

Case Study – Norwegian land stability monitoring

The Client's challenge

Norwegian Water Resources & Energy Directorate (NVE)

NVE manages risks and provides early warnings for a wide range of geo-hazards including, among others, landslides, floods, rockfalls, snow avalanches, and rockfalls.

NVE currently deploys a number of landslide monitoring solutions but they are unable to monitor landslides in remote locations or where terrestrial communications connectivity is unreliable. There are approximately 7,000 landslides and rockfalls in Norway every year.



The Client's need

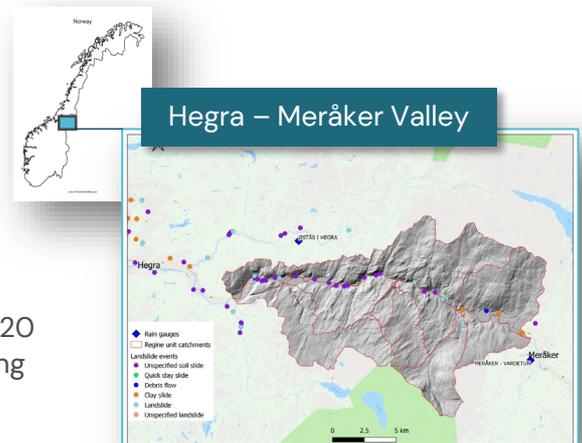
To implement an IoT-based monitoring system to monitor the stability of land in remote areas of Norway with reduced or no cell phone network coverage and where there is a demonstrably high-risk of water-induced landslides. The system must consume low power and have long durability and low maintenance in harsh conditions, and support a very reliable and secure data transfer from sensors to users.

Country/Location

Norway

The Stjørdalselva river catchment area, is between Hegra and Meråker, 45km north-east of Trondheim.

According to NVE the area is highly susceptible to water-induced landslides, clay landslides, debris flow and rockfalls, with many such events occurring in the last 20 years. The majority of the population live in the valley along the road, and alongside the railway, both of which suffer frequent closures due to landslides.



Background



The European Space Agency (ESA) is active in enabling remote sensing data communication to support environmental monitoring. The ESA Space Systems for Safety & Security (4S) programme provided part-funding to Insight Terra's partner Inmarsat Global for the implementation

of this project with the objective of accelerating the development and introduction to the market of this geohazard monitoring platform as an innovative space-enabled application. Additional support for the project comes from the Norwegian and UK Space Agencies.



Services provided

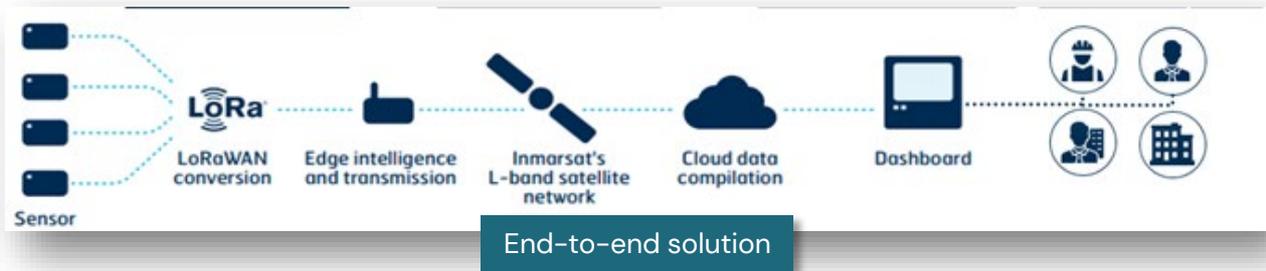
Monitoring of land stability / threat of water-induced landslides

Insight Terra and Inmarsat together designed and deployed a sensory network, working closely with NVE, SINTEF and Geonor to understand the detailed local requirements. The network collects and evaluates information on the local hydrological and meteorological conditions using a combination of different sensors and a weather station, all of which transmit data to the cloud via an Inmarsat satellite link.

