IDEAS-QA4EO

ENVISAT and ERS-1/2 CEOS-ARD SAR NRB PROJECT

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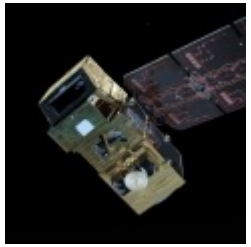
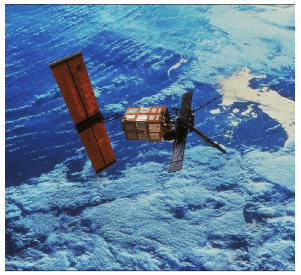
Recap from April 2022

- Project started in January 2022
- Development based on Sentinel-1 ARD prototype
- Processor prototype design driven by:
  - **Immediate analysis –**
    - *by means of ensuring that CEOS-ARD requirements related to radiometric terrain correction, projection of DEM etc. are implemented;*
  - **Interoperability –**
    - *by ensuring that the same gridding and DEM are used as in the Sentinel-2 mission, thus expanding interoperability with Sentinel-1, and future Sentinel-1 NG, ROSE-L and BIOMASS missions;*
  - **Cloud computation capability –**
    - *by developing the output product in the Cloud-Optimised GeoTIFF (COG) format;*
  - **Open science compliance –**
    - *by developing an open-source software for the processor.*

