



GSA

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First results of the Geodetic Integrated Monitoring System (GIMS) project



geonumerics



Gims

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Geomatics Research & Developemnt s.r.l.

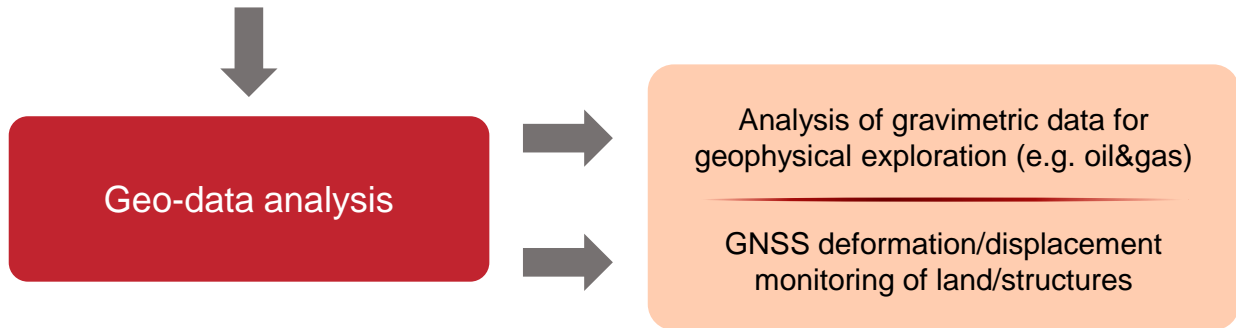


37° convegno nazionale del GNGTS, Bologna. 19 - 21 novembre 2018



Geomatics Research & Development s.r.l. (GReD) is a Politecnico di Milano Spin-off SME, founded in 2012 under the supervision of Prof. Fernando Sansò

GReD activities concern research & development, consultancies and services in the field of geodesy and geomatics (acquisition, modelling, interpretation of geospatial information)



Clients / collaborations / funding

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Kyoto University
**Research Institute for
Sustainable Humansphere**

e-geos
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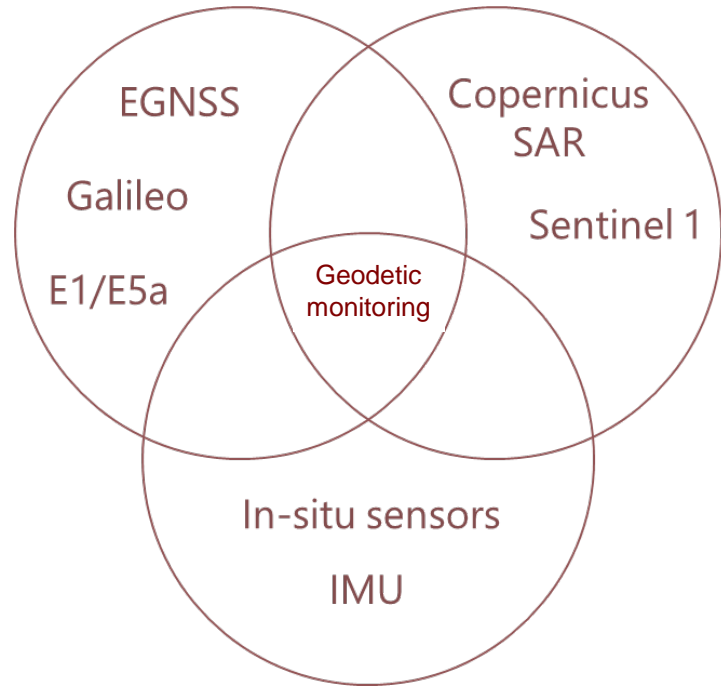
Comune di
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AIST Fukushima
Renewable Energy
Institute (FREI)
NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY (AIST)

Key factors:

- **Low-cost solution** (hardware, software, data, ...)
- Designed as an **end-to-end service**
- Integration between Galileo **GNSS**, **Sentinel InSAR** and **IMU**
 - High temporal resolution: IMU, GNSS
 - High spatial resolution: InSAR
- **Targeting different ground movements:**
 - slow (long-term GNSS time series),
 - sudden accelerations/cracks (IMU),
 - area-wise deformation patterns (InSAR)



