Nemo-HD Microsatellite and Ground Station Infrastructure for Agile Acquisitions of Multispectral Data and Video from Space

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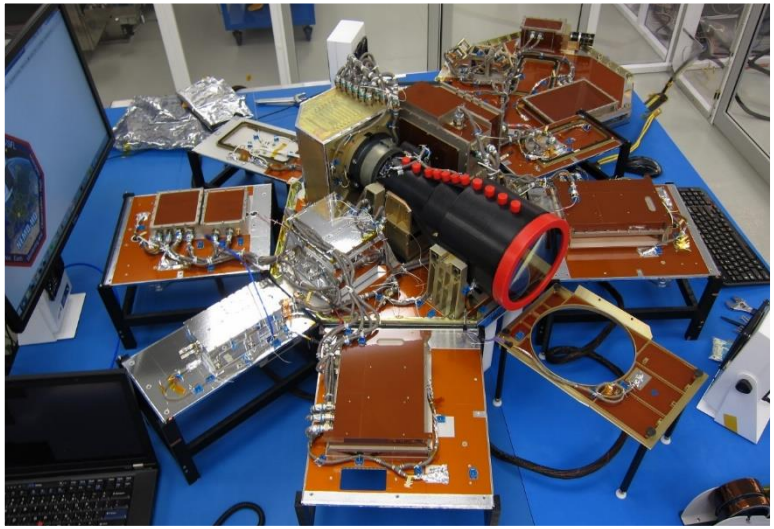
UN/Austria Symposium 2023
Graz, Austria, 14. 9. 2023

NEMO-HD Mission Overview

- First Slovenian microsatellite.
- Developed together with UTIAS SFL.
- Launched September 2, 2020 on VEGA VV16.
- Circular, Sun-Synchronous Orbit; 10:30 LTDN, 535 km.
- Octagonal form factor, 65 km mass.
- Low-latency remote sensing:
  - Pan-sharpened multispectral images.
  - High definition video.
- Agile ADCS enables different observation modes.

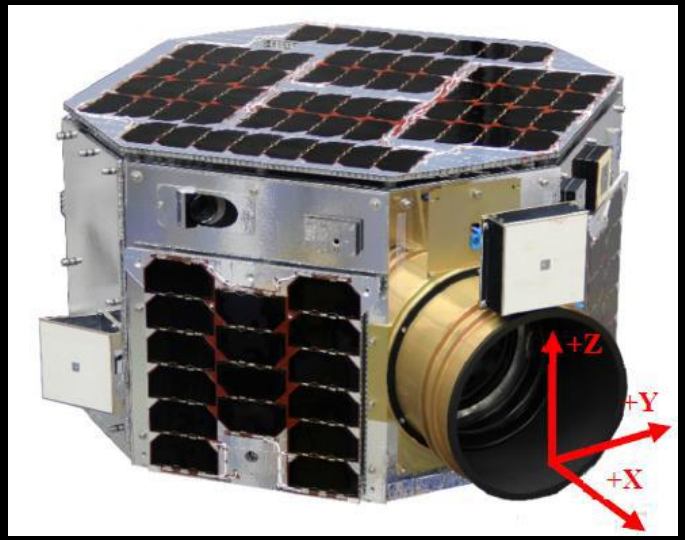
NEMO-HD Primary Payload Overview

- Lens: 360 mm f/2.3.
- Six channel simultaneous capture.
  - Panchromatic - 10 km swath, 2.8 m GSD.
  - Multispectral (R, G, B, NIR), 5.6 m GSD.
  - HD Video, 1920x1080, 2 channels:
    - Channel 1: 2.8 m GSD, 5 km swath.
    - Channel 2: 40 m GSD, 75 km swath.



NEMO-HD ADCS Overview

- **Three-Axis Control**
- **Coarse determination sensors:**
  - Magnetometer (1x)
  - Sun Sensor (6x)
  - Rate Sensor (1x)
- **Fine determination:**
  - Star trackers (2x)
  - GSP (L1)
- **Fine control:**
  - Reaction wheels (3x)
- **Magnetorquers (3x) for angular momentum control**



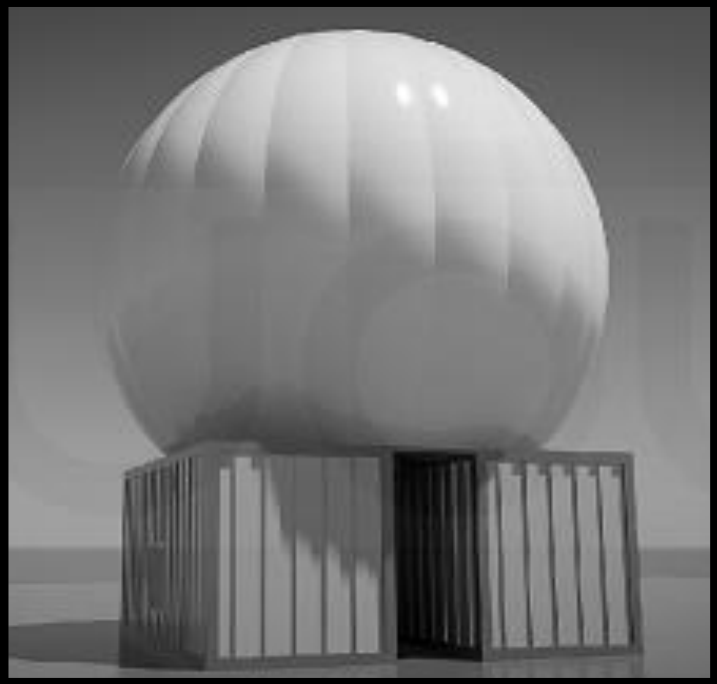
Ground Station

Ground Station (S & X)