Recap from April 2022

Sentinel-2





ERS-1/2

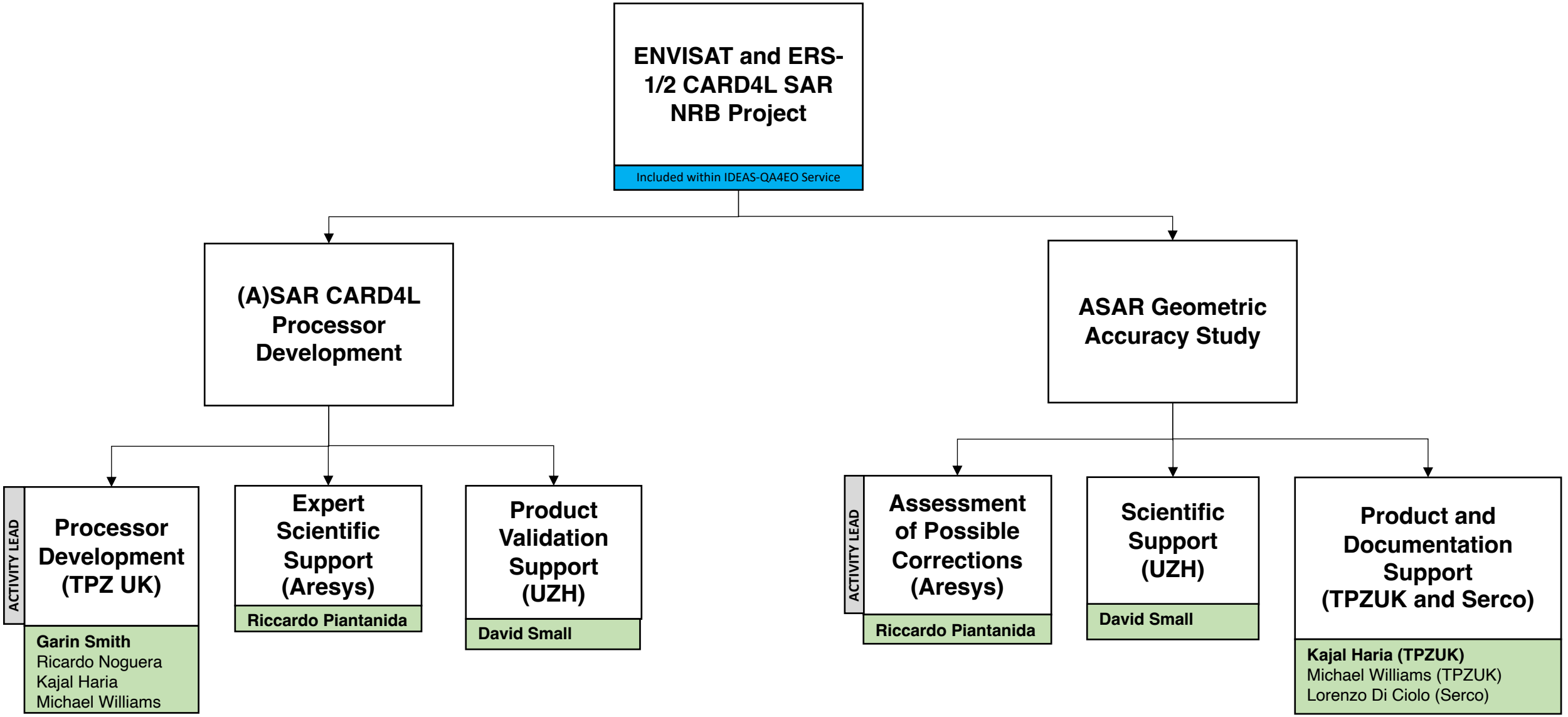
ENVISAT

Sentinel-1

ROSE-L

BIOMASS

Recap from April 2022



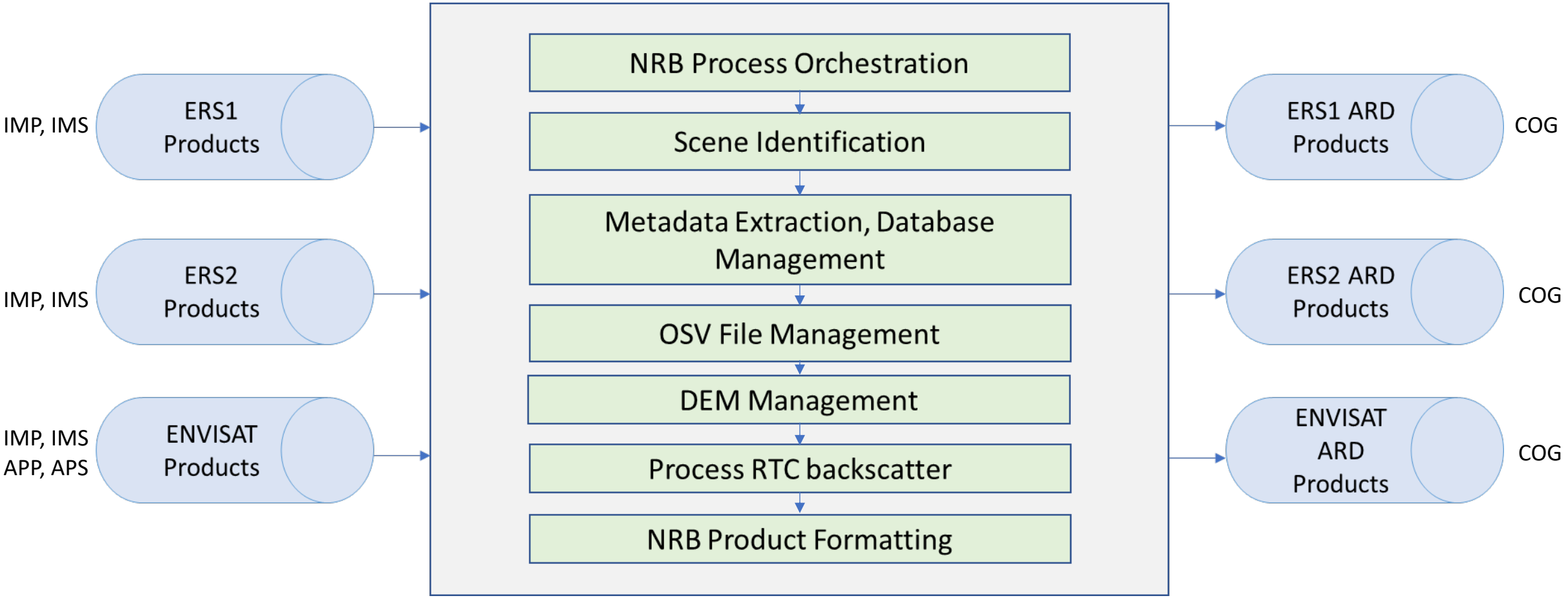
Current Status

- Processor development: **COMPLETE**
  - Builds upon: ***PyroSAR library of Python***
    SNAP -> Open source
  - Digital Elevation Model (DEM): ***Copernicus DEM***
    EEA-10 (over EEA39 countries) and GLO-30 DEM (over other countries)
    Few areas with restricted access where the GLO-90 DEM used
  - Radiometric Terrain Correction (RTC): ***Flattening Gamma: Radiometric Terrain Correction for SAR Imagery, Small, D. (2011)***
  - Gridding: ***Aligned to Military Grid Reference System (MGRS)***
    Geometry and CRS of each tile read from a reference KML file provided by the Sentinel-2 mission
    Pixel spacing is dependent on the image mode (ASAR IMP: 12.5 m) (ASAR WSM: 75 m)