The consortium



Consortium leader – administration, EGNSS processing



EGNSS hardware design and development



MEMS/IMU processing



Development of active reflectors and SAR processing



Project management and business development

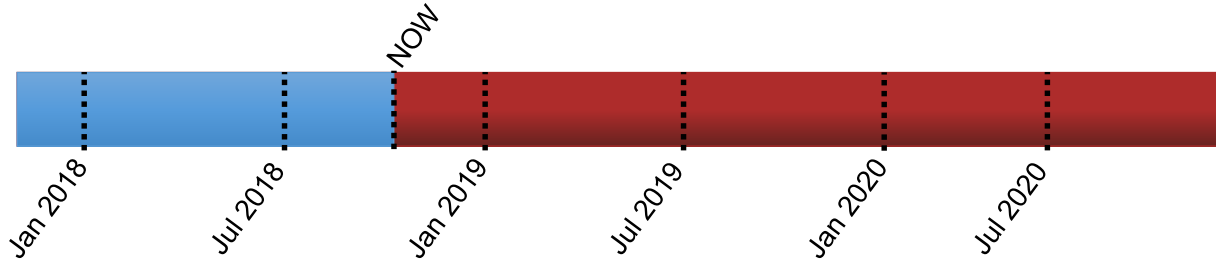


Geological interpretation and pilot test supervision



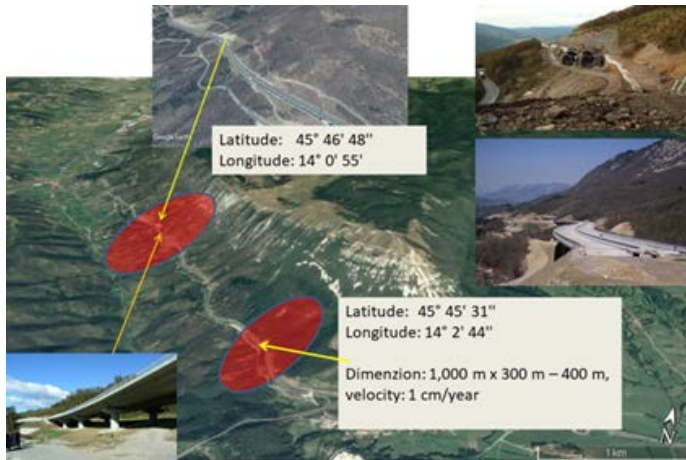
Gims project

Estimated Project Cost: 2.2 million €



Project duration: 3 years
November 2017 – October 2020

The GIMS system will be validated on two landslides, located in Slovenia



Motorway H4 Razdrto-Vipava (pilot area 1)

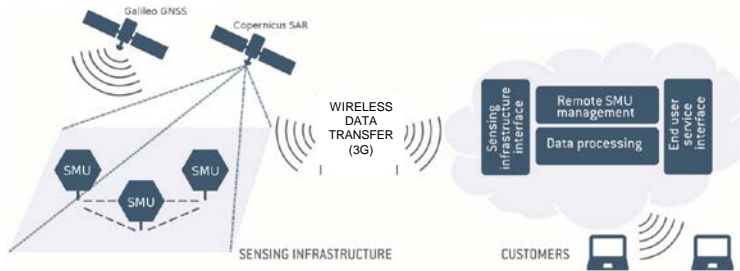


Landslide Macesnik (potential pilot area 2)

Gims project final scope



Once industrialized, the output of the GIMS project will be taken to the market by GReD, in collaboration with GIMS Partners, through the already existing GeoGuard® service (developed by GReD)



- Low-cost GPS
- No InSAR
- No IMU

The following examples are taken from the GeoGuard service

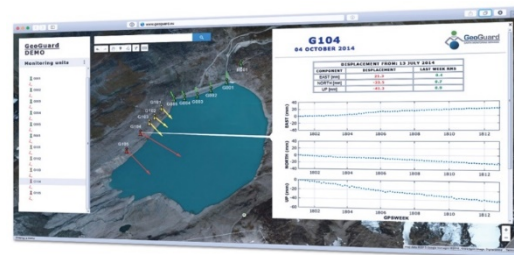


GEOGUARD



GeoGuard is an innovative end-to-end service based on **cost-effective GNSS receivers**, and **high-accuracy observation processing**, to measure structure displacements and deformations at **mm-level**

- *Industrial Partner: Softeco*
- *Development started in: 2014*
- *Current stage: TRL9* (actual system proven in operational environment)
- *Operative (2018): 16 sites, 70 monitored points*



GNSS data
processing &
quality analysis



Awards
H2020 SME Instr. 1 (2015)
Keys to Japan (2015)



Monitoring unit
design,
development &
management



HOW PRECISE GNSS IS?



