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# NEMO-HD Satellite Data and Digital Twin Models

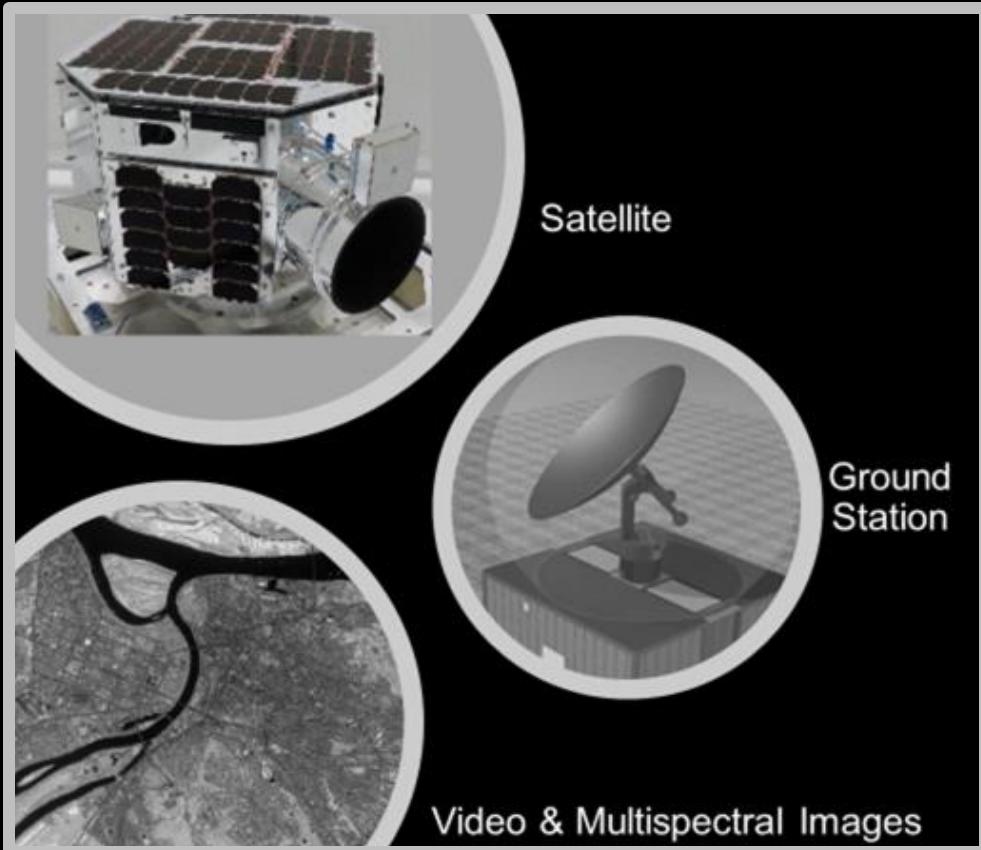
to Support Management of Ecosystems and Multi-hazard Risks

prof. dr. Tomaž Rodič, SPACE-SI



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Nemo-HD mission





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## Nemo-HD microsatellite

**Video & Multispectral images**

**Orbit SSO 535 km**

**Dimensions 38 x 57 x 57 cm**

**Mass 60,18 kg**

**Apperture 155 mm**

**HR GSD 2,8 m @ SWOT 10 km**

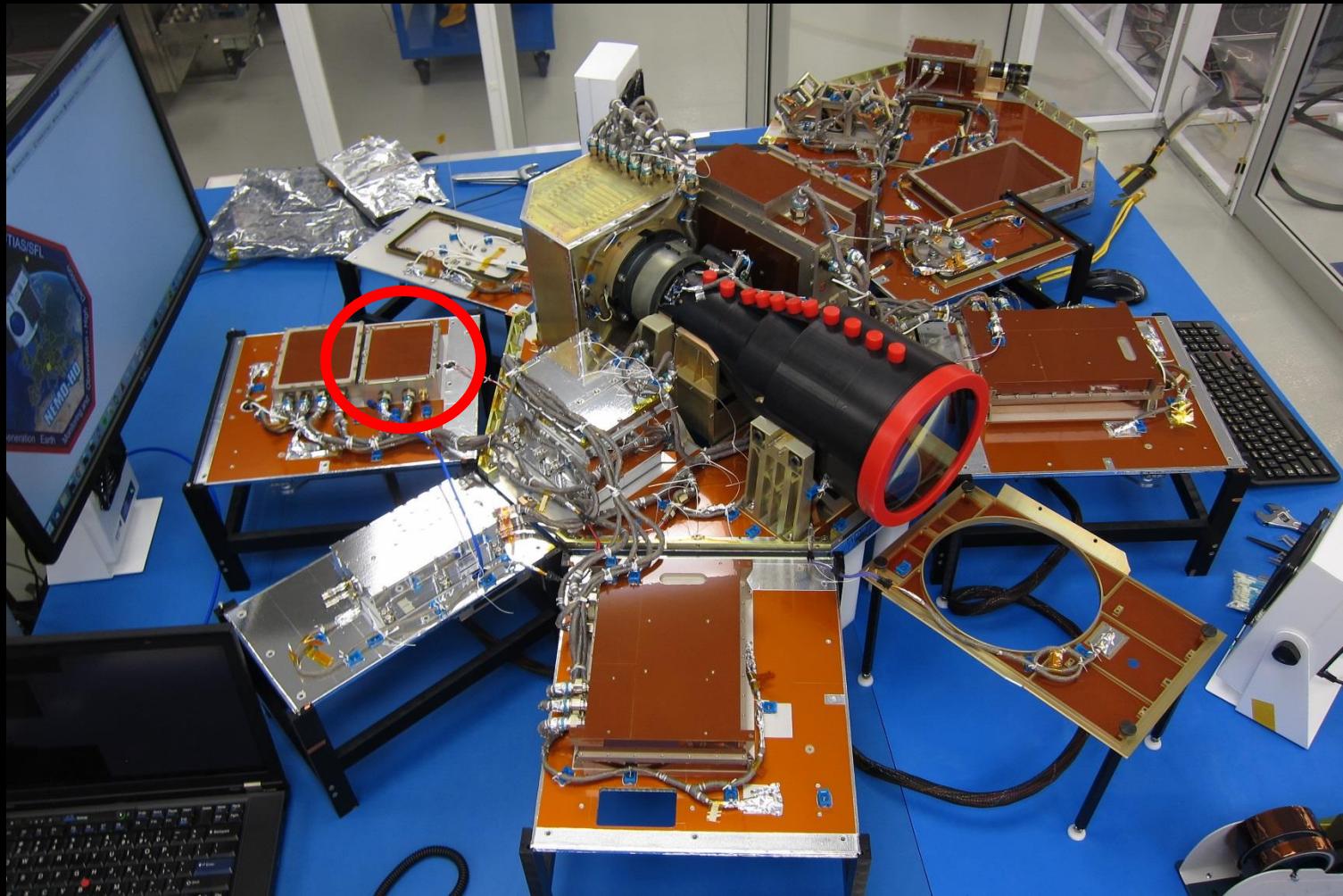
**LR GSD 40 m @ SWOT 70 km**





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## Nemo-HD microsatellite





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## Ground Station (S & X)

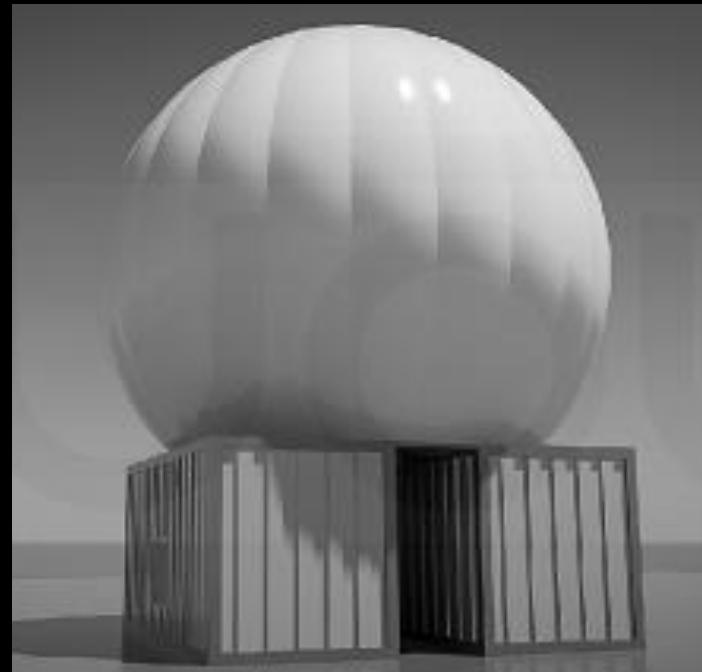


Pomjan near Koper  
since 2012





## Transportable Ground Station S. X, Ka/Ku bands





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Transportable ground station





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Transportable ground station





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## Sentinel-2 Frankfurt Airport