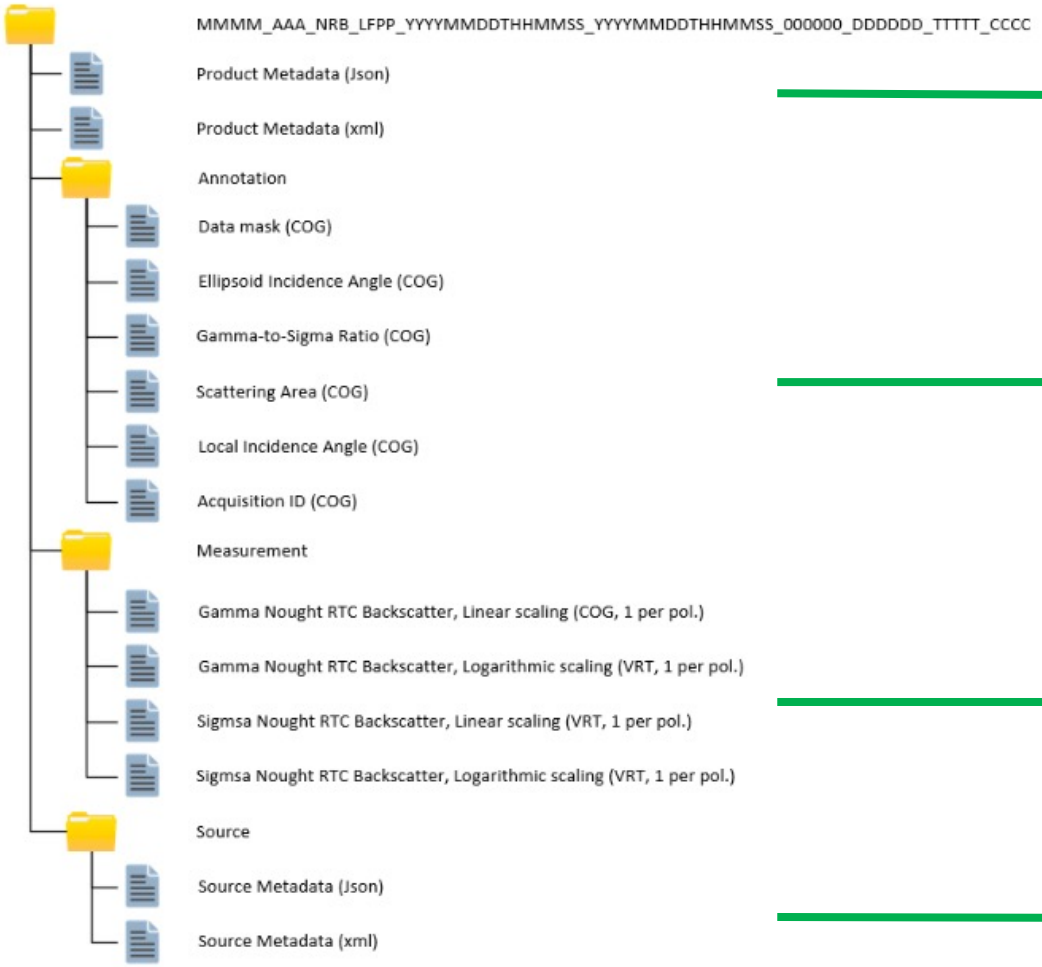
Current Status

- 30/30 CEOS-ARD NRB ‘Threshold’ requirements implemented (**100%**)
- 7/14 ‘Target’ requirements implemented (**50%**)
- Outputs are being verified in the final stage
- 1st Version of documentation released. Updates to follow after verification is completed:
  - Architecture design document
  - Verification plan and report
  - Software user manual
  - Product specification

