



BelSAR

BelSAR *Bistatic SAR Campaign over HESBANIA*



BelSAR : an Airborne Campaign for L-Band Full-Polarimetric and Interferometric Bistatic SAR Measurements over Belgium

ESA Contract No. 4000117154/16/NL/FF/mc

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Objectives

1st Airborne Campaign for SAR Bistatic Interferometric Measurements at L-Band and Full-Polarization over a Belgian Test Site

Assessing potential of **SAOCOM/SAOCOM-CS** mission for applications in

- agriculture
- soil moisture
- bistatic SAR science

➤ To provide **measurements of interferometric coherence and bistatic radar cross section** at different timescales

➤ To **fit as much as possible with the SAOCOM-CS configuration**

Background: OLIVIA study (CSL, 2013-2014 under ESA contract) :

candidate applications that could benefit from a SAOCOM – SAOCOM-CS 1B mission

Ref. : Christian Barbier, Dominique Derauw, Anne Orban, and Malcolm W.J. Davidson, *Study of a Passive Companion Micro-Satellite to the SAOCOM-1B Satellite of Argentina, for Bistatic and Interferometric SAR Applications*, Proc. SPIE Remote Sensing Conf., Amsterdam, 22-24 September 2014.



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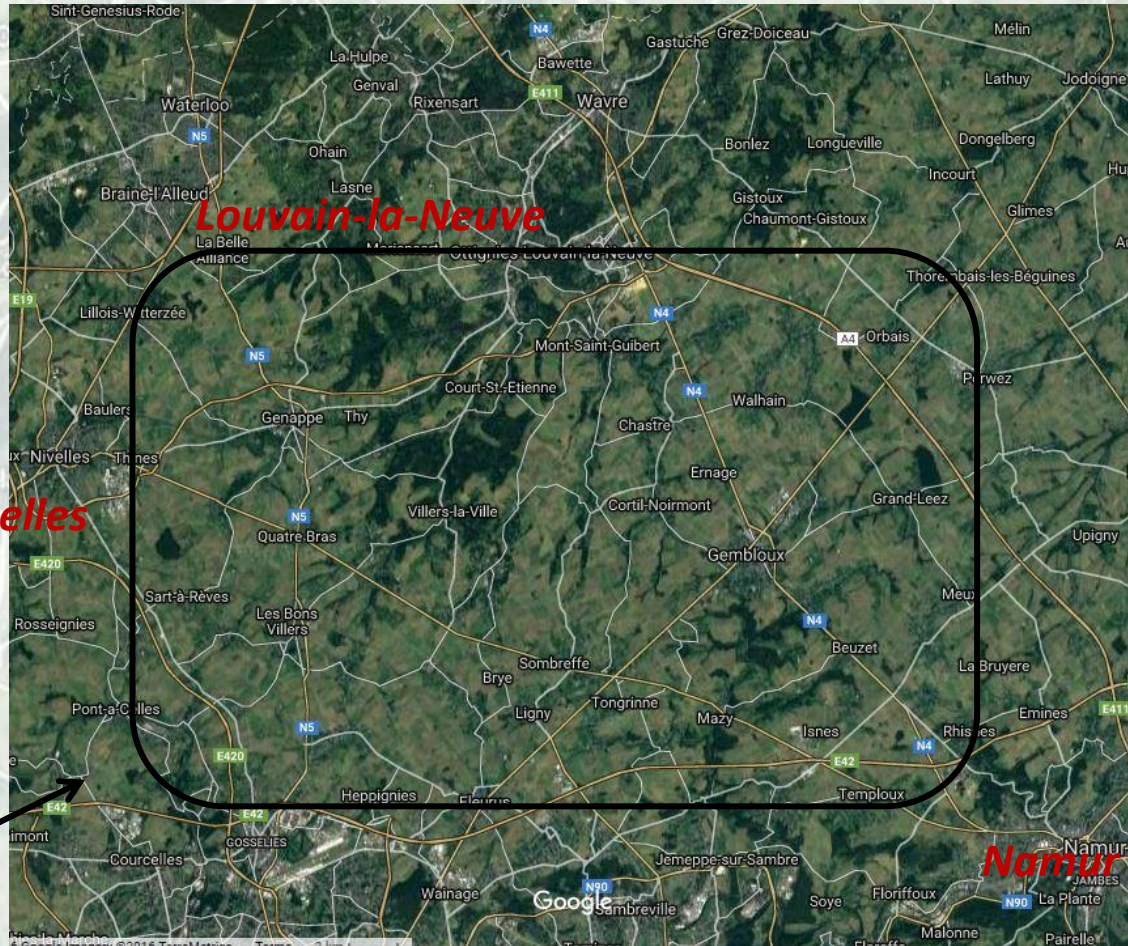
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Partners