Pomjan near Koper
since 2012

Transportable Ground Station

Transportable Ground Station S, X, Ka/Ku bands



Transportable Ground Station

- Can be set-up in one day
- No construction work needed
- Needs electricity and internet connection
- No environmental footprint

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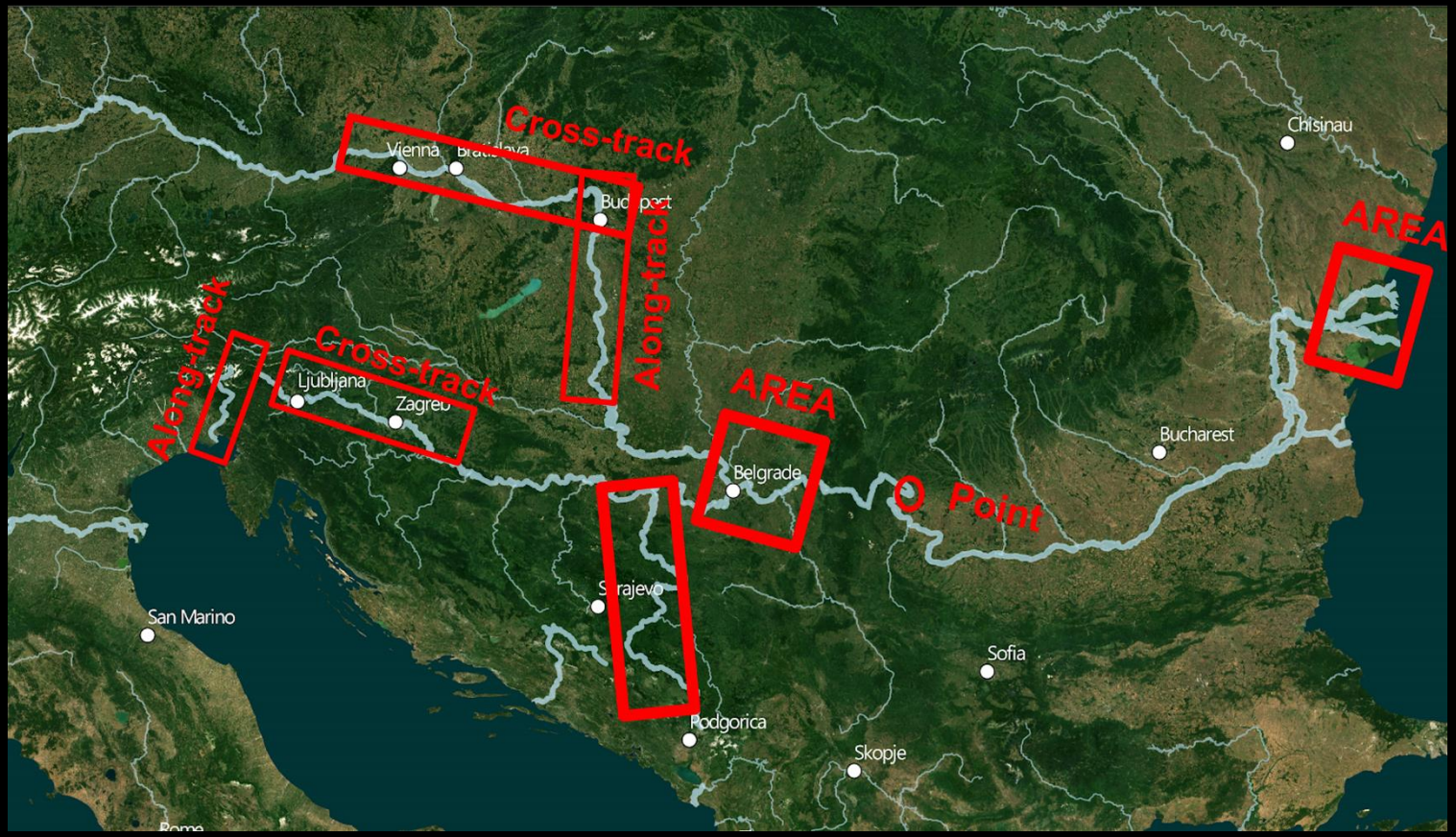
Transportable Ground Station