Processor Architecture



Outputs



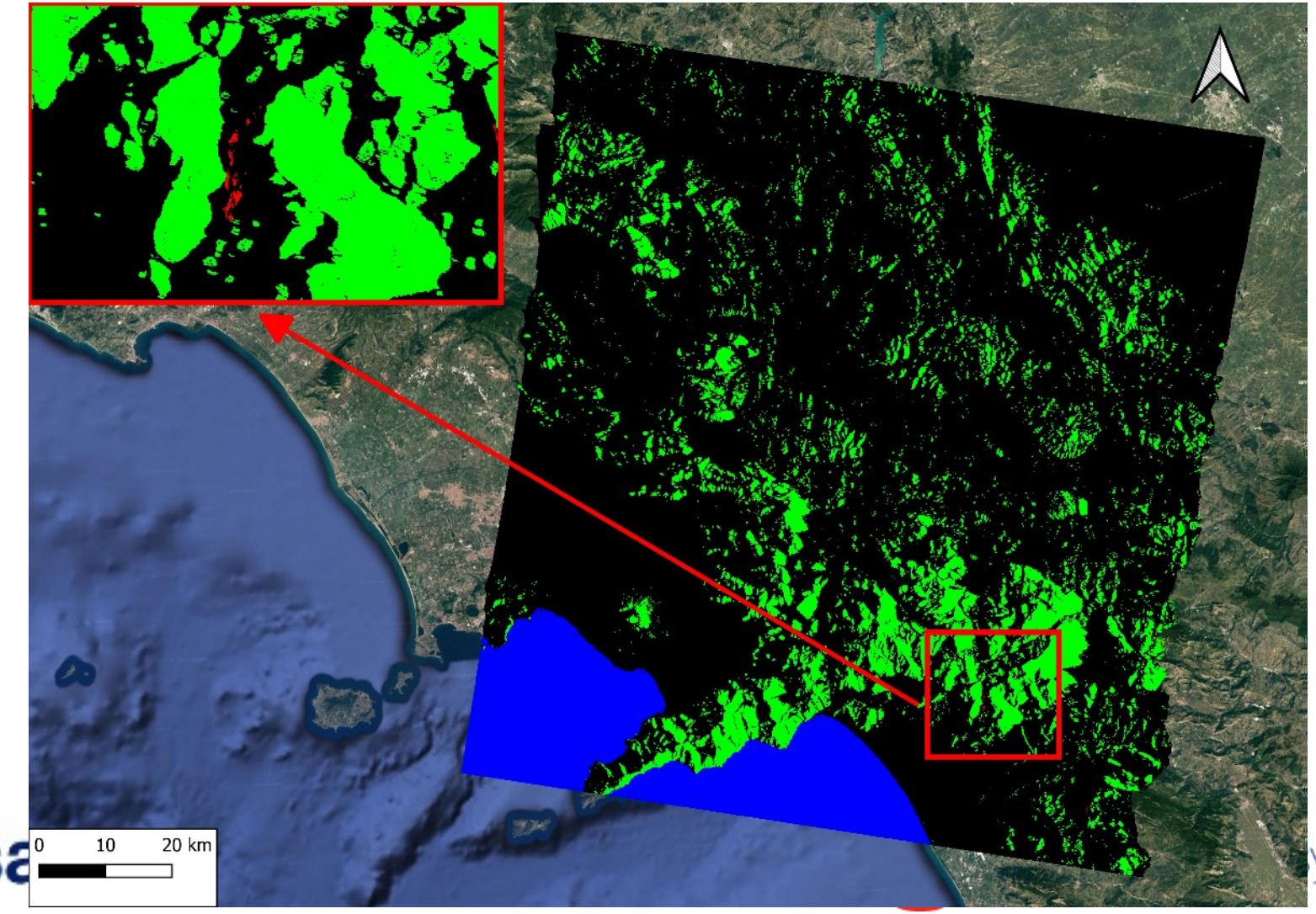
Metatdata of output product

Image files providing information supporting the backscatter measurements

Backscatter image files, one for each polarization, as well as virtual raster files for logarithmic scaling and conversion to sigma0 RTC.