- **Centre Spatial de Liège (CSL) – ULg (B):**
Prime contractor
InSAR/PolInSAR measurements
Time series of interferometric coherence maps in context of land cover monitoring
- **Earth and Life Institute – Pole of Environmental Sciences (ELIE) – UCL (B):**
Crop identification, land cover
Crop growth monitoring (development stage)
Characterization of biophysical variables (total leaf biomass, leaf area, water content)
- **Laboratory of Hydrology and Water Management (LHWM) – UGent (B):**
Monitoring of soil moisture on bare soils
Monostatic/bistatic acquisitions regarding roughness effects
- **Signal and Image Center (SIC) – RMA (B):**
Bistatic science, processing needs
Phase noise effects
- **MetaSensing BV (NL):**
Campaign operation
SAR data acquisition and processing

Test site: HESBANIA

- Results from previous studies allow attesting its interest and applicability in the context of the BelSAR campaign.
- Exact location under selection, region near Louvain-la-Neuve.





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Acquisition Scenario

Airborne acquisition configuration: two fully polarimetric L-band sensors on two aircrafts,

- one transmitting/receiving (T/R)
- one only receiving,

providing two simultaneous images

- one monostatic image
- one bistatic image

Sensors installed on the same side of aircrafts, allowing **across-track** and **along-track bistatic** acquisitions.