Sentinel-2



Sentinel-2

NEMO-HD

Airportring



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Nemo-HD Video from Space



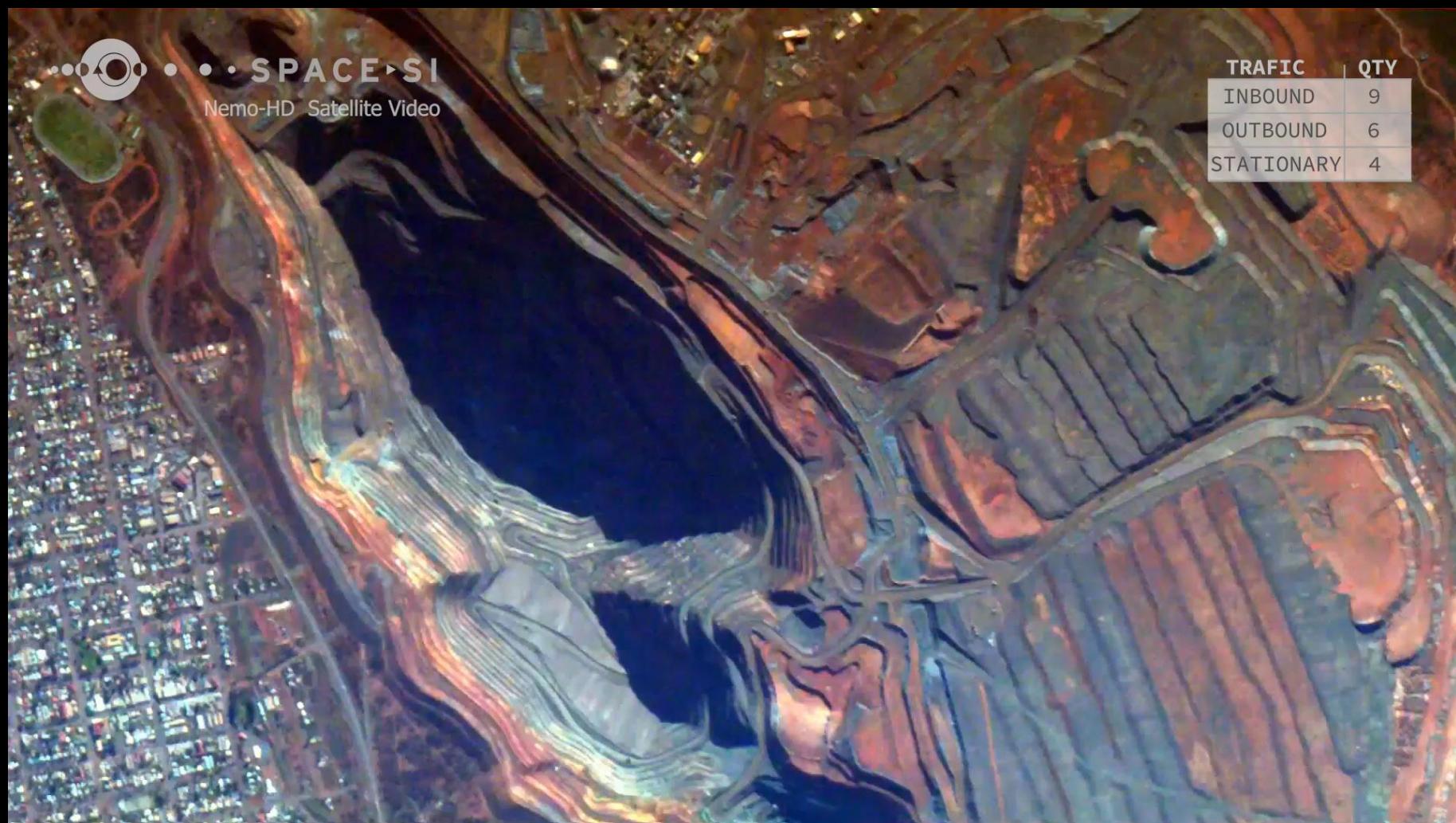


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Nemo-HD Video from Space



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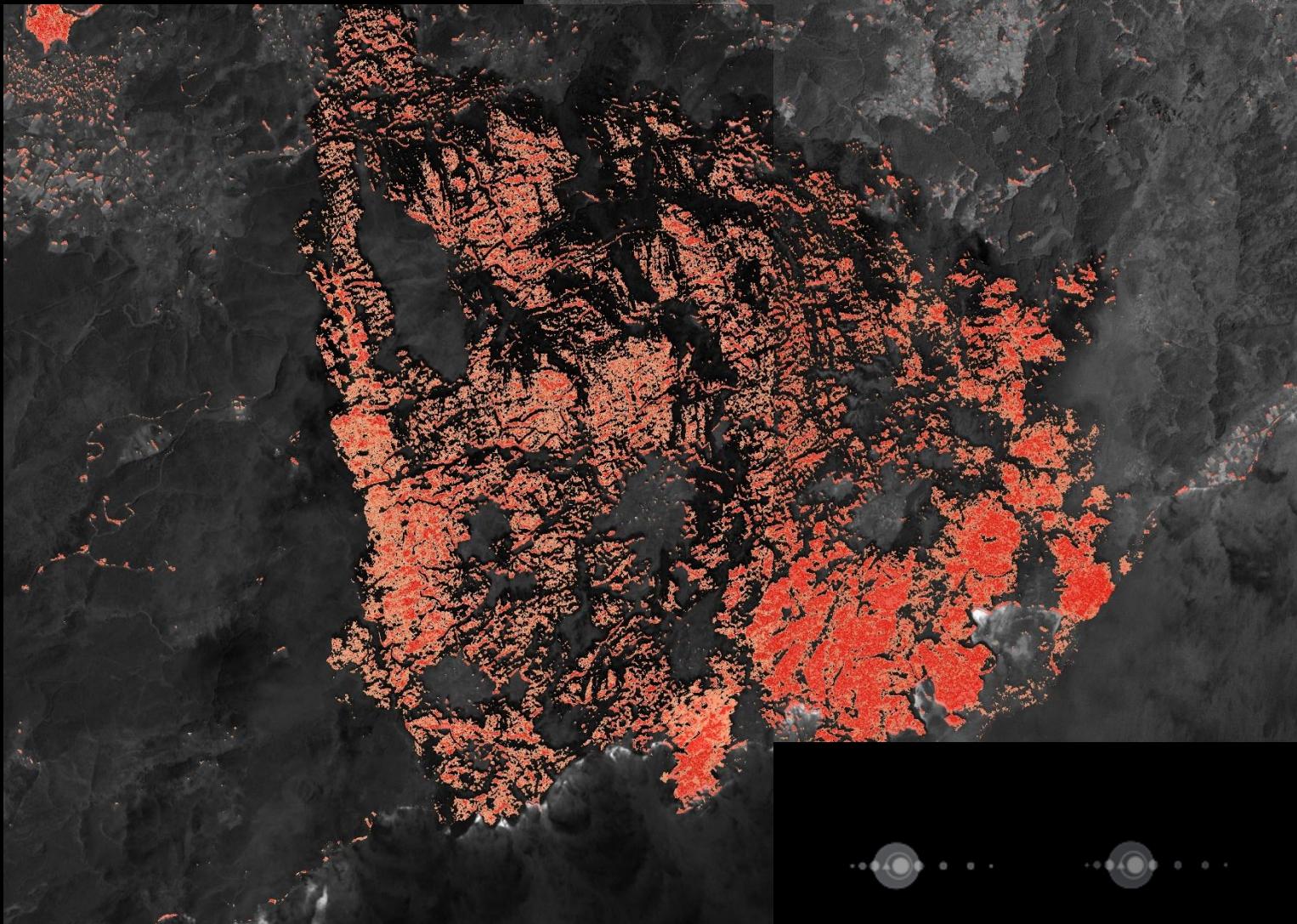
Forest fire scanning





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## Forest fire scanning - NDVI