NEMO-RBS challenge

Test agile attitude modes for river basin monitoring



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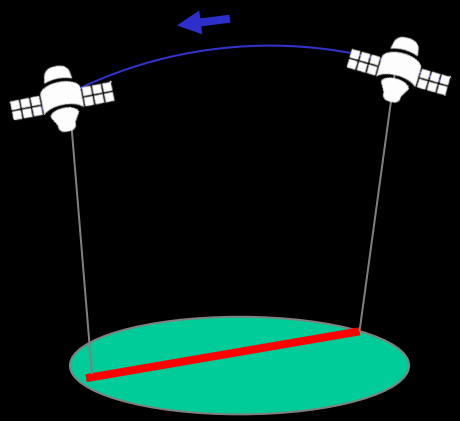
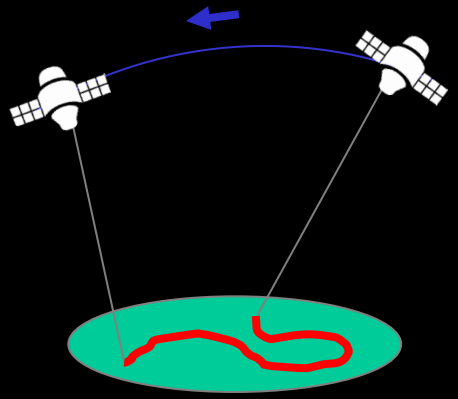
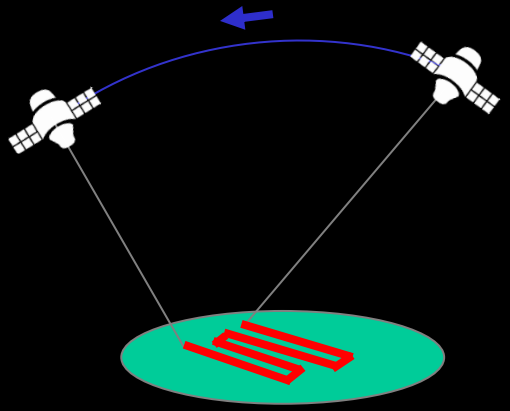
NEMO-HD attitude modes



