

ROSE-L – the Radar Observation System for Europe at L-band

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Copernicus Timeline – Current and Future SAR Missions

Copernicus Expansion missions

- Provides new information not yet available (**Gaps**)
- Provides enhanced information in combination with current Sentinel missions (**Enhanced continuity**)



ROSE-L Objectives and Services



CLMS



C3S



CMEMS



EMS



Security



Meteorology and
Hydrology Services



National and Local
Authorities

Geohazards Monitoring

- Deformation
- Landslides
- Urban subsidence
- Flooding

Land Use, Agriculture and Forestry

- Forest biomass and structure
- Land over and land cover change
- Agriculture

Soil Moisture

- High-resolution soil moisture

Cryosphere and Arctic

- Sea ice characterization
- Ice sheets and glacier velocity
- Grounding line
- Snow water equivalent
- Permafrost thawing and extent

Marine Monitoring

- Ocean surface wind vectors
- Swell properties

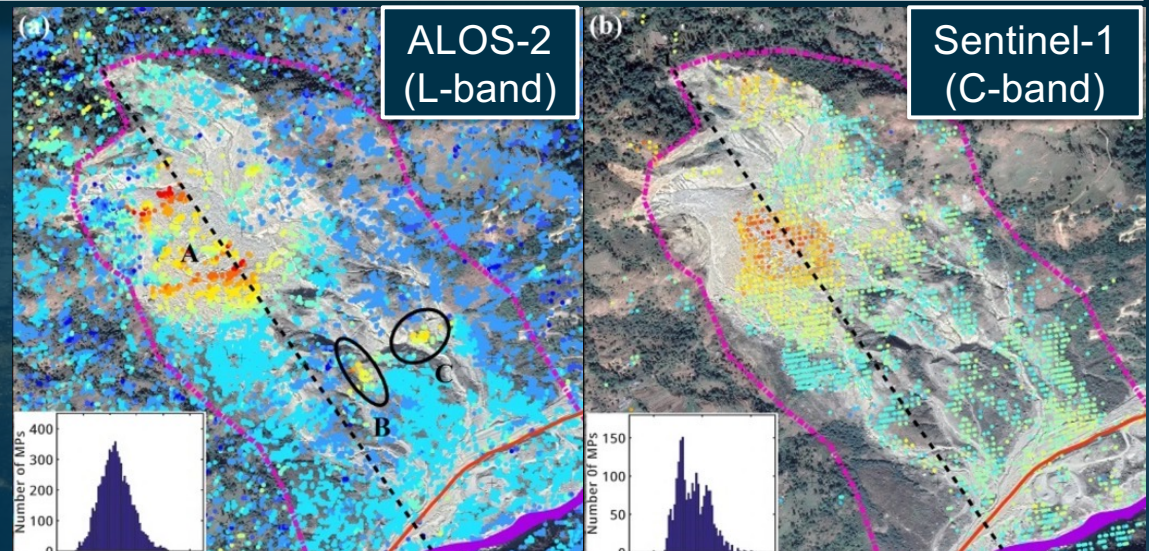
Maritime Monitoring

- Iceberg location, size and drift
- Vessel location, size and velocity
- Oil spill location and morphology



Geohazards Monitoring – Ground Motion

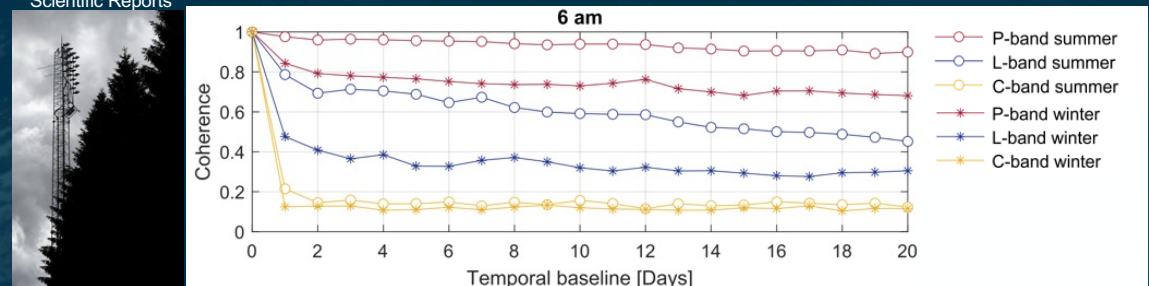
- **Improved coverage** and availability of motion information in **vegetated and snow covered areas**, compared to C-band, mainly due the capability of sensing the ground
- **Enhanced robustness to phase unwrapping** in fast deformation scenarios due to longer wavelengths



Post-disaster annual mean LoS deformation rate of Sunkoshi landslide measured by (a) ALOS-2 data during period I (2014-2017) and (b) Sentinel-1 data during period I (2017-2019, with 10 months overlap with period I).
From Ao et al., 2020, Characterizing the evolution life cycle of the Sunkoshi landslide in Nepal with multi-source SAR data, Nature, Scientific Reports

REQUIREMENTS

- 6 days repeat pass with two satellites
- 50 m2 Resolution for localized displacement
- ASC and DESC acquisitions for EW motion
- Low latency for rapid mapping after event



