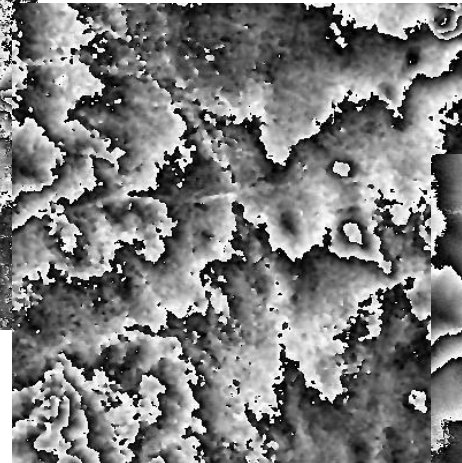
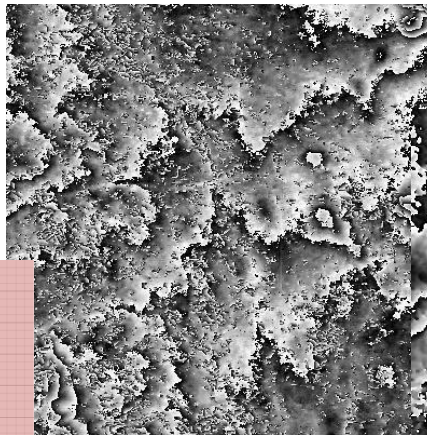
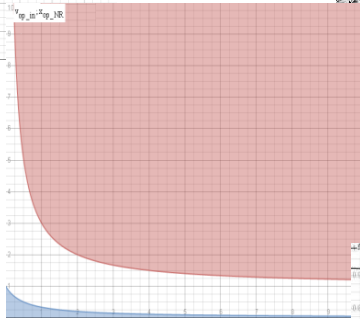
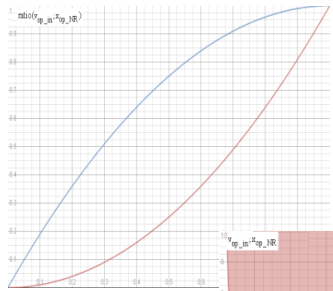


RSLab's recent (2016) published research results

✓ ..selected

“New parametric model based method for noise reduction in the Interferometric process”

Sakellari et al, 2016 ..

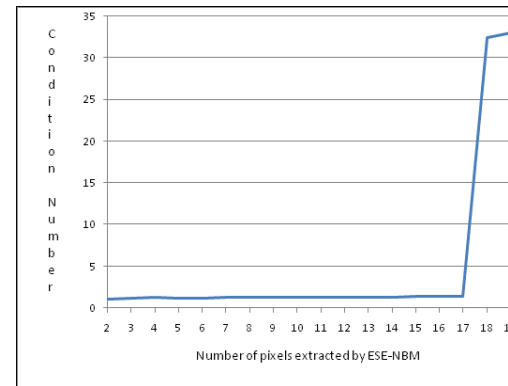
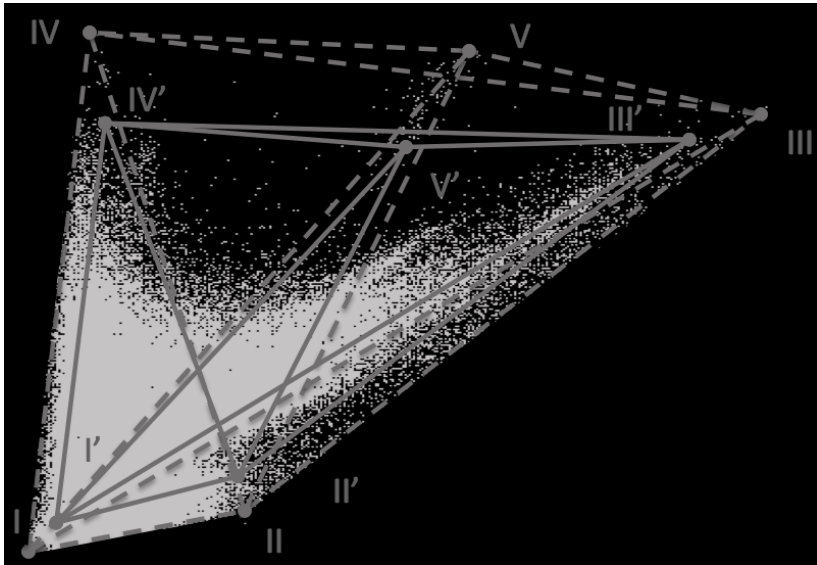


RSLab's recent (2015) published research results

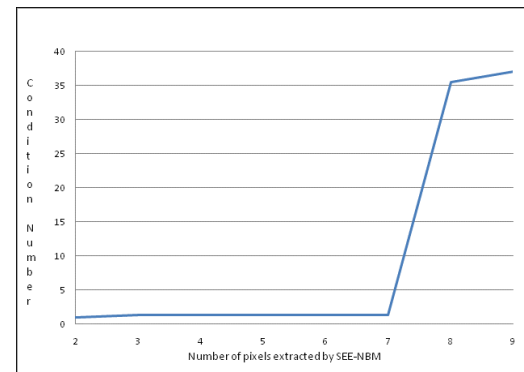
✓ ..selected

“Exploiting the Fractional Distance Matrix for estimating the number of endmembers and extract them”

Sykas et al, 2015 ..



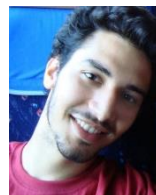
Indian pines
(17
endmembers)



Cuprite image
(7
endmembers)

REMOTE SENSING LABORATORY

!! Thank you !!



RS Lab

Remote Sensing Laboratory
National Technical University of Athens



✓ Sensing ✓ Analytics ✓ Monitoring