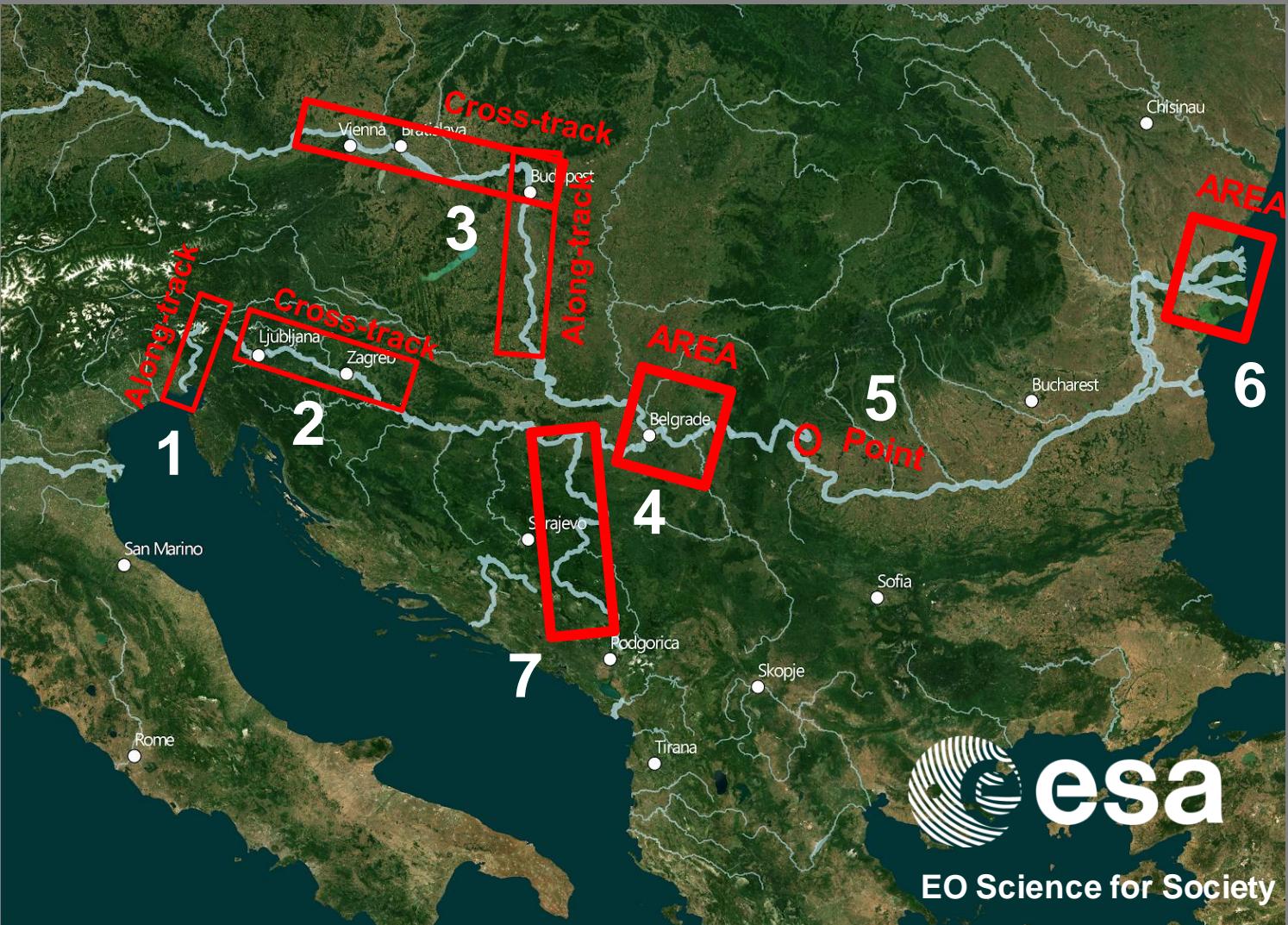




### Satellite Technology Challenges



### River Basin Scanning Modes





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Soča S2S  
Source-to-Sea

Source

interactions  
between

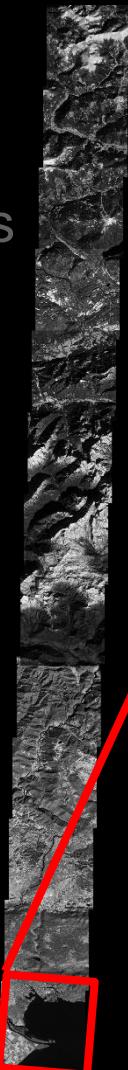
Land

&

River

&

Sea



River  
Discharge  
Area



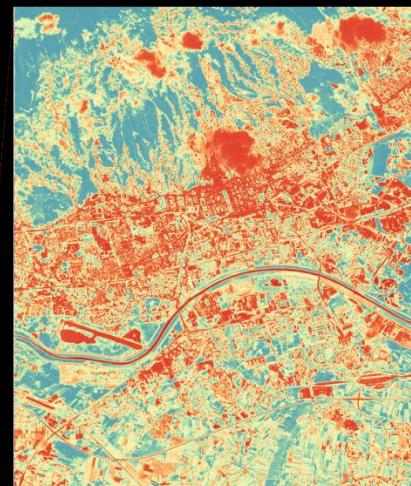
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## Sava River Scanning

Ljubljana  
SLOVENIA



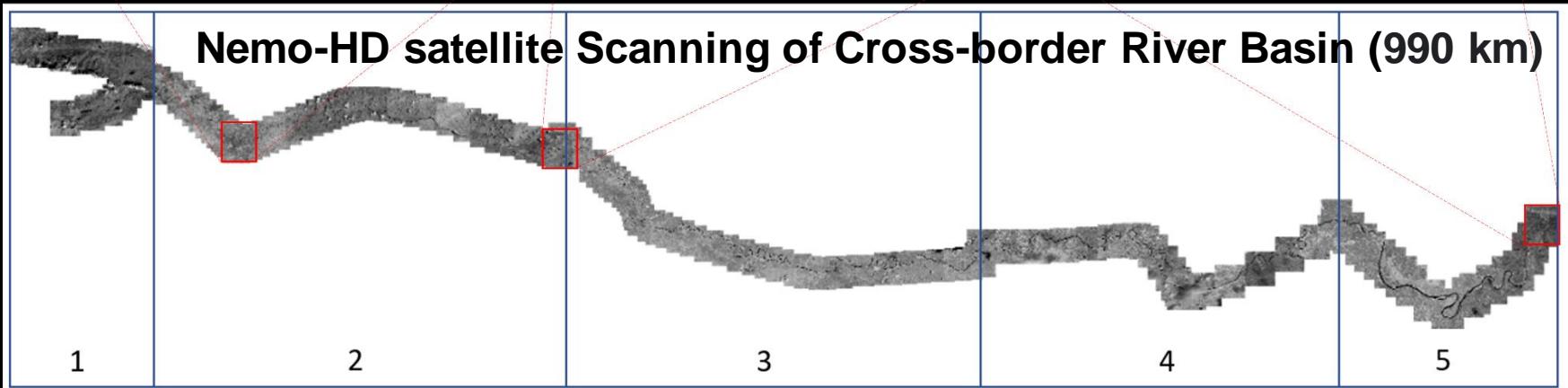
Zagreb  
CROATIA



Belgrade  
SERBIA



Nemo-HD satellite Scanning of Cross-border River Basin (990 km)