Acquisition Scenario

SAOCOM/SAOCOM-CS configurations

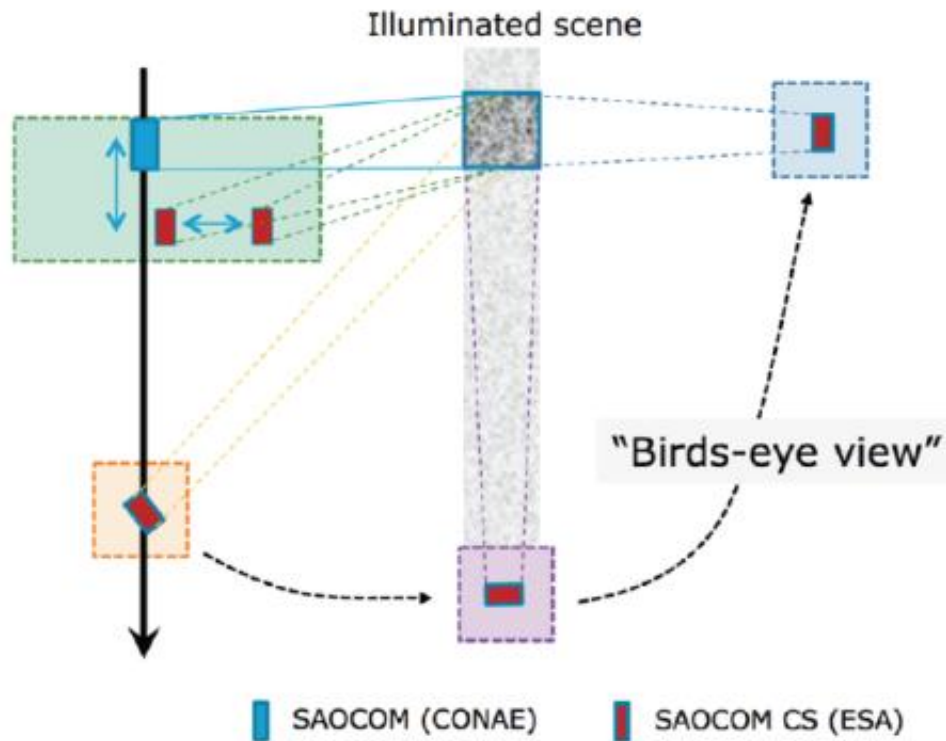


Figure 2-1. Bird's-eye view' of the SAOCOM and SAOCOM-CS geometrical positions with green = tomographic geometry (TG), orange = along track bistatic geometry (ATB), purple = perpendicular bistatic geometry (PBG) and blue = to specular geometry (SG). (ESA)



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Acquisition Scenario

Proposed configuration: two fully polarimetric L-band sensors on two aircraft,

- one transmitting/receiving (T/R)
- one only receiving,

providing two simultaneous images

- one monostatic image
- one bistatic image

Sensors installed on the same side of aircrafts, allowing **cross-track** and **along-track bistatic & interferometric** acquisitions.

Repeat-pass acquisitions on nearly same tracks, very short time interval



Fully Polarimetric Monostatic/Bistatic Interferometric SAR Data



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Acquisition Schedule

Driven by the context of agriculture and soil moisture monitoring, the BelSAR acquisitions are planned over the 2017 vegetation growth season:

- A first acquisition end of **March** on still bare soils: soil moisture monitoring and preliminary to vegetation development.
- Three acquisitions during senescence phase in the period **mid of June – end of July**: monitoring vegetation growth and characteristics.
- A last acquisition during **August**: soil moisture on yet again bare soils (harvested wheat or barley fields) and still-growing vegetation follow-up (mainly corn).

Ground-based measurements campaign

- specific to each application
- simultaneous to airborne SAR data acquisitions

Ground measurements campaign

- Simultaneous to airborne SAR data acquisitions
- Same fields for crop monitoring & soil moisture study
- For vegetation monitoring
 - Crop type information: 30 fields of 5 main crop types (wheat, barley, maize, sugar beet, potato)
 - Plant parameters: 10 winter wheat and 10 maize fields
- For soil moisture assessment
 - Soil moisture
 - Soil roughness
 - Soil texture & density

Task 1 - Scientific and Technical Requirements

❖ Scientific requirements of the campaign specific to each application:

- Soil moisture (UG)
- Agriculture (UCL)
- InSAR/PolInSAR (CSL)
- Bistatic SAR science (RMA)

Technical requirements:

- required data, acquisition frequency, campaign duration
- monostatic/bistatic acquisition geometry, incidence and bistatic angles, altitude
- spatial resolutions
- interferometric data requirements, critical/optimal baseline, phase preservation
- ...

❖ SAR processing requirements (MS)

❖ Acquisition scenarios (MS)

❖ Technical test campaign (MS)

Task 2 – Campaign Set-up

- ❖ Campaign Implementation Plan (CSL)
- ❖ Campaign Securing (MS)
- ❖ Verification of Technical Readiness (MS)

Task 3 – Data acquisition

- ❖ Ground Measurements (UG, UCL)
- ❖ SAR Data Acquisition (MS)

Task 4 – Data processing and Preliminary Analyses

- ❖ SAR Data Processing (MS)
- ❖ Higher-level Products: Time Series of Coherence Maps (CSL)
- ❖ Agriculture Monitoring (UCL)
- ❖ Soil Moisture Study (UG)
- ❖ Bistatic SAR Science (RMA)



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Thank you for your attention !