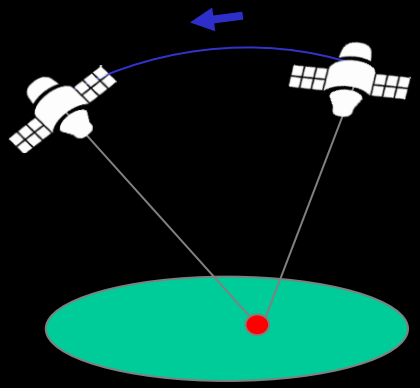
Innertial pointing



Curve tracking

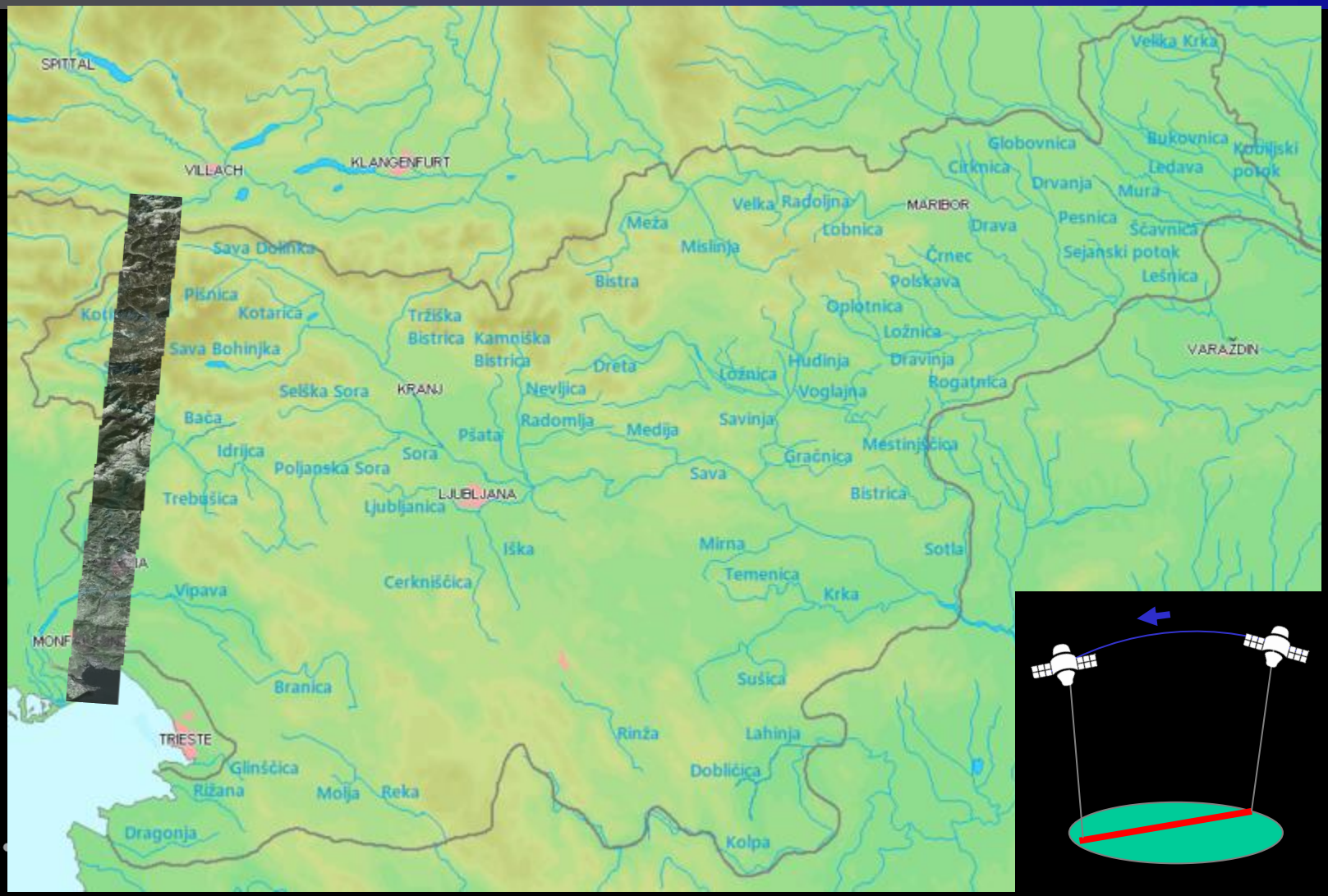


Area scanning



Target tracking

NEMO-HD Innertial pointing