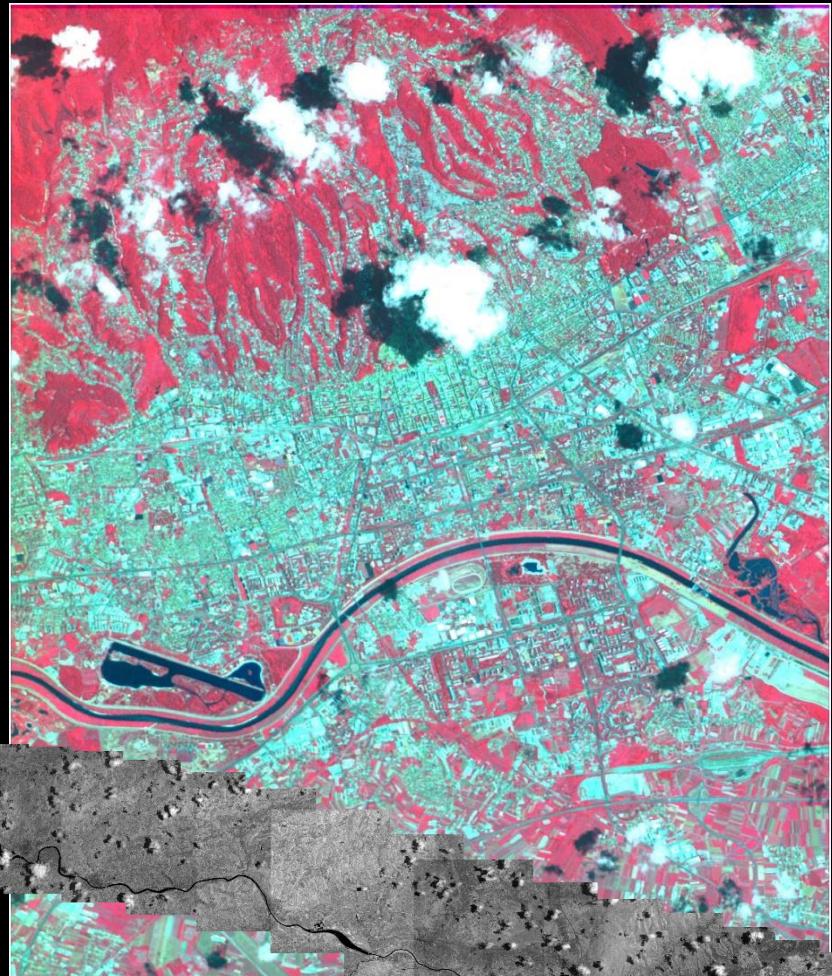


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## Sava River Scanning



**Sava**  
Bled - Zagreb



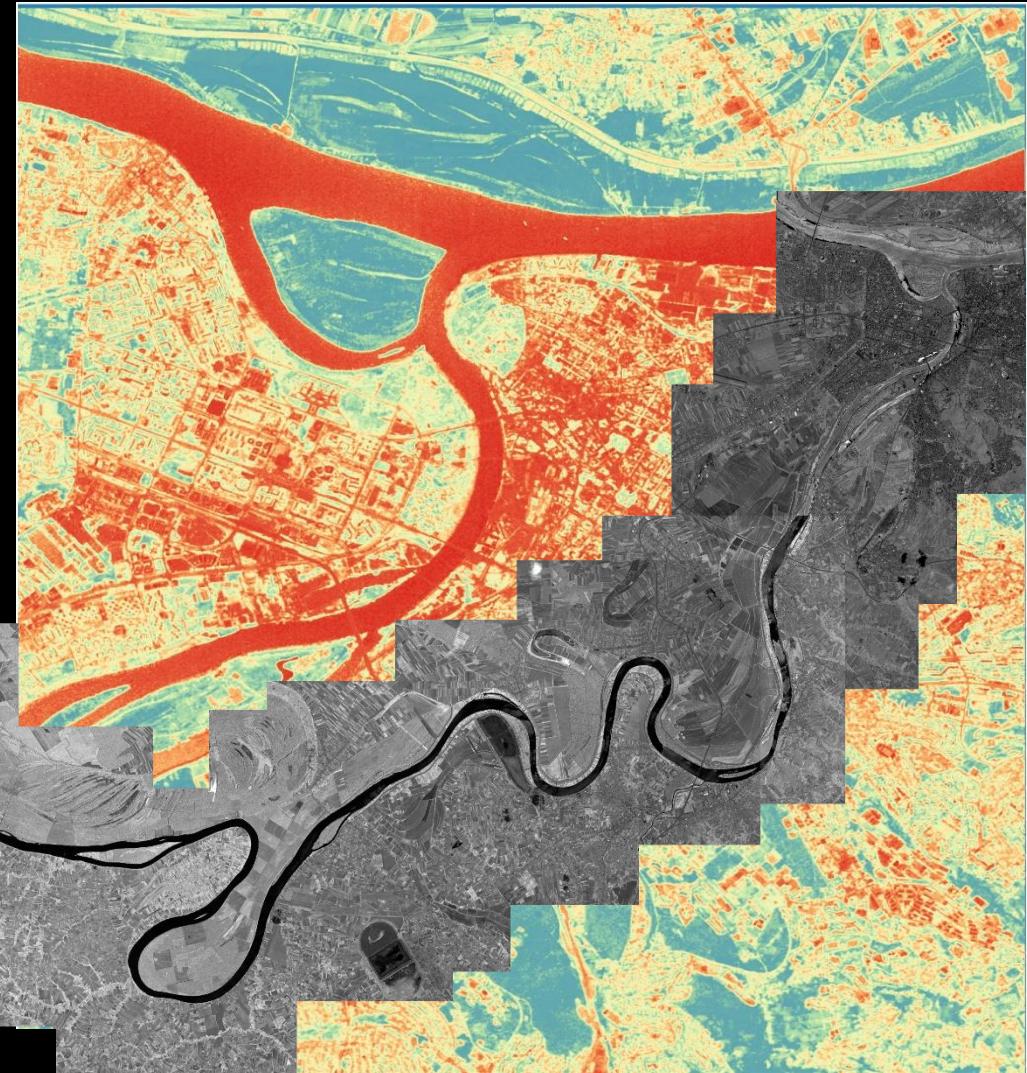


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## Sava River Scanning

### Sava - Danube

Sremska Mitrovica to Belgrade





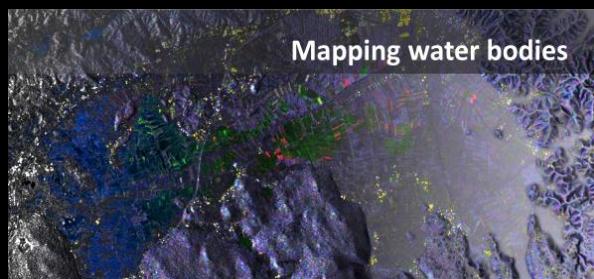
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# Indicators for monitoring food, water, energy & climate SECURITY

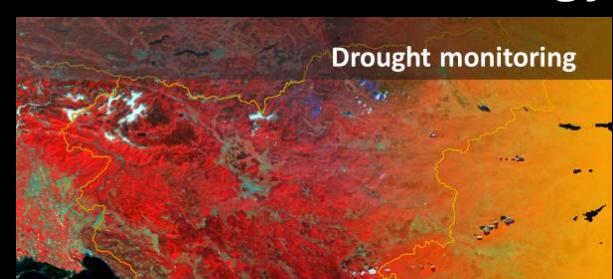
## Food



## Water

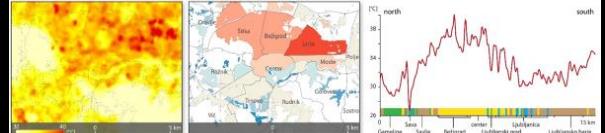
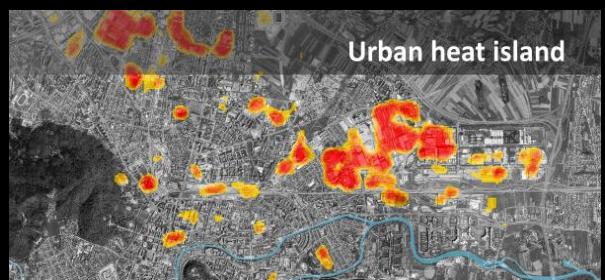


## Climate



## Energy

## Urban environments



## Natural disasters



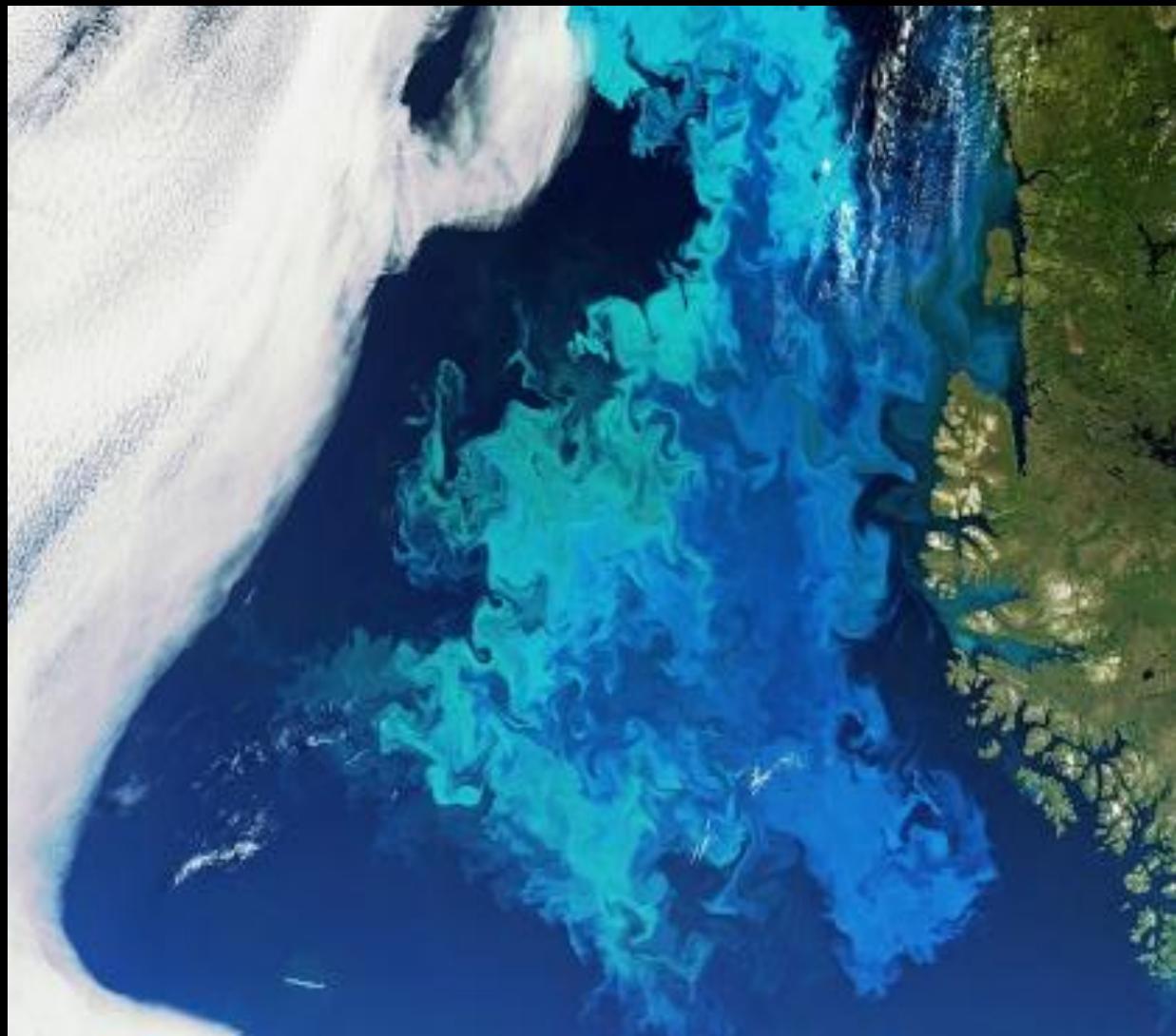
## Maritime, air, land Transport





## Sentinel & Nemo-HD

- Sediments
- Chlorophyll
- Turbidity
- Temperature
- Plastics
- etc.





