


New developments of advanced airborne SAR sensors for Earth Observation

Simone Placidi, Adriano Meta

METASENSING

Introduction to MetaSensing

MetaSensing airborne SAR technology

Multi-bands and multi-channels radar sensors

Example of current sensor (MetaSAR-XL, SnowSAR)

Future developments (OSCAR, KaSAR)

Company history

Before 2008	**2008**	**2010**	2011	2015
TU Delft, DLR, ESA, UNIRoma	**Founded within ESA BIC**	**Independent from ESA-BIC**	Second office in Munich - DE	Third office in Cassino - IT

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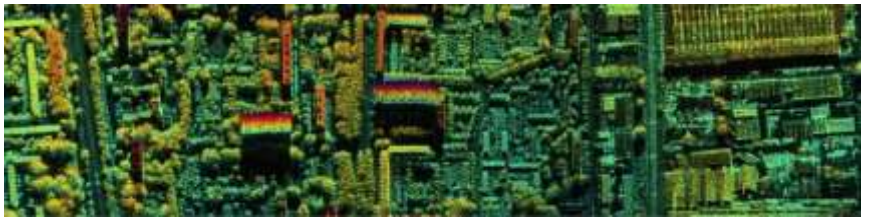
- Innovative remote sensing company with unique expertise
- We develop airborne Synthetic Aperture Radar (SAR) and ground-based radar
- We offer services such as data acquisitions and SAR processing
- High level of customization for scientific, commercial and governmental communities









Frequency Band	Frequency	Characteristic	Main Application
P	400 MHz	**2 Tx – 2 Rx** Interferometry (repeat pass) Polarimetry (quad-pol)	Vegetation penetration, DEM, concealed target detection
L	1.3 GHz		Vegetation mapping, agriculture DEM, land cover classification
C	5.3 GHz	**2 Tx – 2 Rx** Interferometry (single pass) Polarimetry (quad-pol)	Sea Ice, mapping, snow and ice properties
X	9.6 GHz		Imaging, MTI, mapping, DSM, surveillance, reconnaissance, weather, coherent change detection
Ku	17.2 GHz		Mapping, imaging, snow and ice properties, deformation monitoring
Ka	35 GHz		Mapping, imaging

Multi-frequency radars (X-L, X-P, X-Ku, L-Ku)

MetaSAR-XL

	L-band	X-band
Central frequency	1.3 GHz	9.6 GHz
Bandwidth	200 MHz	500 MHz
Slant range resolution	up 0.75 m	up 0.3 m
Azimuth resolution	up to 18 cm	up to 18 cm
Transmitted power	10W (average)	10W (average)
Transmitting channels	2 switching	2 switching
Receiving channels	2 simultaneous	2 simultaneous
Polarimetry	Yes	Yes
Interferometry	Repeat pass	Single pass
Slant range coverage	4 to 8 km (at 5 km altitude)	4 to 8 km (at 5 km altitude)

Application:

Land cover classification
Biomass monitoring
Digital Surface Model
Glaciers and Snow monitoring

PolSAR-L CM

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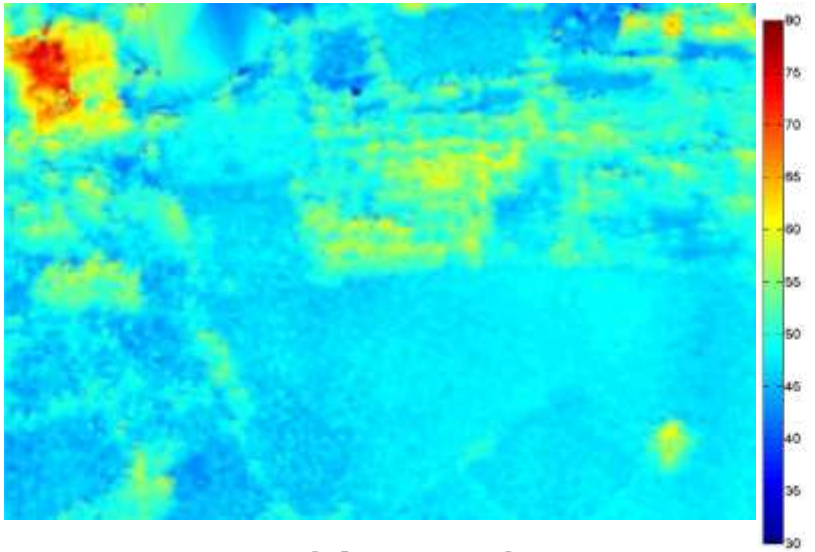