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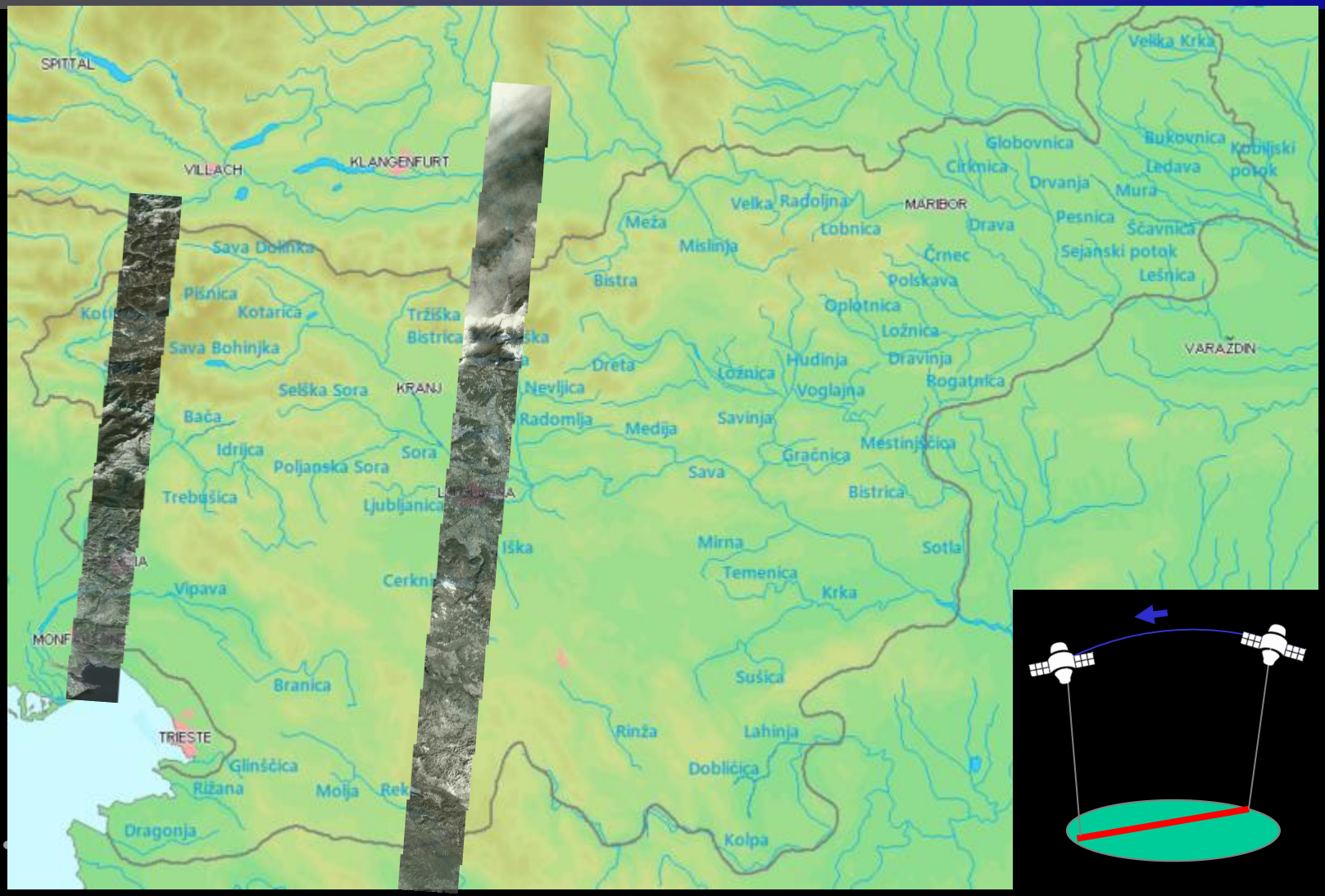
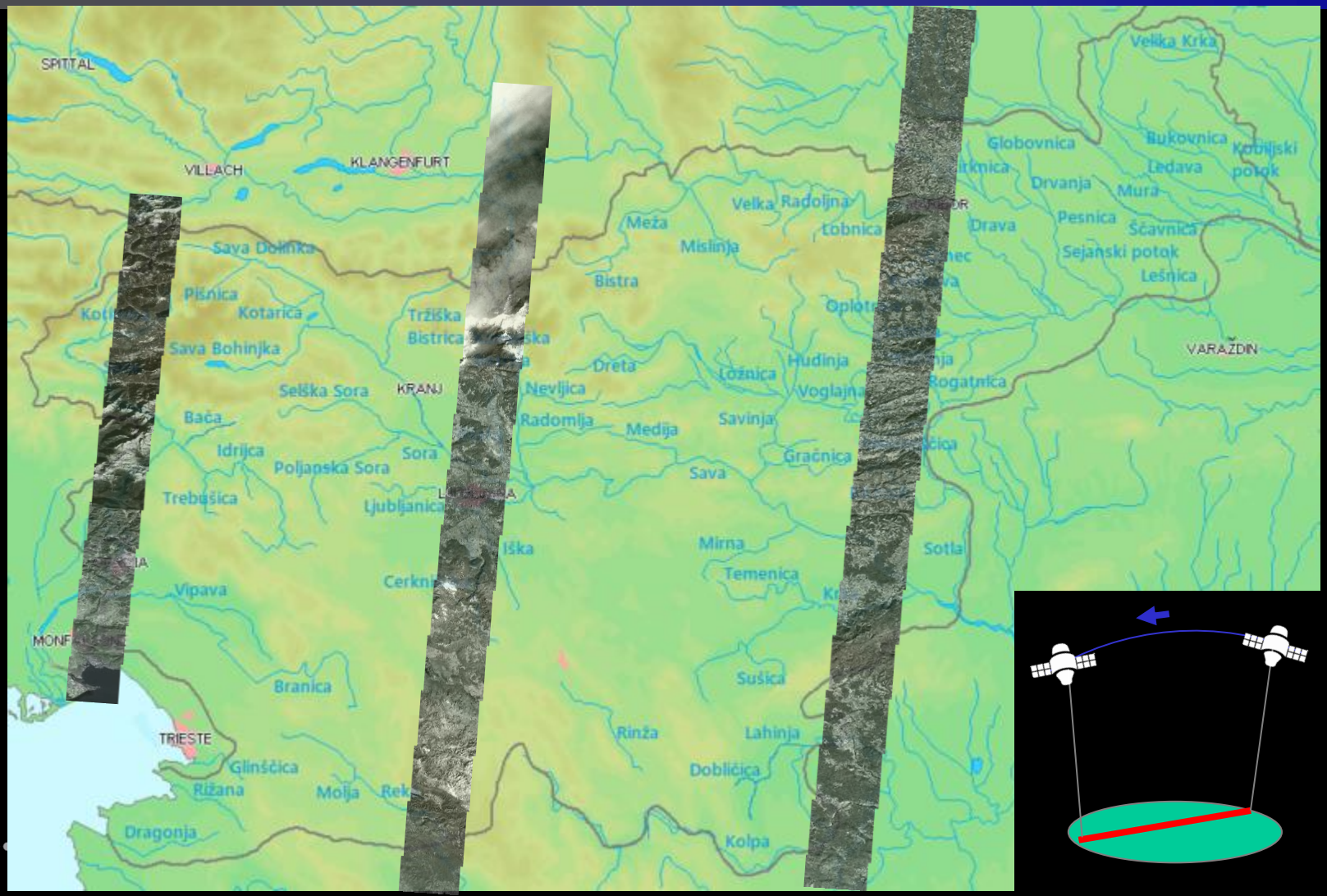
NEMO-HD Innertial pointing