Drina river, Bosnia

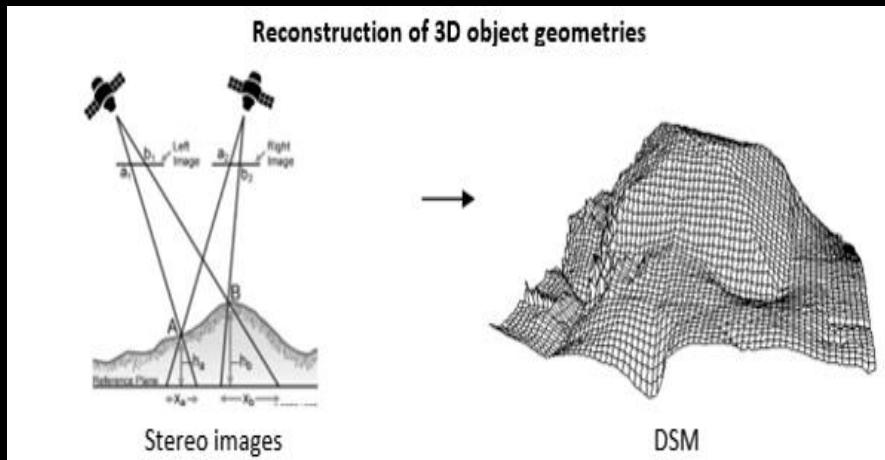
Satellite data can be used  
to monitor plastic waste





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Nemo-3D



Monitoring of Potential Interactions in Ecoconnectivities between Land, Rivers, Lakes and Sea.



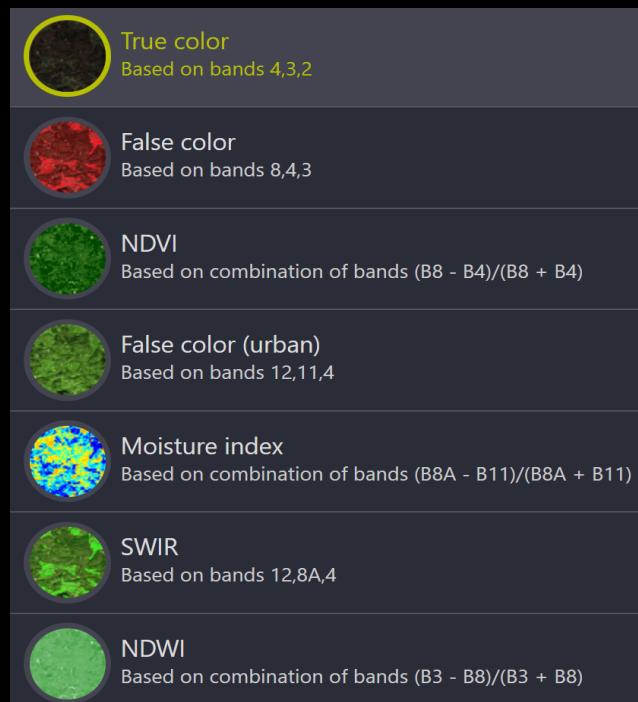


## Creation of Digital 3D Twin

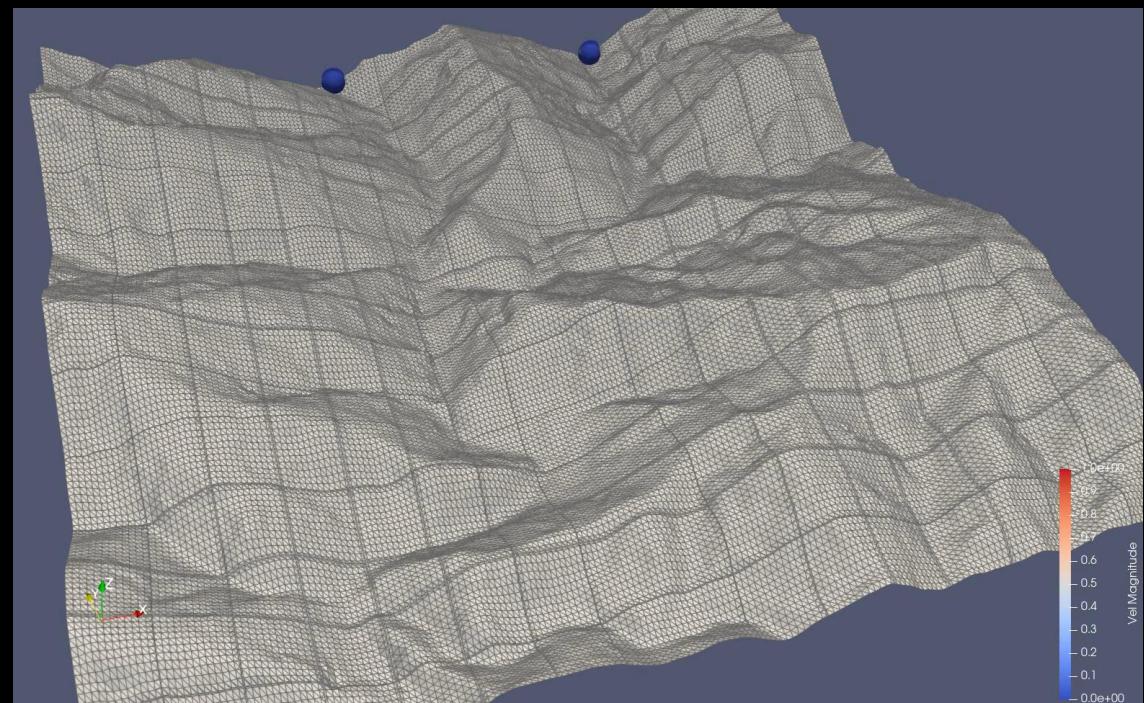




## Satellite data

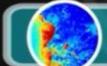
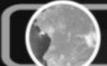
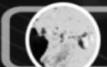


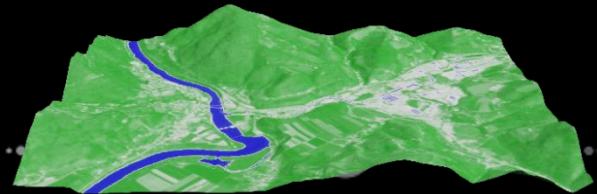
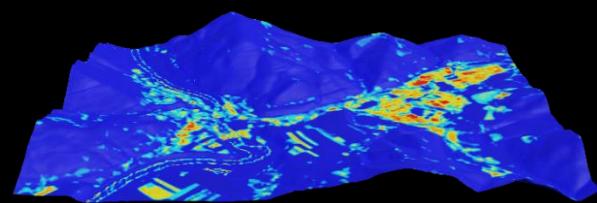
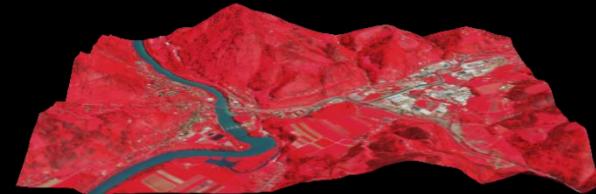
## Digital Twin Model of River Flow





## Creation of Digital 3D Twin

-  True color
-  False color
-  Moisture index
-  Vegetation Index
-  SWIR



-  Water
-  Food
-  Urban
-  Maritime
-  Drought
-  Flood
-  Fire



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## Floods, Slovenia 2023



Cesta Ljubno-Luče



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# Floods, Slovenia 2023

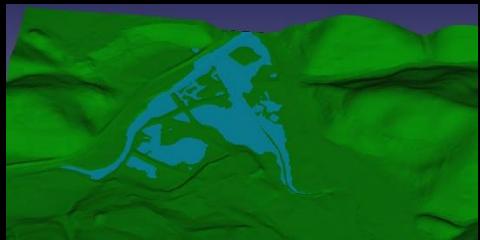
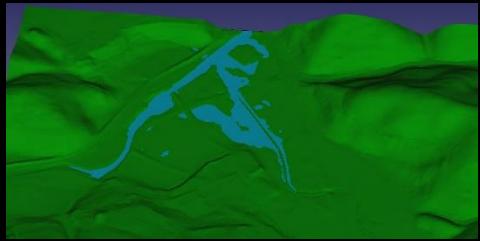
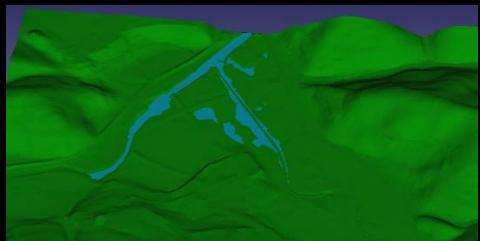