InSAR-X DSM

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Automatic Land Cover Classification

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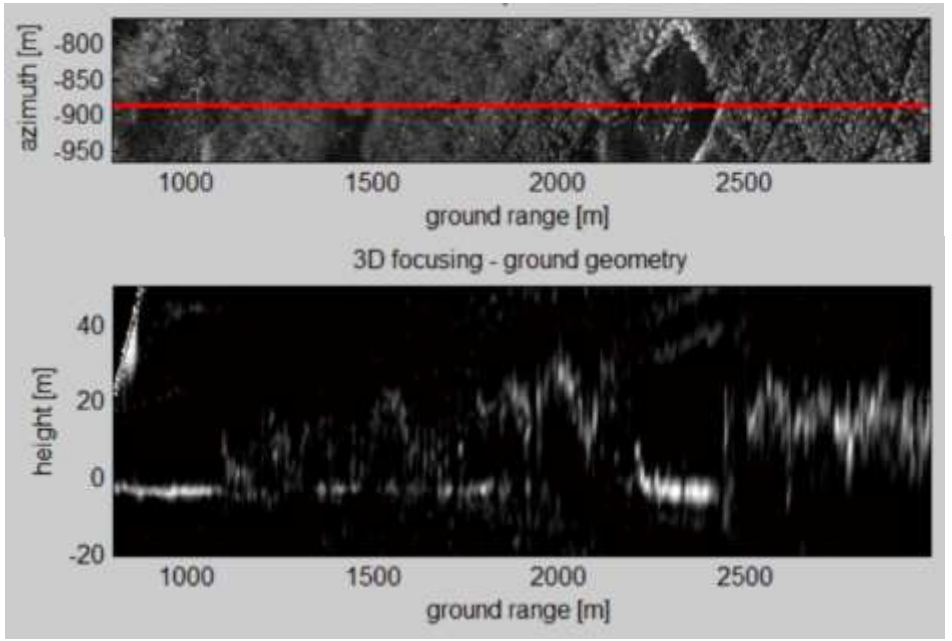
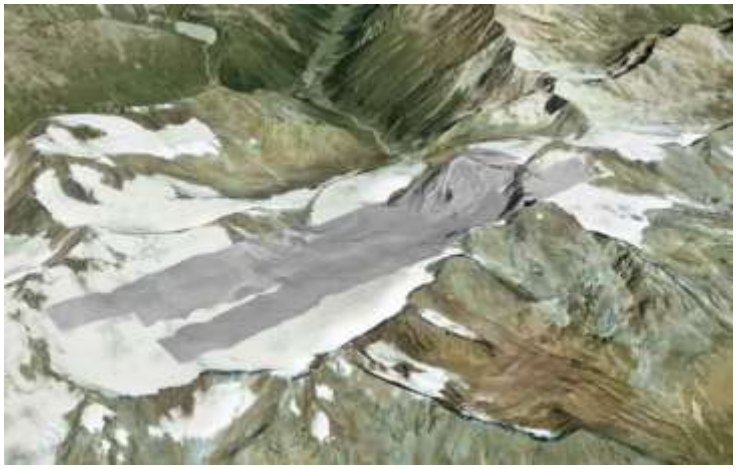
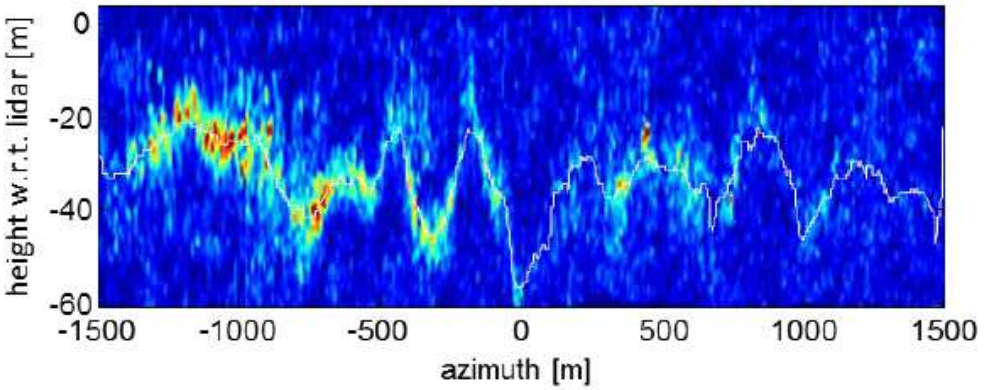