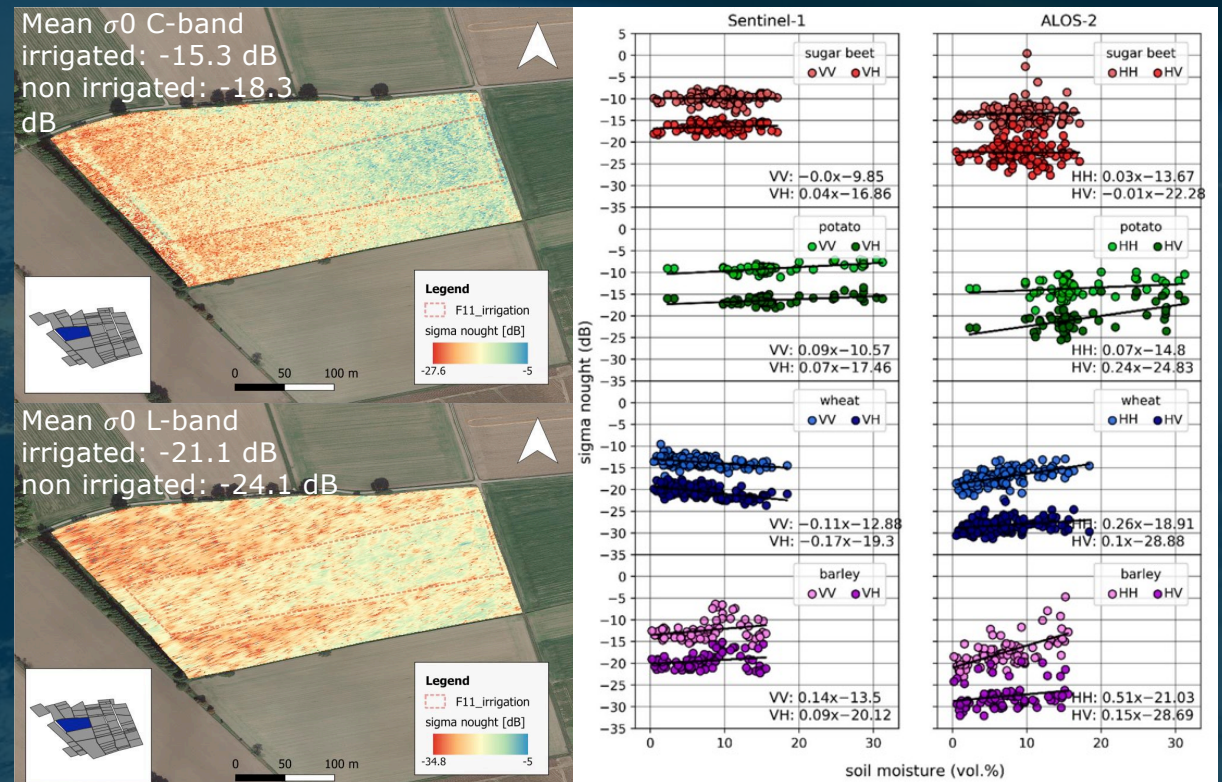
ESA BorealScat experiment. Median temporal coherence over temporal baselines of multiples of one day.
From Monteith and Ulander, TGRS, 2021

Soil Moisture

- **High-resolution Soil Moisture tracking in a broad range of crops and vegetated land**, complementing Sentinel-1 SSM products that are mainly suitable for bare soils and low vegetation areas.
- Information of **Soil Moisture up to ~5 cm depth** that shall be combined with upper 1 cm layer SSM from Sentinel-1

REQUIREMENTS

- Revisit (6 days Global, 3 days Europe)
- High resolution
- Low noise level (NESZ, ambiguities)
- Integration (downscaling) with Scatterometers and L-band Radiometers for temporal revisit and accuracy



Results from ESA Sarsense air- and space- borne campaign. Acquisitions over Selhausen (DE).
(left) Change in backscatter observed in C- and L-band for irrigated and non-irrigated area (F11), but also range dependent.
(Right) Scatter plots between soil moisture and backscattering signal from co- and cross-polarized channels of C- and L-band satellite data. From Mengen et al., 2021, Remote Sensing

ROSE-L Mission in Brief

GENERAL

- ❖ Constellation of 2 satellites (PFM & FM2) + options under study
- ❖ Consortium led by Thales Alenia Space Italy (TAS-I), involving 29 companies from 15 countries
- ❖ Service continuity with Sentinel-1 FG and NG

COVERAGE

- ❖ Coverage of Global Land (excl. Antarctica) and Arctic
- ❖ Revisit with 2 satellites :
 - 6 days Global Land
 - 3 days Europe
 - 1 day Arctic
- ❖ Repeat cycle of 6 days over Global Land (2 satellites)

PROGRAMMATICS

- ❖ Currently at the beginning of Phase C
- ❖ Science Plan activities start in 2023
- ❖ Launch of PFM expected in 2028
- ❖ FM2 delivery expected in 2030

IMAGING

- ❖ L-Band – 85 MHz ITU allocated band (1.215-1.300 GHz)
- ❖ Dual-Pol and Quad-Pol modes
- ❖ Wave mode capability
- ❖ Resolution < 50 m2 (RIWS mode)
- ❖ NESZ < -28 dB
- ❖ DTAR < -23 dB
- ❖ Swath width > 250 km

SYSTEM

- ❖ Synergic acquisitions with Sentinel-1: co-located swaths and support to convoy configuration
- ❖ Low latency
 - 10 min Europe coastal waters
 - 200 min Global
- ❖ Companion friendliness for Single-Pass Interferometry