© Gregor Ravnjak



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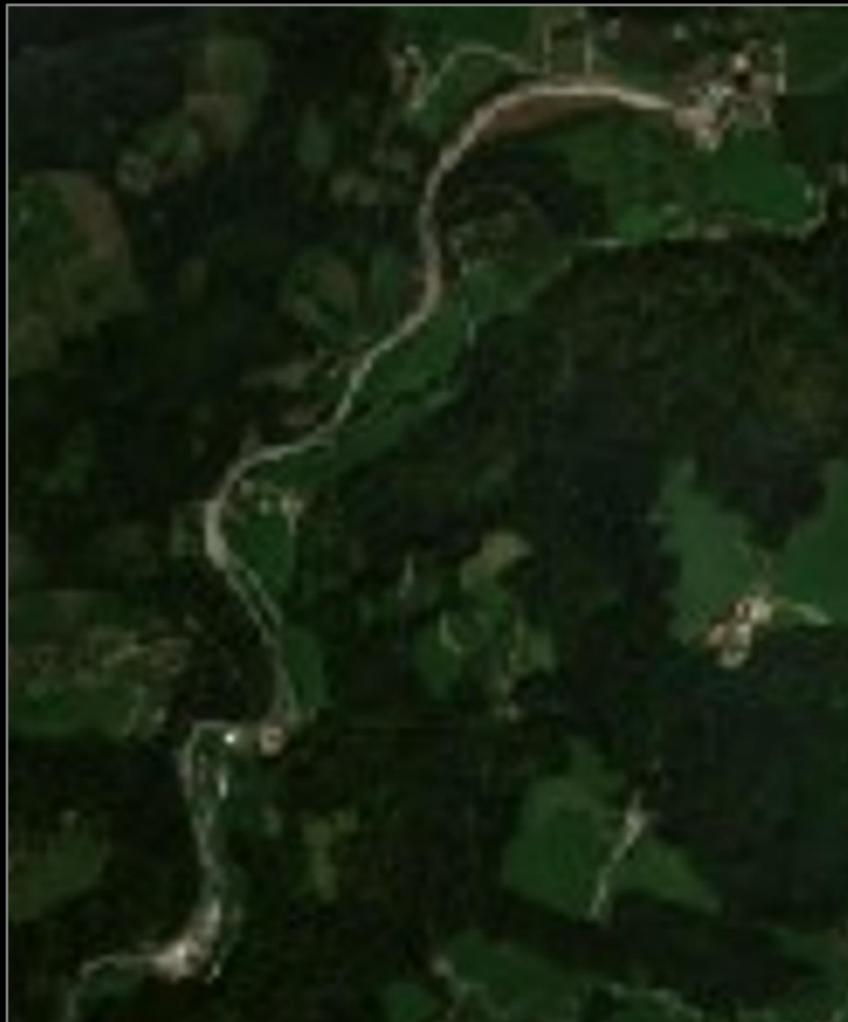
# Floods, Slovenia 2023





SPACE.si

29.7.2023



13.8.2023





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NDVI

29.7.2023



13.8.2023





Dobrova pri  
Dravogradu

Koroška cesta

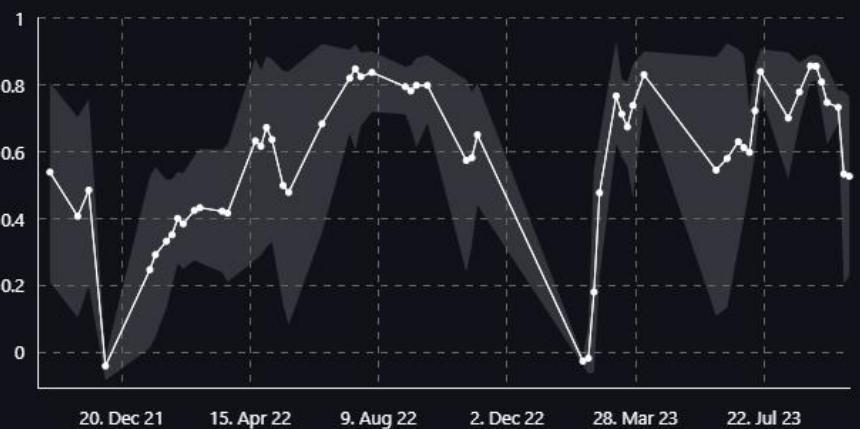
Štrekna

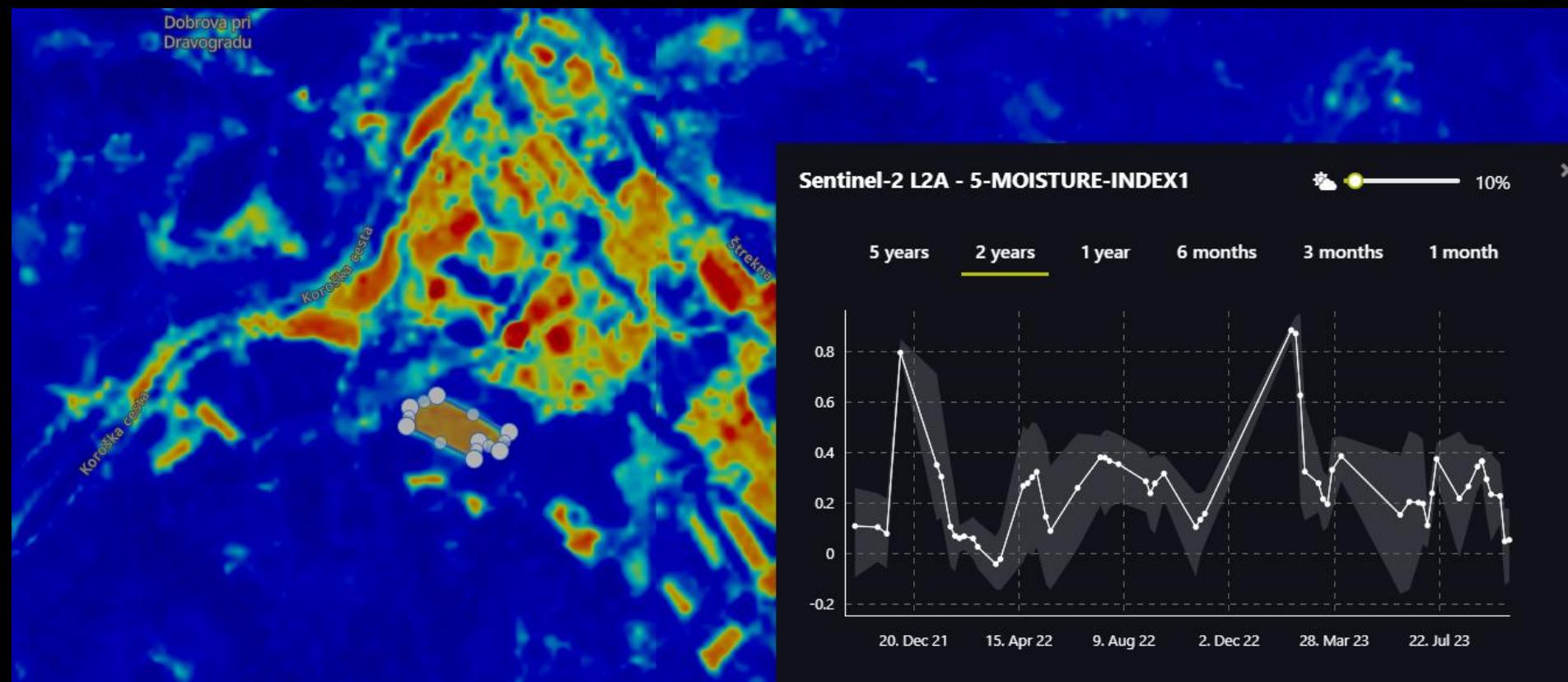
Koroška cesta

Sentinel-2 L2A - 3\_NDVI

10% X

5 years 2 years 1 year 6 months 3 months 1 month







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<https://geohub.gov.si/portal/apps/mapviewer/index.html?layers=986446bd48414d0484c3f14d2dca4779>



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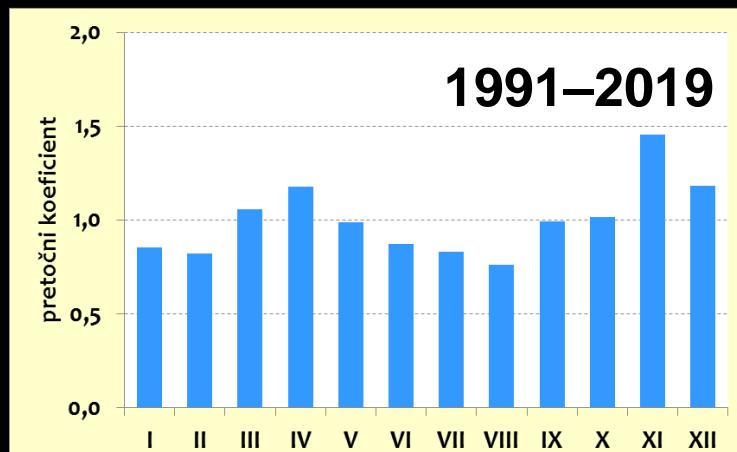
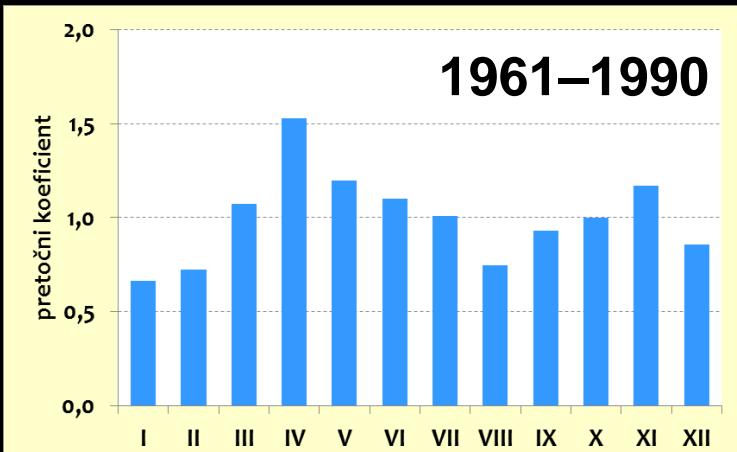
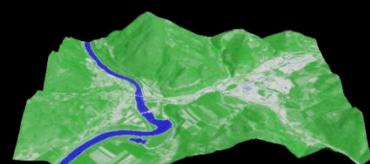
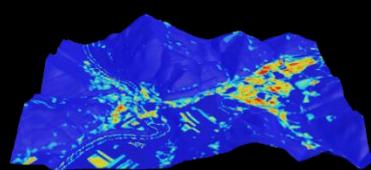
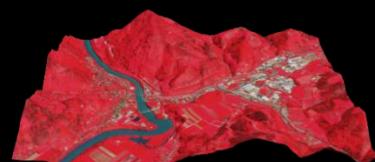
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Meža River



