METASENSING
Radar Solutions


# FASTGBSAR-S

MetaSensing's FastGBSAR-S is a ground based radar solution for monitoring unstable natural elements and critical artificial structures. Using SAR (Synthetic Aperture Radar) technology, the FastGBSAR-S is installed on a linear rail to produce two-dimensional (range ans azimuth) images. It is suitable for deformation monitoring of man-made structures such as mines, dams, dikes, buildings, and natural hazards, such as slopes, landslides.

**The FastGBSAR-S is unique for two main reasons:**

- Short acquisition time: one image is produced in 4 seconds, which reduces sensitivity to changes in the scenario (weather changes, passing objects) and improves the image quality.

- Short acquisition Interval: one image is acquired every 10 seconds, which minimizes issues due to phase unwrapping and captures faster changes and deformations.



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## Monitoring a land slope

The FastGBSAR-S was deployed on the side of a high-speed railway track (Fig. 1) to monitor a land slope. Figure 2 shows the measured displacement map plotted on top of the Digital Elevation Model (DEM) of the area. The measured displacement ranges from -0.6 to 0.3 mm, capturing the movement of the dry sand blown away from the wind caused by the passing train.


*Figure 1. FastGBSAR-S deployment for monitoring a land slope next to a high-speed railway track.*

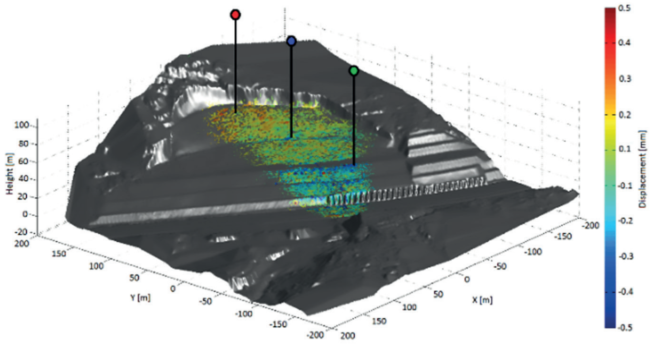


*Figure 2: Displacement data mapped over a DEM of the land slope.*

## Monitoring a glacier

The FastGBSAR-S was deployed to monitor a fast moving glacier in the Italian Alps (Fig. 4). The time series of the displacement of several points in the observed scene are displayed in Fig. 3. Stable points belong to the rocks, whereas points belonging to the glacier show a fast displacement trend.

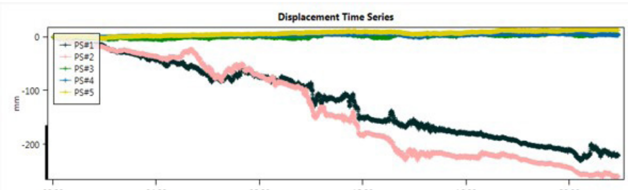


*Figure 3: Time series of the measured displacement for the selected points*


*Figure 4. View of the FastGBSAR-S installed in front of the glacier in the Italian Alps.*

## Monitoring a controlled blast

Controlled blasts in open pit mines are part of normal operations. Here we show the beginning of a controlled blast captured by the FastGBSAR-S during the continuous monitoring of an open pit mine in Chile. Figure 7 represents the displacement and coherence time series of a number of points which have been selected on the displacement map projected on the DEM of the mine (Fig. 6).

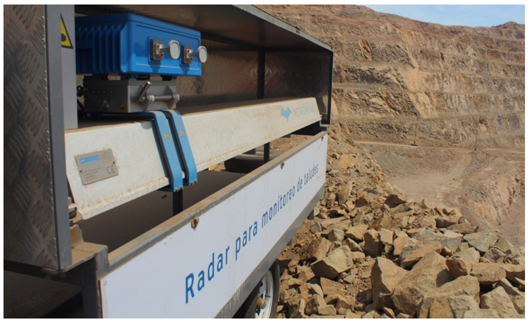


*Figure 5. View of the FstGBSAR-S in an open pit mine.*

The effect of the blast starts to be visible after only thirty seconds, with a linear trend in the displacement time series, and a big drop in the coherence time series.