GNSS receivers measure the distance between their antenna and satellites in orbit by acquiring and tracking signals in L band.

They are passive systems.

Different kinds of receivers are available on the market, targeting different precision levels:

✓ Professional receivers → Millimeter precision → High cost

Cost ~ 25000 €

✓ Mass-market receivers → Meter precision → Low cost

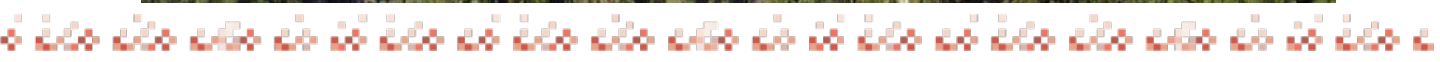
Cost ~ 2500 €



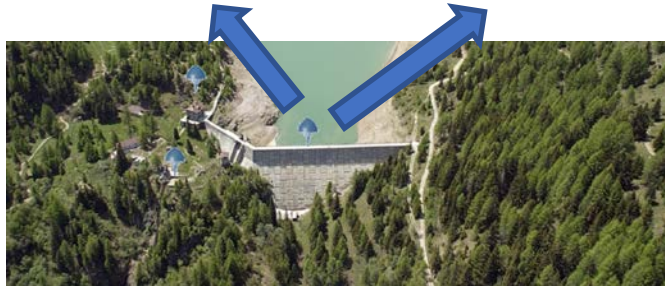
Millimeter
precision



SITE I: DAM



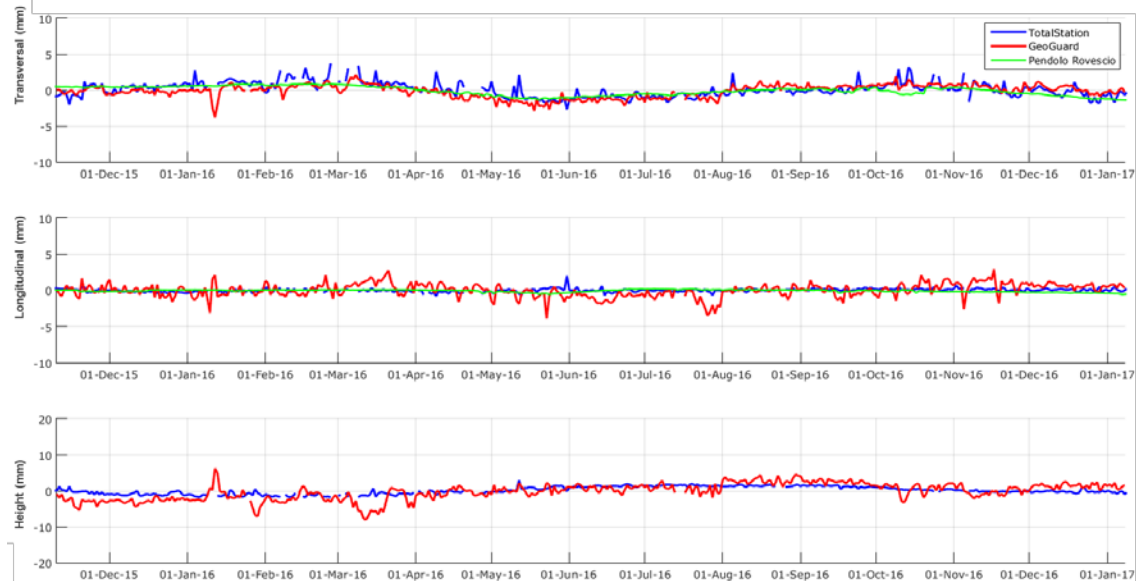