from Hrvatin, 2022



# Frequency of Floods in Slovenia in the last century



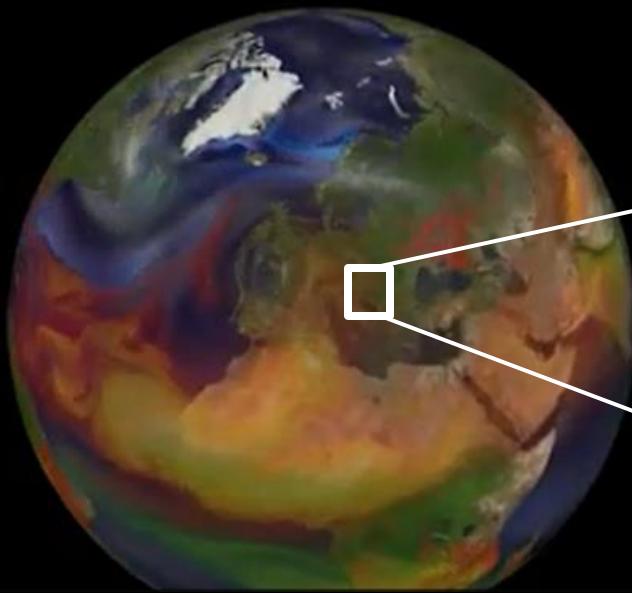
from Hrvatin, 2022



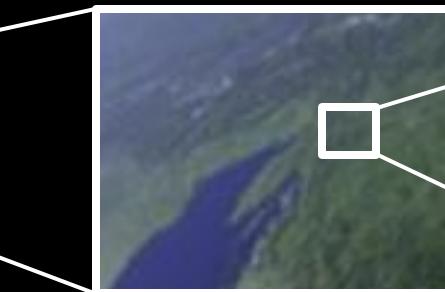


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# Multiscale climate effects on local environments



Global



Macro-regional

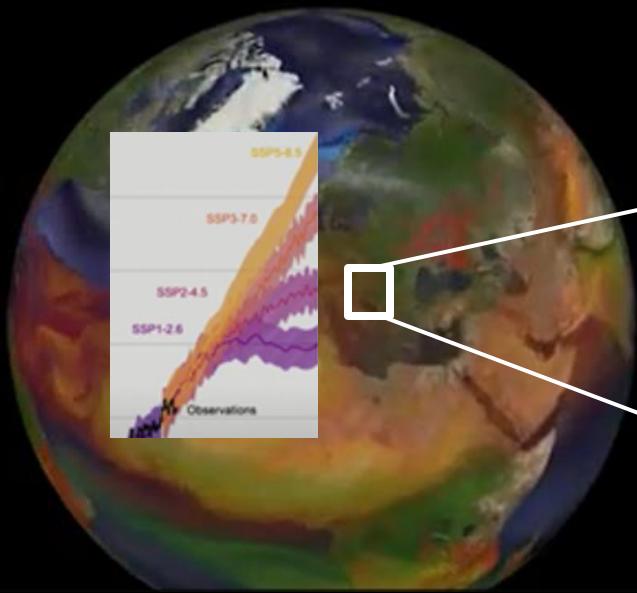


Local



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# Multiscale climate effects on local environments



Global



Macro-regional



Local



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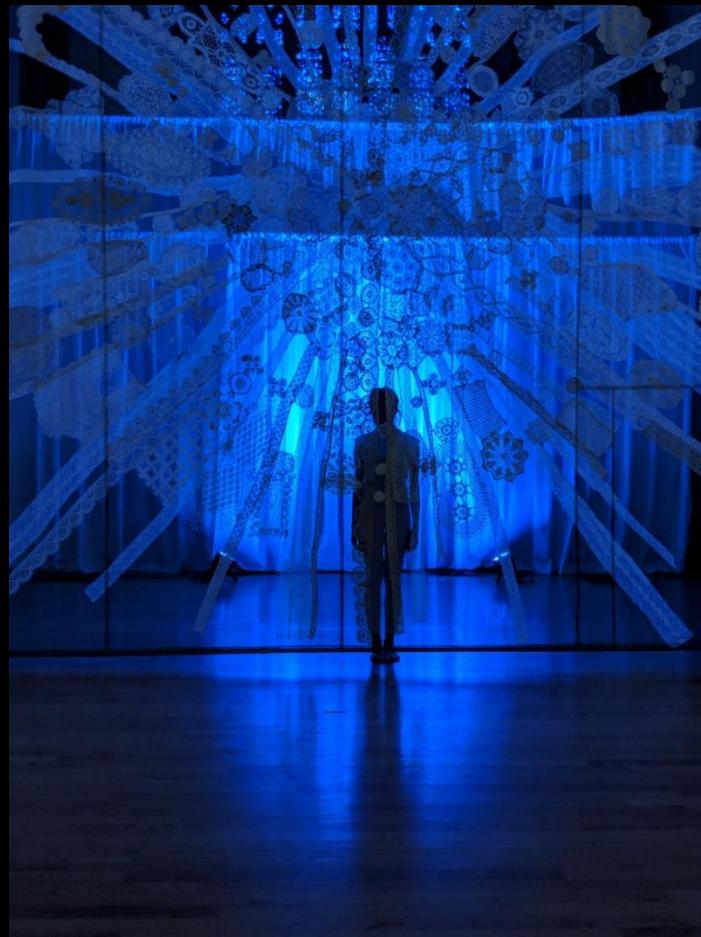
δ))





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Arts – Sci & Tech



“Eden transplanted”  
Eva Petrič





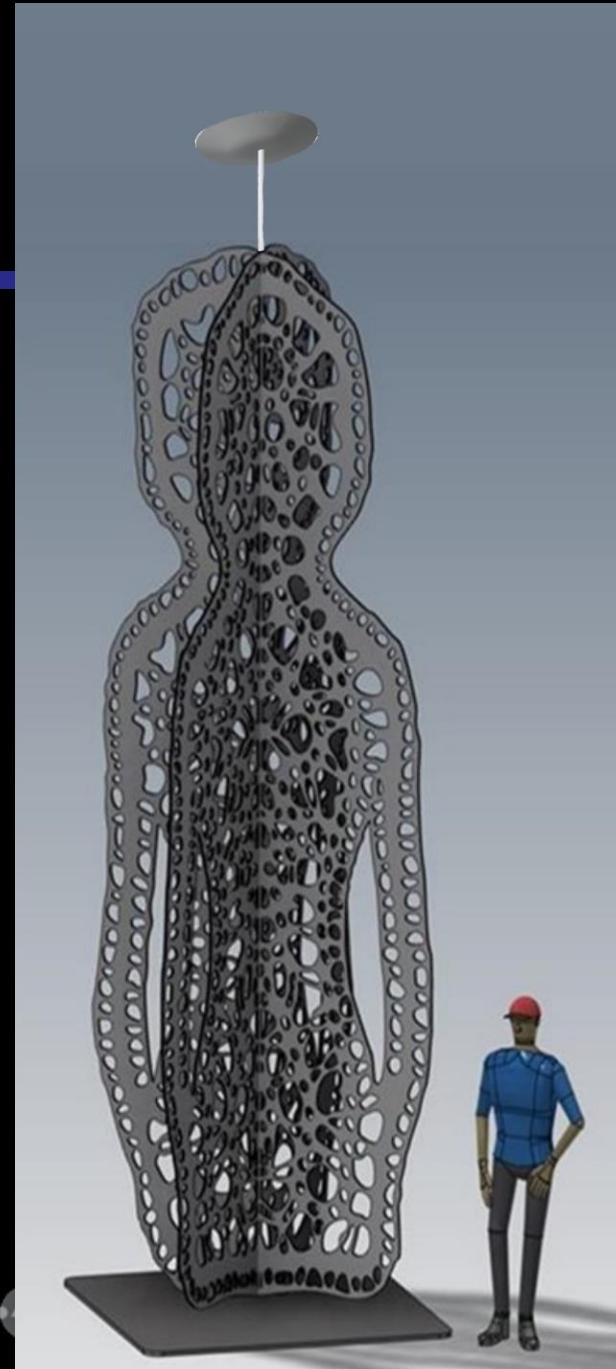
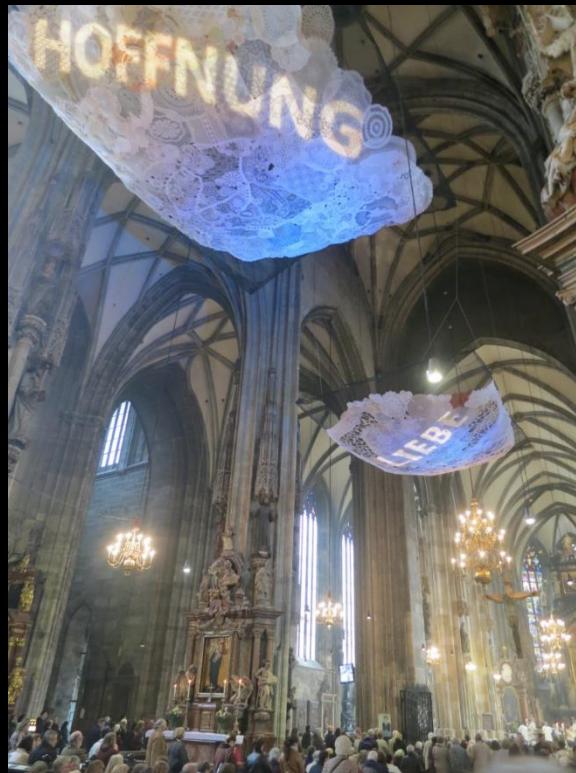
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Arts – Sci & Tech