Metadata of source product

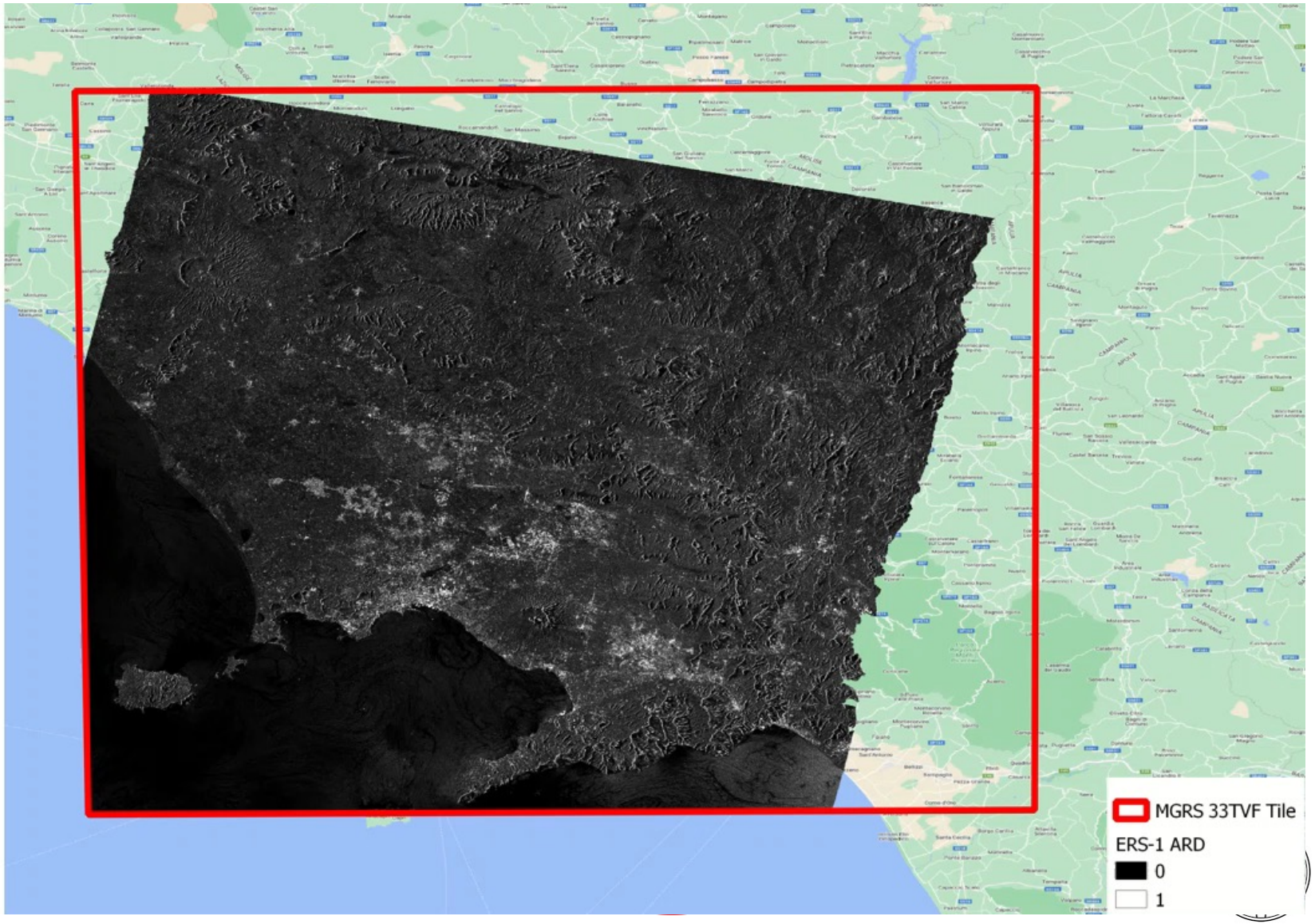
Output Product Layers



Data Mask in RGB

ERS-1 vs ERS-2 vs ENVISAT ASAR vs S-1 CSAR

ERS-1
VV Polarisation
(09/08/1991)



Geolocation Study Results

- The geolocation accuracy assessment was carried out for ASAR IMS products. Out-of-the-box results were compared to results after post-processing corrections application

RECOMMENDATION

Implement the azimuth bi-static delay within ASAR ARD processor as bulk correction of the whole image for the slant range time in the middle of the product

confirming that an average atmospheric delay is already included in the range bias correction which is applied during ASAR processing

- Azimuth bi-static delay: ***Post-processing correction led to a significant enhancement of the ASAR geolocation accuracy, being both the azimuth bias and RMSE improved***

Conclusions and Next Steps

- The CEOS-ARD NRB Prototype Processor for (A)SAR products has a very ***promising start***
  - Output products show good scientific quality
  - Outputs products are reasonably aligned with Sentinel-1 ARD products
- **Short term:**
  - Deliver final version of the processor and documentation
- **Medium term:**
  - Validate products using UZH internal RTC processor
  - Implement and verify noise removal in a more intuitive manner
  - Implement results from Geolocation Accuracy Study
  - Improve RTC
  - Implement dedicated processor for products over Ocean – ORB Processor
- **Long term:**
  - Alternative processing without SNAP

THANK YOU!