NEMO-HD Innertial pointing



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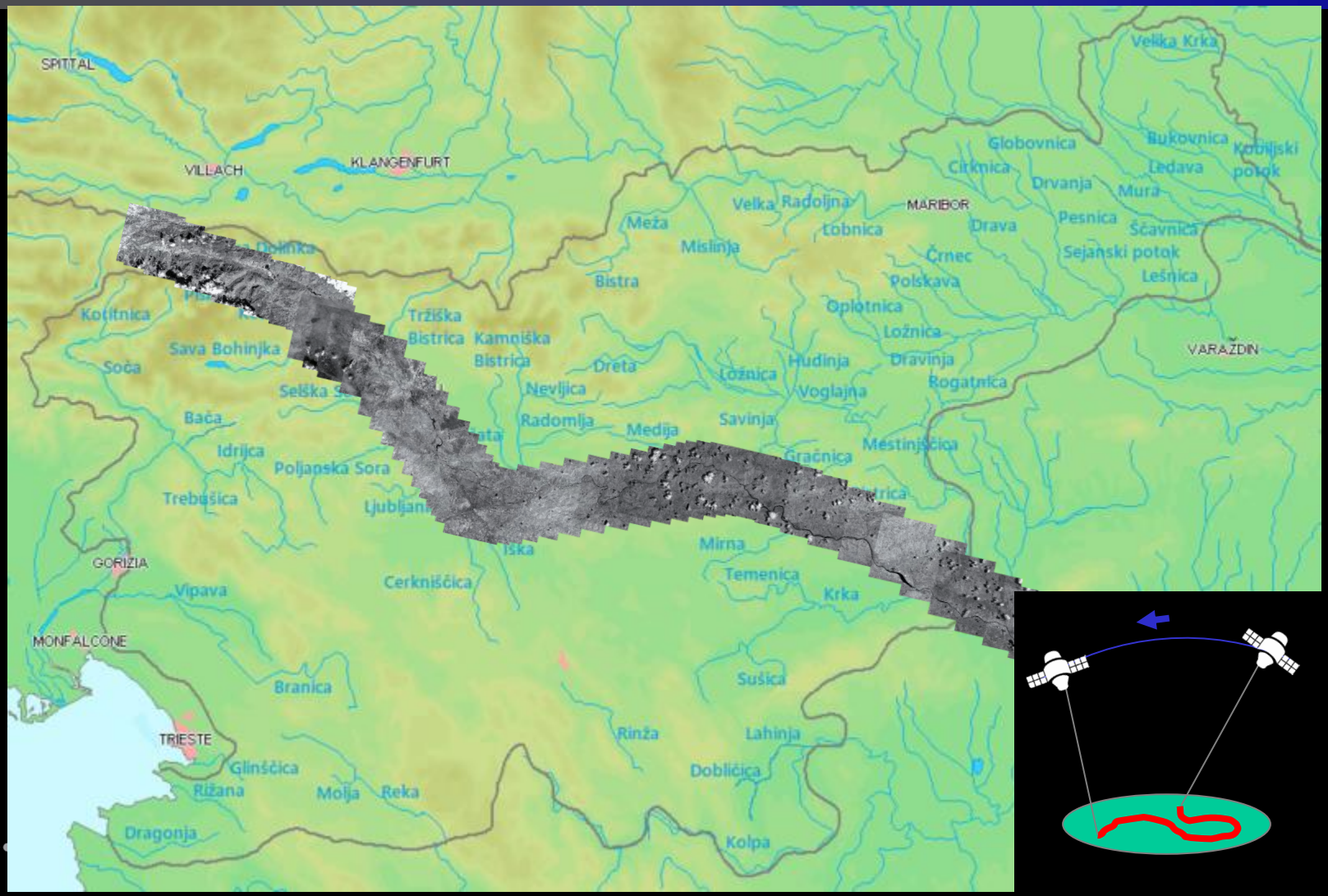
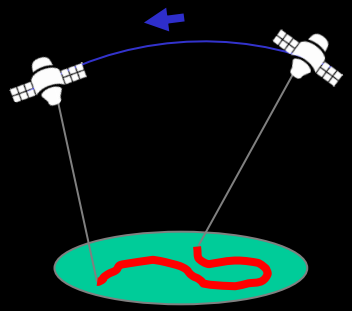
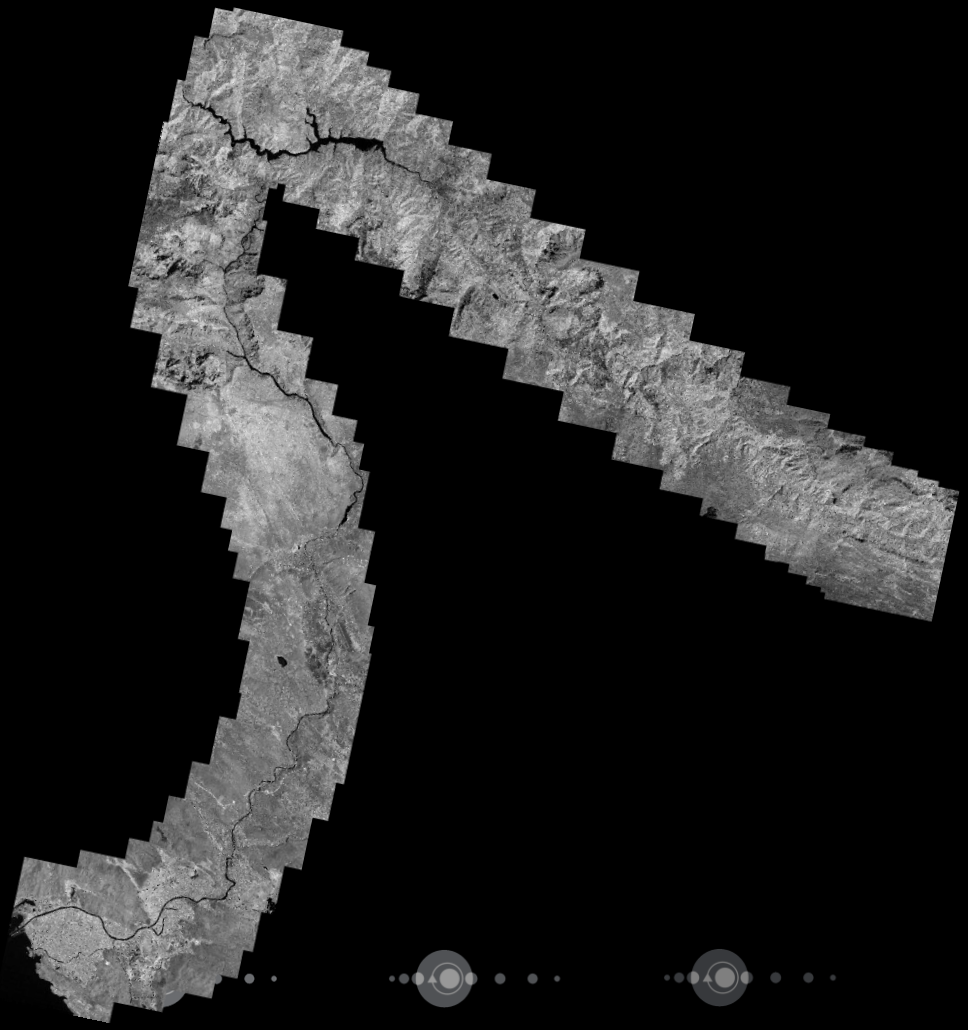
NEMO-HD Curve tracking - Sava River in Slovenia