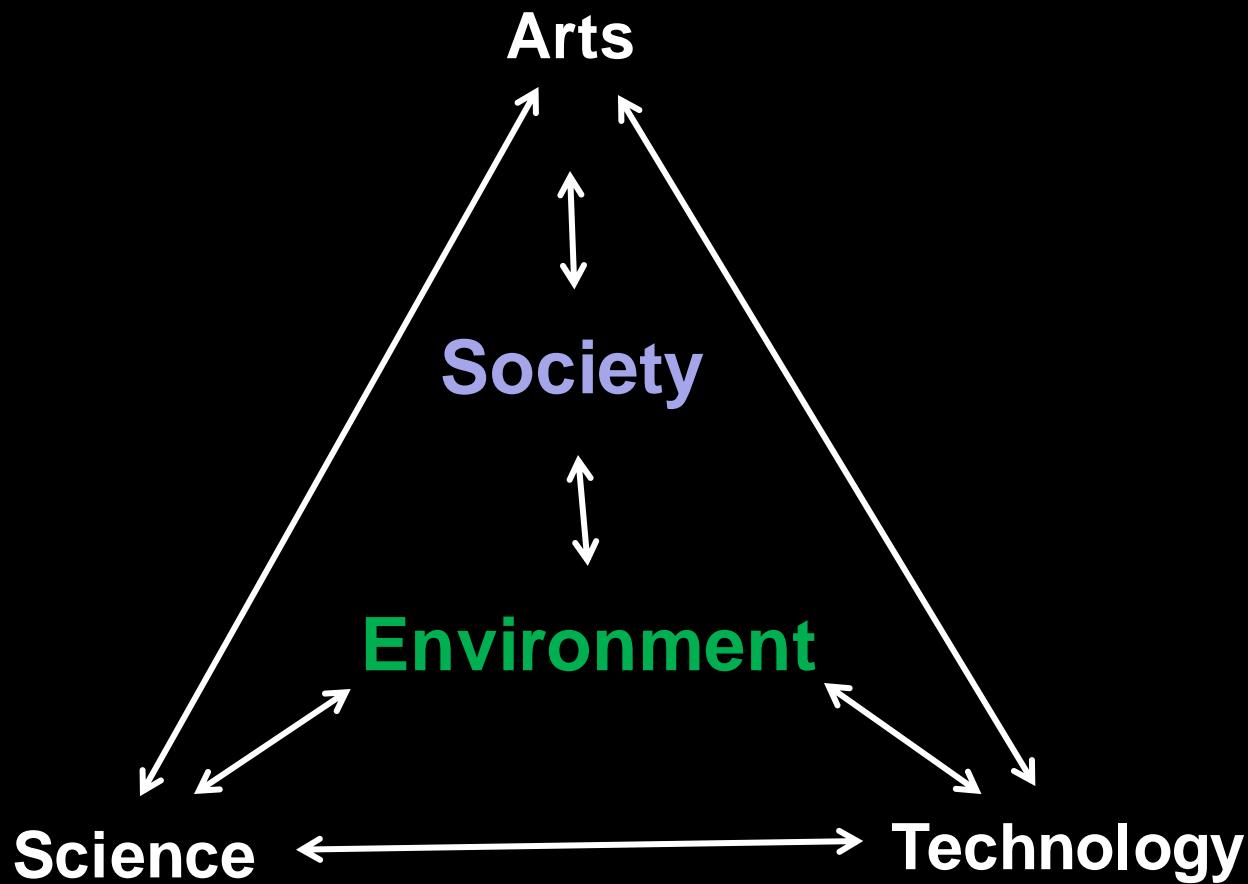


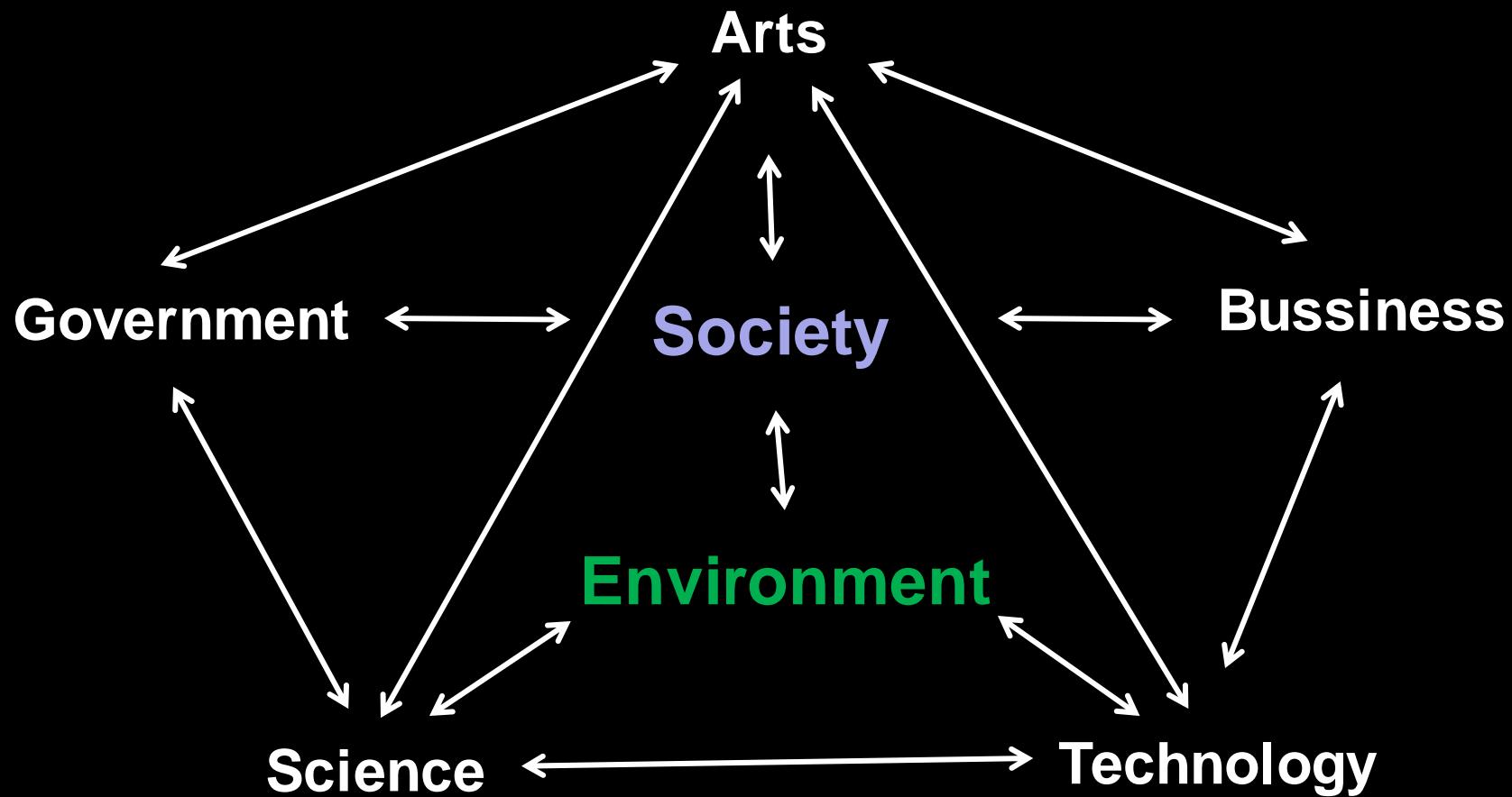
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River Tame, UK



Centre for Ganga River Basin Management and Studies  
Indian Institute of Technology Kanpur



River Mekong, Cambodia



River Amazon, Brazil

# Economics of Biodiversity Conservation and Innovative Approaches to Finance

Case Studies: 4 distinct river systems

River Tame (UK) | River Ganga (India) | River Mekong (Cambodia) | River Amazon (Brazil)



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**United  
Nations**

Department of Economic and Social Affairs  
Sustainable Development



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# Satellite Data and Digital Twin Models to support River Basin Management

SPACE-SI, Slovenian Centre of Excellence for Space Sciences and Technologies (Partnership)

[#SDGAction50361](#)

DESCRIPTION

SDGS & TARGETS

DELIVERABLES & TIMELINE

RESOURCES MOBILIZED

PROGRESS REPORTS

FEEDBACK



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Secretariat of Governing Bodies and Stakeholders

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Languages



## Sixth session of the United Nations Environment Assembly (UNEA-6)

**Featured updates:** Registration is now open



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Participate ▾

Events ▾

Documents and resources ▾

Registration

<https://www.unep.org/environmentassembly/unea6>



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[tomaz.rodic@space.si](mailto:tomaz.rodic@space.si)



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# SPACE-SI Satellite Systems & Services

Slovenian Centre of Excellence for Space Sciences and Technologies

prof. dr. Tomaž Rodič