Our solution

The Insight Platform deployed for NVE has three key components:

- Edge-based hardware, data collection, aggregation and data transfer
- Cloud-based Insight Platform for near real-time data management
- Web-based customizable dashboard for visualization of raw data, calculated and contextual data metrics



The hydrogeological sensors are of three types – volumetric water content sensors; suction sensors and vibrating wire piezometers and are integrated into a LoRa network to enable the data to be collected in real-time by the LoRa Gateway which is co-located with an all-weather telecommunications kiosk. The kiosk also houses the edge compute node, power storage/management, Inmarsat satellite terminal and is supported by dual wind-turbines and PV solar arrays for totally independent remote operation.

The Insight Platform is built on Amazon's Web Services (AWS) cloud infrastructure, and by virtue of its microservices architecture provides high levels of scalability, availability, security, integration and data management.

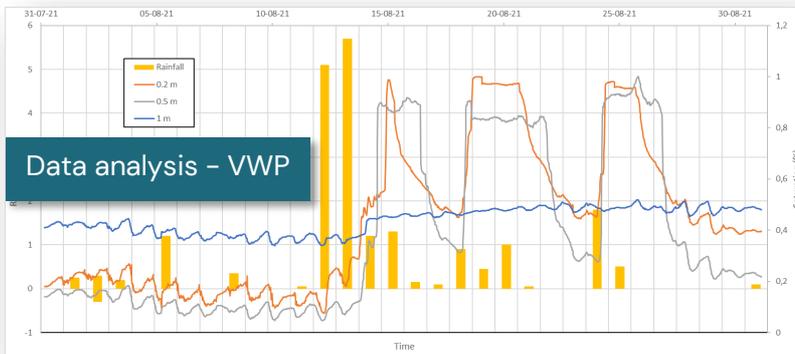
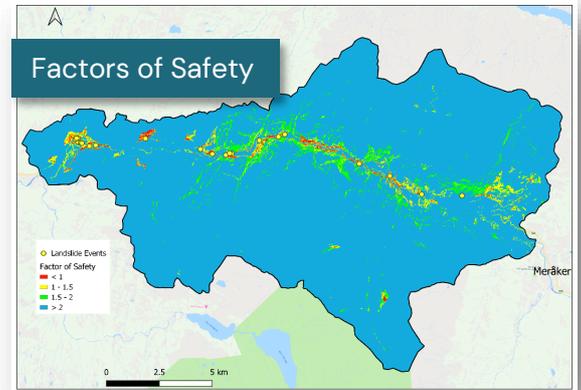
The Insight Platform manages the ingestion, validation, transformation, aggregation and storage of IoT related data from the sensors. It collects aggregated data at edge, ingests this raw data and then – using algorithms – decodes, validates and transforms or enriches the data into meaningful metrics for analysis. It checks the status of the sensors and stores data securely and makes this data available via the web-based Customer Dashboard and/or an API gateway which provides a single point of entry to access the platform.



How is the Client benefiting from our solution?

In conjunction with NVE, SINTEF is performing a range of data analytics on the sensor data received by the Insight Platform. This analysis is intended to detect and quantify the response of groundwater conditions to both rainfall and snowmelt, within a landslide risk assessment framework.

NVE has expressed a need to enhance its existing landslide warning system and will investigate the potential of the Insight Platform to improve the accuracy of the current system. To assist NVE with this evaluation SINTEF is using the actual real-life monitoring sensor data to calibrate the NVE landslide prediction model, thus ensuring more reliable and consistent landslide predictions and improved risk management.



SINTEF has assessed the Insight Terra Insight Platform and its integrated resilient Inmarsat satellite connectivity as an *"..innovative IoT technology development that will add real value to NVE's operational capability to monitor geo-hazards in remote and inaccessible areas."*

Project partners

Inmarsat

A UK-based global satellite communications operator that provides the resilient satellite connectivity and standalone power generation capability to this project. Inmarsat is working with Insight Terra on further security hardening of the solution.



SINTEF

A broad-based Norwegian research institution that has experience supporting NVE on landslide monitoring projects, and utilizes the monitoring data to develop and implement risk mitigation measures for geohazards.



Geonor

A Norwegian geotechnical, hydrological and meteorological systems manufacturer, integrator and service provider with experience of deploying LoRaWAN IoT solutions in the geohazard environment.