NEMO-HD Curve tracking - Neretva River in BiH S2S

Observation of rivers from **source to sea** for holistic management.





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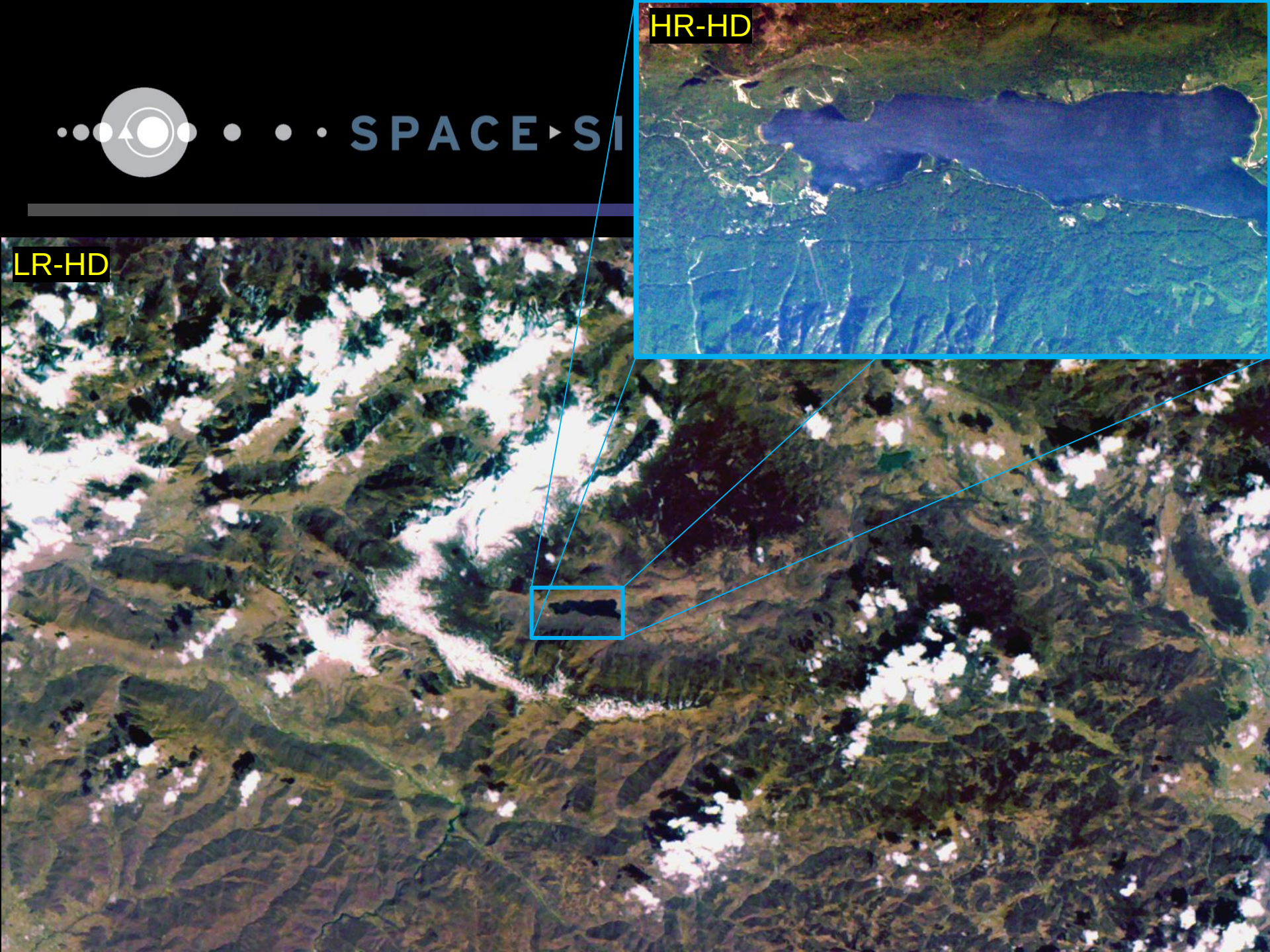
NEMO-HD Curve tracking – HR and LR video, Bohinj–Bled–Ljubljana, Slovenia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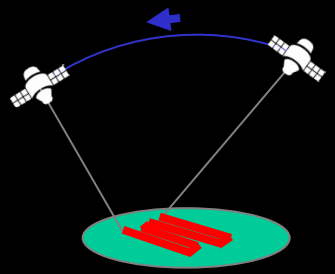
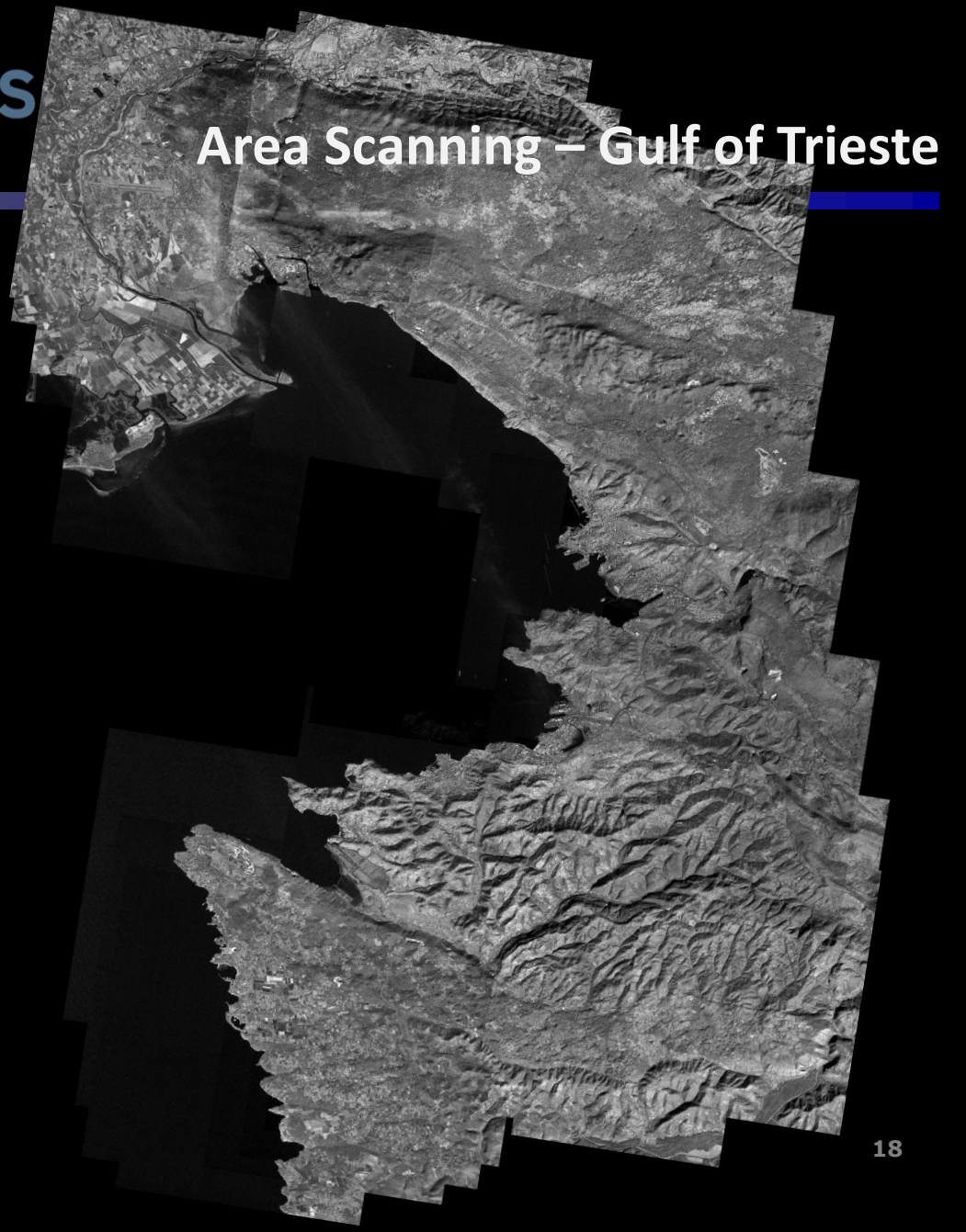
HR-HD
LR-HD

Area Scanning – Gulf of Trieste





NEMO-HD Target tracking - Istanbul, Turkey

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Live Video from Space

Conclusion

- **Challenge:** How to cover areas of interest wider than the satellite swath with a single microsatellite and get the data in near real time

- **Solution:**
  - the use of different attitude modes
    - **Inertial pointing** for systematic monitoring
    - **Curve tracking** for monitoring of rivers or coastlines (Source-to-sea)
    - **Area scanning** to cover wider areas – river delta, large cities, large forest fires
    - **Target pointing** for video acquisition
  - Transportable ground station for low latency and (near) real time data transmission

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