Biomass monitoring

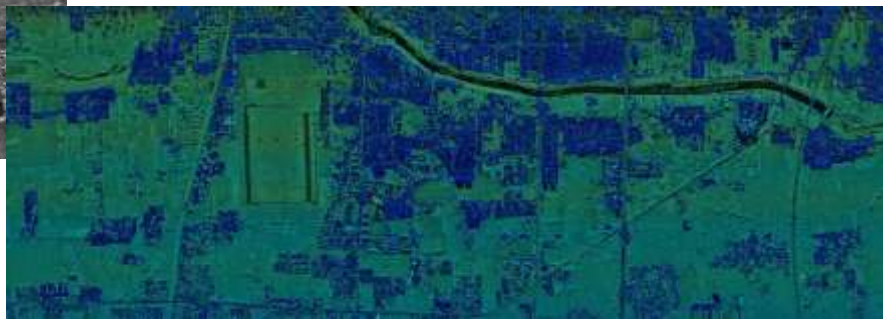
Glaciers mapping and profiling



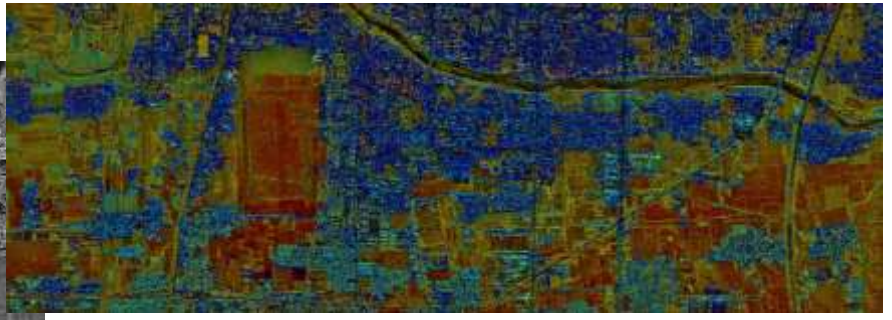


MetaSAR-XL flew last week in Henan Province, China

L-band



X-band



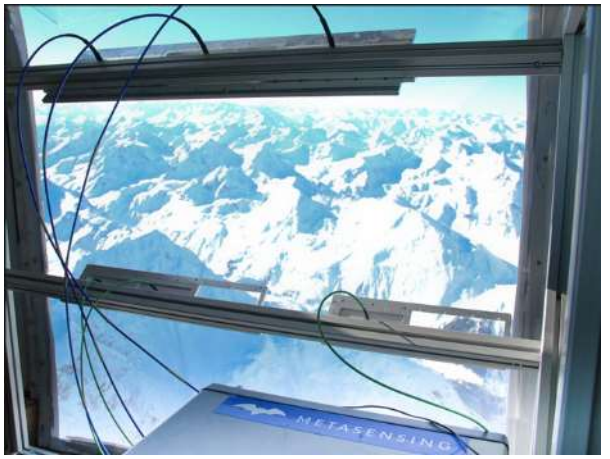
SnowSAR

Development of an airborne polarimetric SAR instrument at X- & Ku-band

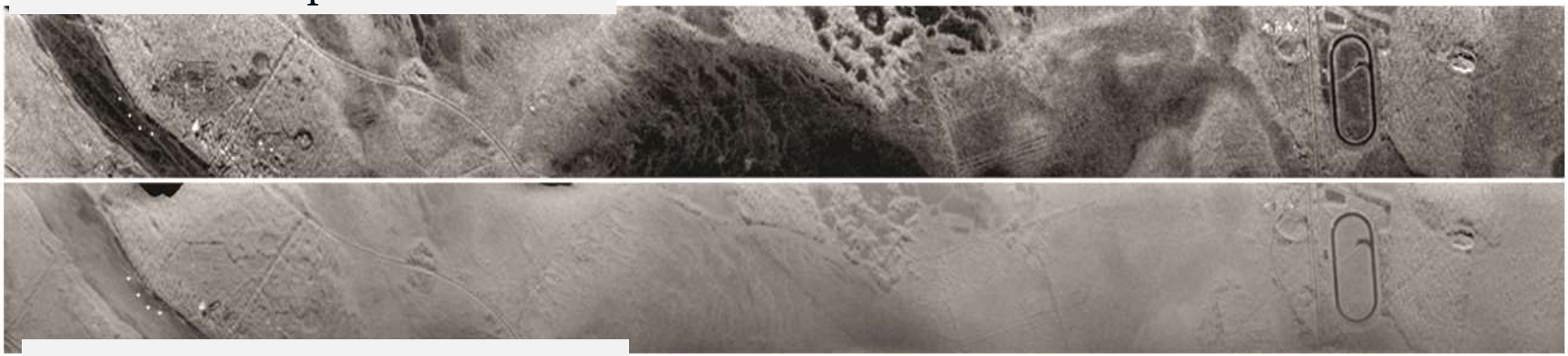
	Ku-band	**X-band**
Central frequency	17.2 GHz	9.6 GHz