SITE I: DAM



SITE I: DAM



Crowning dam: 70 meters away from total station and local master

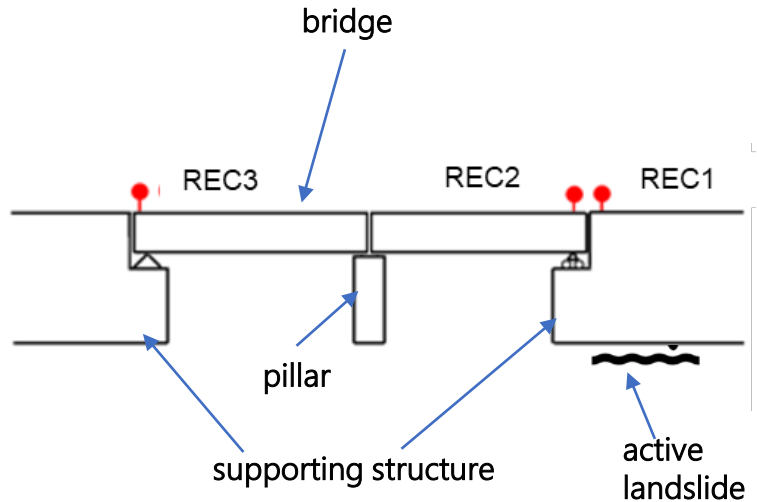


Longitudinal	RMS (mm)
Total Station	1.0
GeoGuard	0.9
Inverted Pendulum	0.6

Transversal	RMS (mm)
Total Station	0.3
GeoGuard	0.9
Inverted Pendulum	0.2

Height	RMS (mm)
Total Station	1.0
GeoGuard	2.1
Inverted Pendulum	-

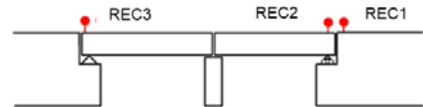
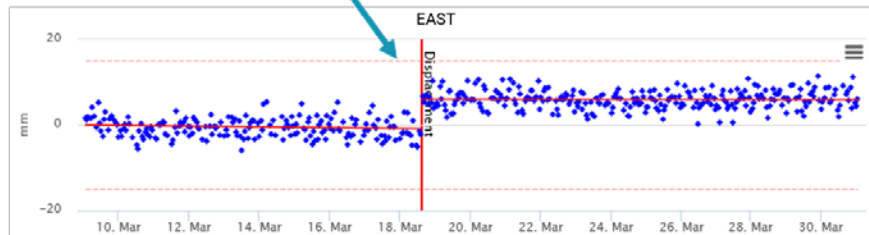
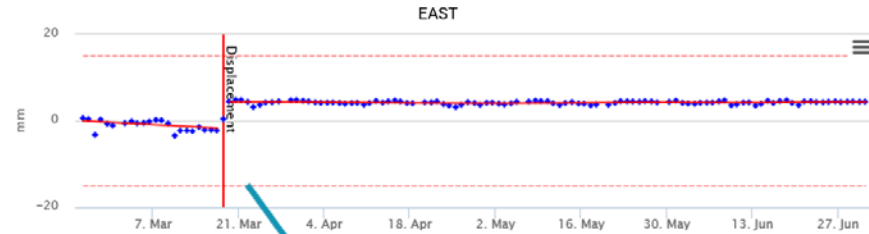
SITE II: HIGHWAY BRIDGE - SLIP DETECTION