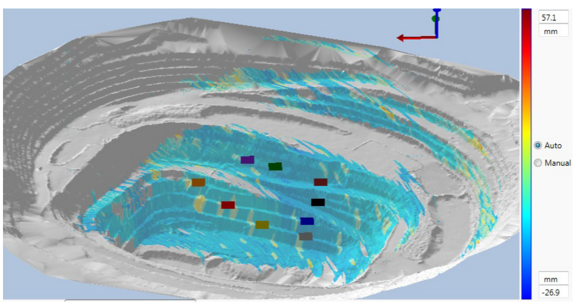


*Figure 6. Selected points over the displacement map projected on the DEM of the mine.*


*Figure 7. Displacement (top) and coherence (bottom) time series of the selected points during the controlled blast.*

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## Monitoring an open-pit mine

The FastGBSAR-S has been intensively monitoring an open-pit mine in Czech Republic too produce an accurate displacement map of the area (Fig. 8). The maximum distance was set to 1500 m, with a range resolution of 0.5 m and azimuth resolution of 5.4 mrad.

Figure 9 shows the displacement map measured by the FastGBSAR around the open-pit mine and projected on a DEM.

The displacement is close to zero in the area except in one part, where a deformation of about 100 mm appears. Figure 10 shows a zoom-in of the area interested by the displacement.

*Figure 8: Overview of the open-pit mine in Czech Republic with the FastGBSAR installed to look at the working areas of the mine*

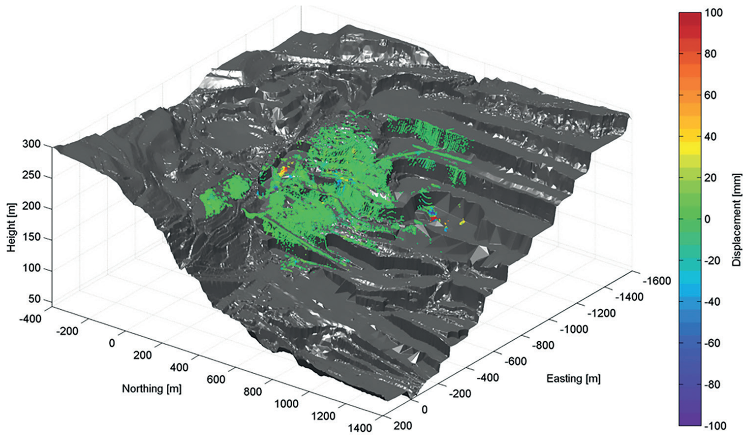



*Figure 9: Digital Elevation Model of the mine with the displacement data plotted on top of it.*

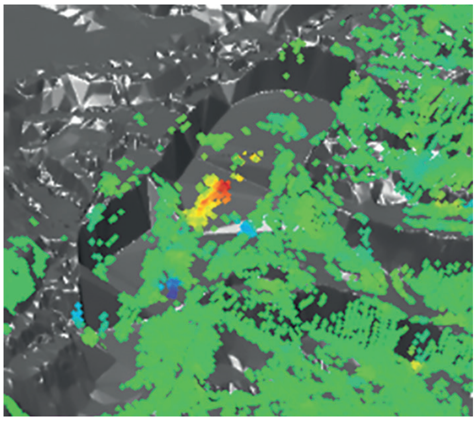
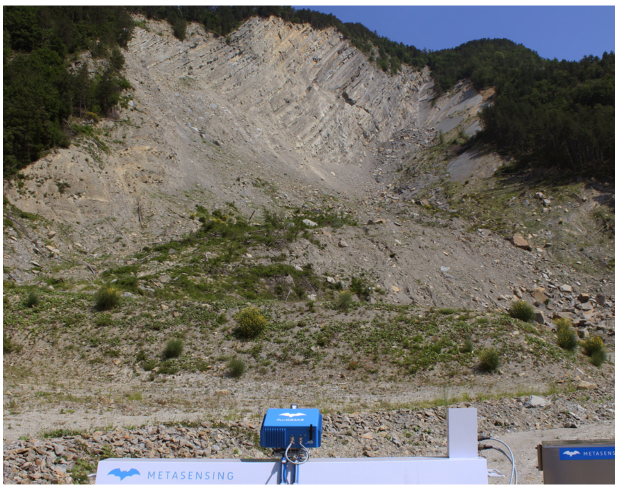


*Figure 10: Zoom-in of the measured deformation on the displacement map depicted in Fig. 9.*

## Monitoring a land slide

The FastGBSAR-S was deployed to observe a land slide in Italy to monitor slope stability and falling rocks (Fig. 11).
Figures 12 shows the time series of the displacement and coherence for several points. The very high rate of acquisitions (one image every 10 seconds) allows for an efficient detection of falling rocks. The falling rock events can be seen as abrupt and instantaneous changes in the displacement and coherence time series.