Bandwidth	200 MHz	500 MHz
Slant range resolution	up 0.75 m	up 0.3 m
Azimuth resolution	up to 10 cm	up to 18 cm
Transmitted power	10 W (average)	10W (average)
Transmitting channels	2 switching	2 switching
Receiving channels	2 simultaneous	2 simultaneous
Polarimetry	Yes	Yes
Interferometry	single pass	Single pass

Application:

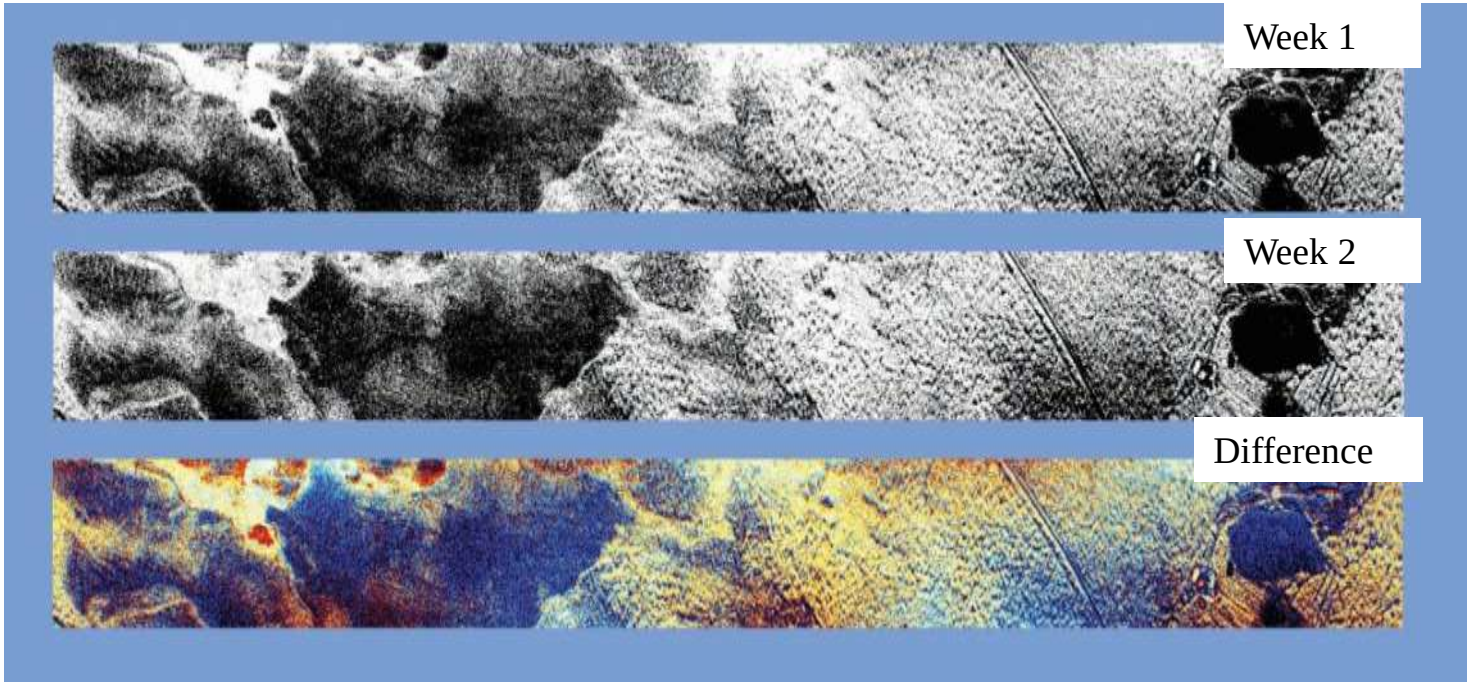
Snow monitoring
Snow Water Equivalent retrieval
Glaciers monitoring
Cryosphere