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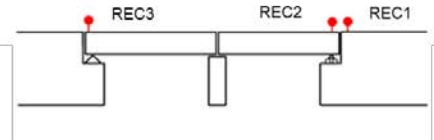
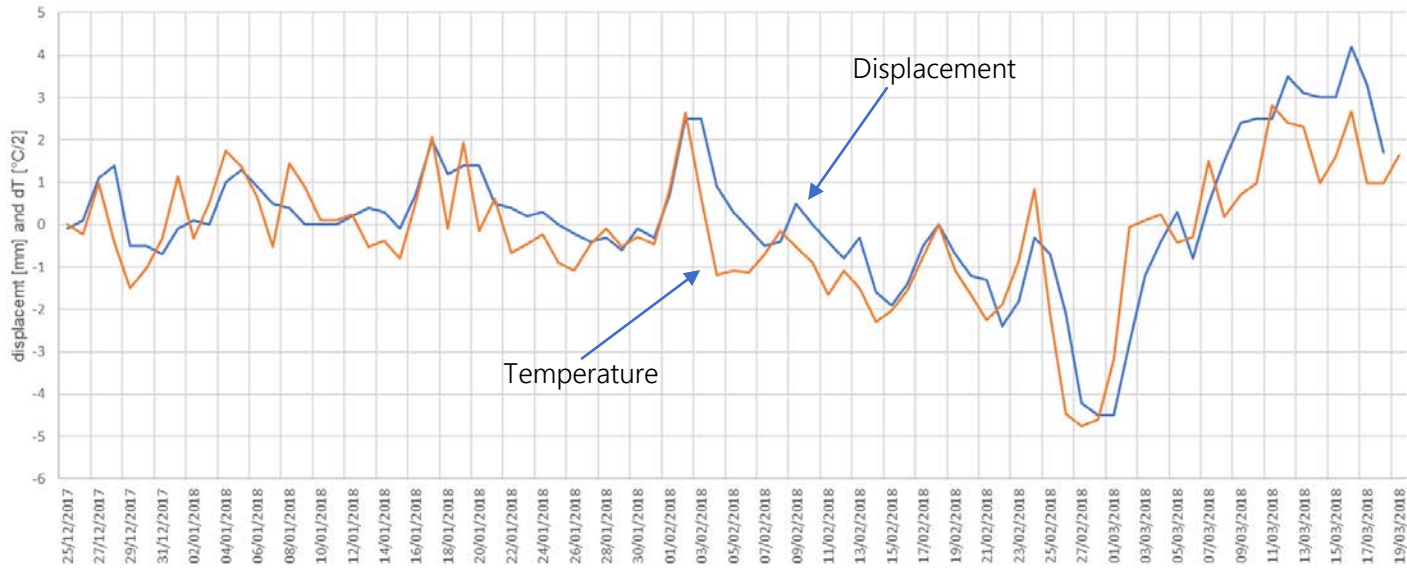


REC 2 Displacements, REC1 is master

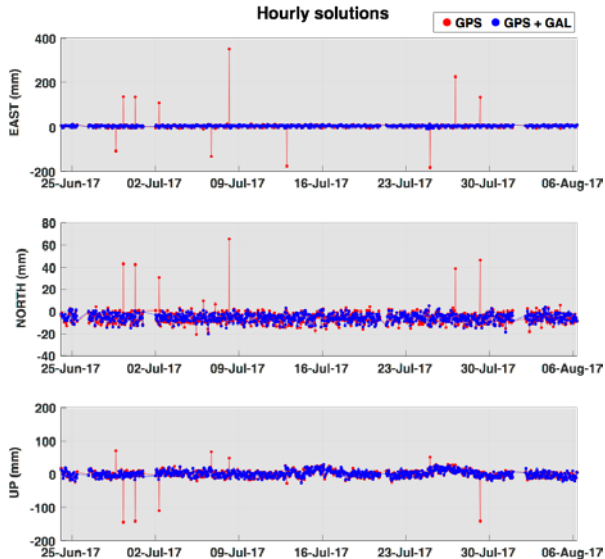


SITE II: HIGHWAY BRIDGE - THERMAL DILATION

REC3-REC2: Longitudinal (Span is 70 m)



Gims the role of Galileo



Adding Galileo to a GPS solution can increase drastically the stability of the solution for sites with limited sky visibility

Up to 80% better precision

Gims Conclusions



- Single-frequency low-cost GNSS receivers can be used for geodetic monitoring with the following accuracies:
 - very short baselines: ~ 1 mm (daily updates)
~ 2.5 mm (hourly updates)
 - short baselines (up to 3 km): ~ 2 mm (daily updates)
~ 5 mm (hourly updates)
- The integration of Galileo and GPS further improves the accuracy of the solution, especially in bad sky visibility conditions;
- The integration of GNSS, SAR and IMU observations will allow for a complete (in the spatial and time domains) monitoring of the displacement.





GSA



Thank you for the kind attention



@GIMS_Project

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Register to the
GIMS
newsletter!