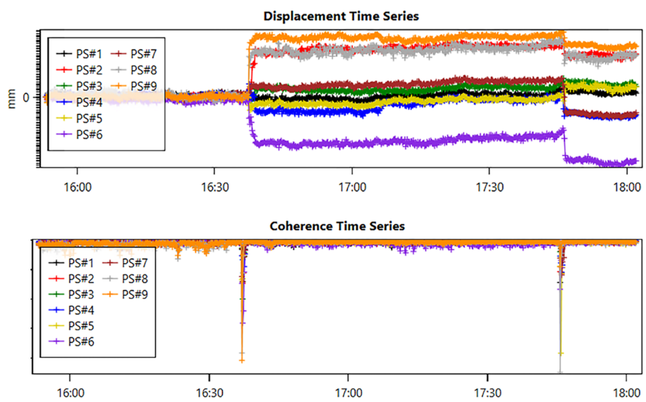
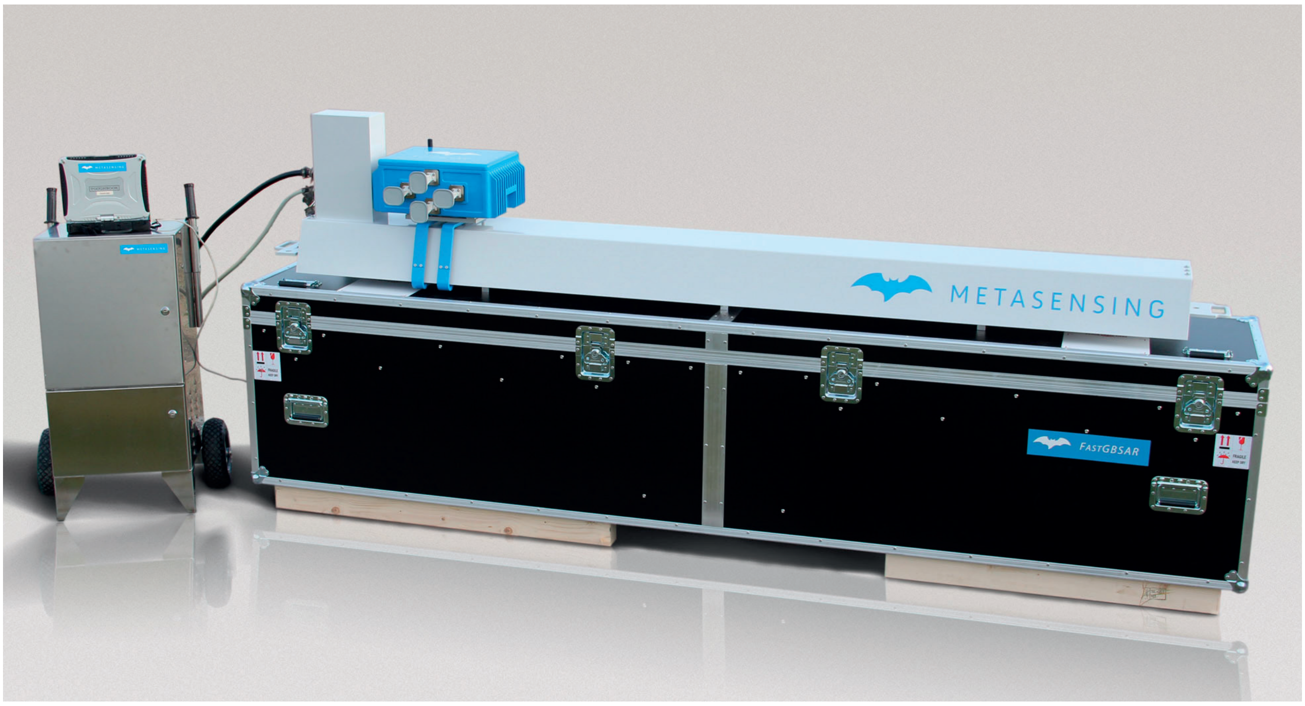




*Figure 12: Displacement (top) and coherence (bottom) time series of the selected points.*

| METASENSING FastGBSAR-S | |
|---|---|
| Operating frequency | 17.2 GHz (Ku Band) |
| Spatial resolution [1] | 0.5 m x 4.8 mrad |
| Operating range | 10 m to 4 km |
| Scan Aquisition time | 4.0 s |
| Time between two aquisitions | 10.0 s |
| EIRP Power | 19 to 42 dBm |
| Accuracy | ± 0.1 mm |
| System weight | 145 kg |
| Environment | IP65 |
| Operating temperature range | -25˚C to 60˚C |
| Power consumption | < 200 W |

*[1]Range resolution depends on the frequency bandwith allowed by local authorities, which is generally limited to 200MHz, leading to a Range resolution of 0.75 m.*




*Fully polarimetric FastGBSAR-S, with rail, power cabinet and flightcase.*

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