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NEXT unveils Concept Design of a Satellite Image Crawler

In an earlier interview, Sebastian Teuwsen, Project Manager at EFTAS Remote Sensing and Transfer of Technology GmbH, explained about the contribution of remote sensing related research activities in the EU funded Horizon 2020 New Exploration Technologies (**NEXT**) project. In this follow-up interview, Sebastian shares further details about the purpose and outcomes of various remote sensing-based methodologies that have been applied in Finnish test sites, and how this inspired the concept design of a Satellite Image Crawler.

Could you elaborate on the purpose and outcomes of the remote sensing-based methodologies you have applied in the Finnish test sites?

To start with, I would like to point out that the development of our remote sensing-based methodologies was particularly boosted as a result of the active cooperation that was extended to us by the company Mawson, which gave us full access to the results of earlier field campaigns they conducted at their exploration site in Finland. These data proved essential to test and validate our algorithms which are applied to data captured by satellite sensors, such as those of Sentinel-2. Sentinel-2 is an Earth observation mission from the Copernicus Programme that systematically acquires optical imagery at high spatial resolution (10 m to 60 m) over land and coastal waters. The mission is a constellation with two twin satellites, Sentinel-2A and Sentinel-2B.

As I explained in my earlier interview, numerous data products can be derived from Sentinel-2 imagery, including but not limited to vegetation type mapping, vegetation change analysis and vegetation structure analysis. All of these products were successfully validated for the Finnish study area, known as Rajapalot. However, Rajapalot presented itself foremost as a test site to develop remote sensing-based methods that would effectively minimize the environmental footprint of mineral exploration activities in sensitive natural areas, such as Natura 2000 sites. Thus, we were particularly interested in developing methods that would enable us to document environmental changes that could possibly be attributed to (earlier) exploration activities, especially during the winter months.

In parallel to this effort, we also made a thorough evaluation of what is required to produce an up-to-date and very quickly processed digital elevation model (DEM). This was motivated by the fact that a DEM is essential for the flight planning of drones and unmanned aerial vehicles (UAVs). It should be noted that due to its geographic location, only a very low-resolution elevation model based on Shuttle Radar Topography Mission (SRTM) data from the year 2000 turned out to be available in some regions with regard to global coverage. Based on these data, the horizontal resolution of the DEM is about 30 metres and the elevation accuracy is about 6 metres. This very low resolution presented a serious obstacle for the company RADAI, as they could not afford to lose their drones equipped with new sensor technology developed in NEXT due to an unforeseeable natural obstacle in the terrain.

To produce a much higher resolution DEM in the test sites shown below, which were selected together with RADAI, we relied on Sentinel-1 radar imagery. As its name implies, Sentinel-1 was the first of the Copernicus Programme satellite constellation to be put in orbit by the European Space Agency. In this video-link, the European Space Agency explains how Sentinel-1 can image the surface of the Earth through cloud and rain and regardless of whether it is day or night.

The figure below shows the results of processing a rapid and current DEM from Sentinel-1 data for three selected test sites in Finland.

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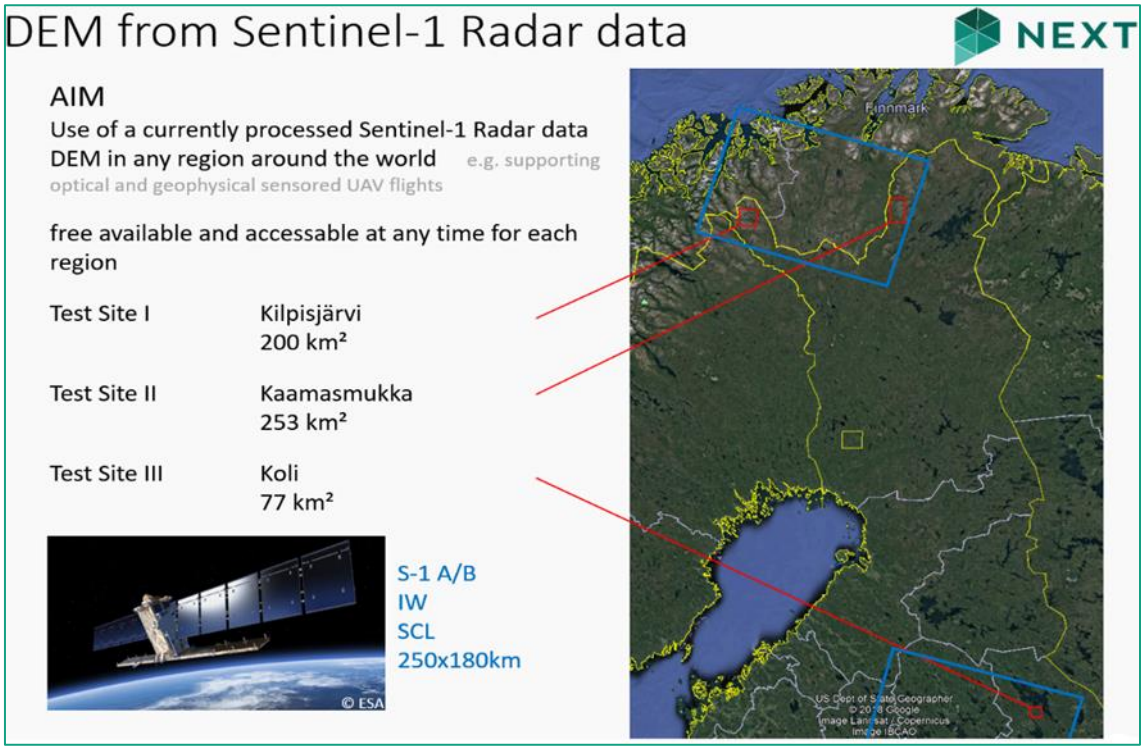