X-band – more penetration



Ku-band – less penetration



Finland

esa

Canada and Alaska

Environment Canada

NASA JPL

Austria

NASA

Next: NASA SnowEX

Multi-year airborne snow campaign

Digital Surface Model Generation

Lidar data resampled to radar spacing

Lidar accuracy is 5 cm

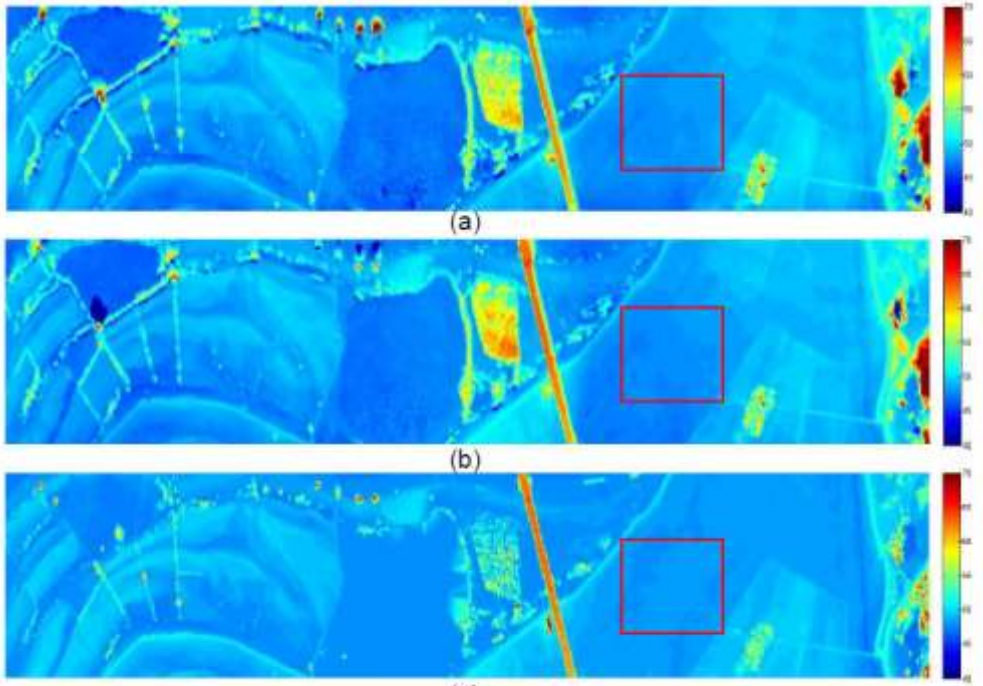


Fig.4. SAR and Lidar color coded DSM representations. X-band DSM (a), Ku-band DSM (b), Lidar DSM (c).

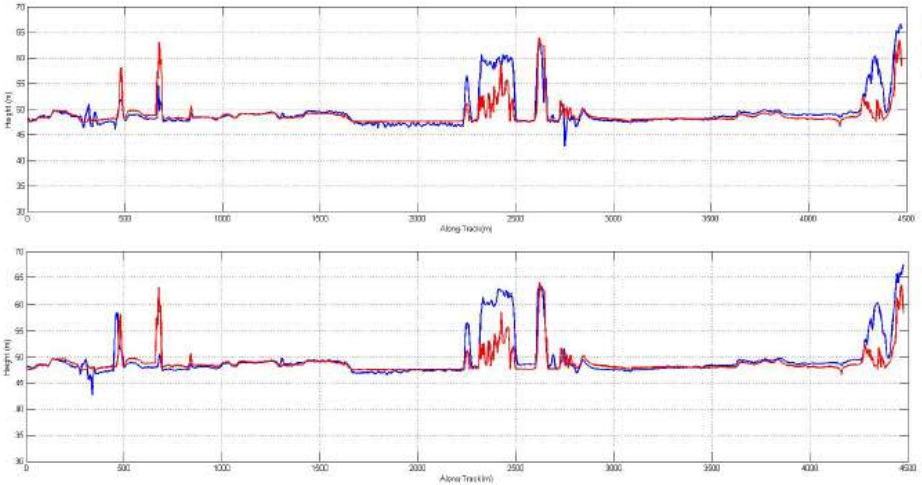


Fig.5. DSM profiles along azimuth. X-band profile overlapped to Lidar (up), Ku-band profile overlapped to Lidar (down).

SAR retrieved DSM vs Lidar DSM

standard deviation: 30 cm

Ocean Surface Current Airborne Demonstrator

Development of an airborne Along Track Interferometry SAR instrument at Ku-band tailored to **Ocean Surface Currents** observations

	OSCAR
Central frequency	**13.5 GHz**
Bandwidth	200 MHz
Slant range resolution	up 0.75 m
Azimuth resolution	up to 10 cm
Transmitted power	20W (average)
Transmitting channels	**4**
Receiving channels	**8 simultaneous**
Polarimetry	Yes (optional)
Interferometry	Single pass

Timeframe: 2 years
Current Phase: Design & Engineering

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National Oceanography Centre
NATURAL ENVIRONMENT RESEARCH COUNCIL

Starlab
Living Science

AIRBUS DEFENCE & SPACE

Ifremer

NLR

Ka-band InSAR Airborne Instrument Demonstrator

Development of an airborne Interferometric SAR instrument at Ka-band

	KaSAR
Central frequency	**35.75 GHz**
Bandwidth	500 MHz
Slant range resolution	up 0.3 m
Azimuth resolution	up to 5 cm
Transmitted power	20 W (average)
Transmitting channels	**2**
Receiving channels	**8 simultaneous**
Polarimetry	Yes
Interferometry	Single pass

Application:

InSAR-DInSAR for terrain monitoring
Water mapping
Cryosphere
Glaciology
Land surface classification
Oceanography

Timeframe: 2 years
Current Phase: Requirements Review

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ALTAMIRA INFORMATION

- MetaSensing is a remote sensing company with unique expertise in radar
- MetaSensing provides radar sensors as well as services
- Results from different SAR systems have been shown
- The future commercial application for Synthetic Aperture Radar sensor is with
  - multiple frequency (different penetration in the media)
  - multiple channels (interferometry, polarimetry)


METASENSING
Space Business Park,
Huygensstraat 44, 2201 DK, Noordwijk, Netherlands
info@metasensing.com
+31 71 751 5973
www.metasensing.com
Visit us at
Booth 18 A
GEOSPATIAL
WORLD
FORUM