Figure 1: Location of the three test sites in Finland

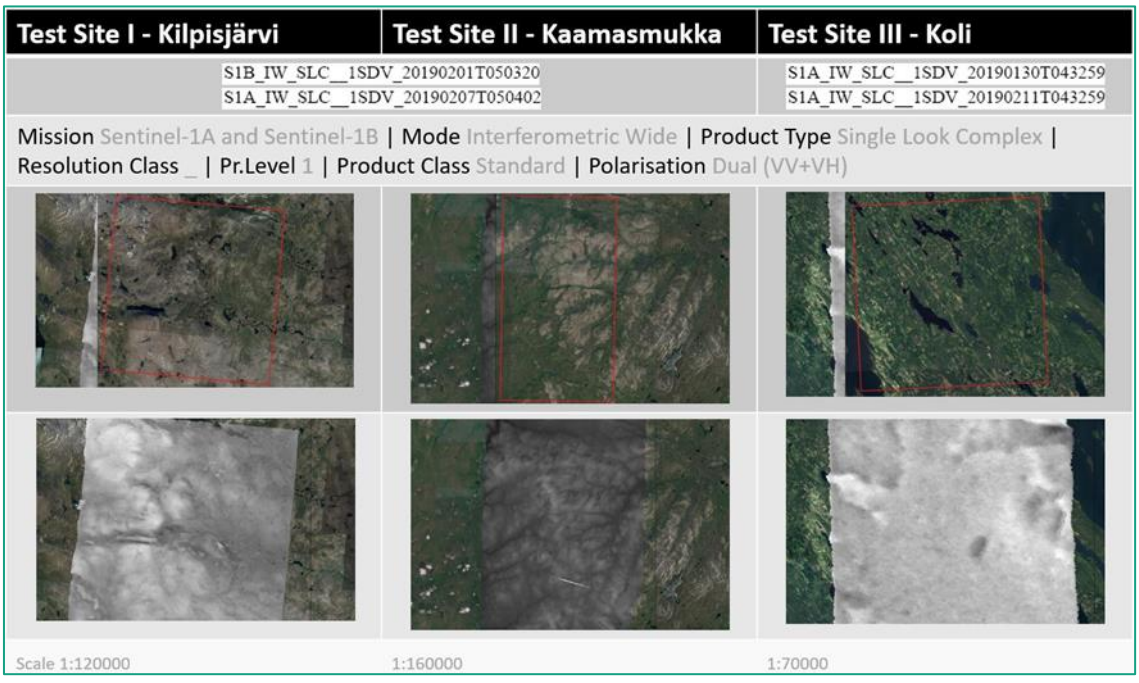

Figure 2: Processing a rapid and current DEM from Sentinel-1 data in the selected test sites

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Which factors led to the idea of developing a Satellite Image Crawler in NEXT?

Our original plan was to develop an automated downloader for satellite data that would serve the needs of the exploration as well as of the mining industry. Back in 2016, this was still a mostly uncharted technical territory. As ever newer technologies in the domains of IT, neural networks, cloud processing and machine learning emerged, the market witnessed a very rapid increase in suppliers of fully automated download software and it did not take long for even publicly accessible and open-source software solutions to become available as well.

In consultation with the NEXT Advisory Board, we shifted our originally intended focus of software development to developing a stand-alone, web-based tool that would offer users access to our results in NEXT. We realized that over time such an online portal will permit us to showcase results also for other areas with new challenges and therefore also with new parameters to be taken into account. This implied that we had to envision this new concept with an appropriately flexible user-oriented functionality, which in itself presented us with a multitude of new questions and challenges.

Our Satellite Image Crawler (SIC) is currently being developed as a post-processing service and is intended as a tool that masters and combines the functions of both searching and analysing. Thus, this universal software tool for data search, acquisition, analysis, storage and post-processing can be used as a one-stop service by customers. Its uniqueness lies with the fact that it showcases the technical added value of our developments in an easy-to-interpret way. This makes it an especially worthwhile offer to customers such as smaller companies and start-ups in the exploration industry.

Prospective customers will be able to access the system via a web-based user interface. Once logged in, they can define their area of interest on the basis of an OpenStreetMap layer, enter the time period for the satellite scenes to be used, with the option to select a single one-time analysis or a complete time series analysis, among additional parameters. On completion of these preliminary steps, the user is invited to select from our portfolio of satellite image derived products. This last step triggers off the start of an automated data search on the European Space Agency (ESA) Hub and of any satellite data already stored on our server. Finally, the user will receive a notification when the desired product has been generated and is ready for download.

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Once fully developed, our Satellite Image Crawler will fulfil the requirements that we envisioned back in 2016 and therefore much before the start of the NEXT project, i.e. a fully automated downloader of satellite imagery. However, the added functionality of automated post-processing is expected to attract the active interest of exploration and mining companies alike.

More about NEXT: www.new-exploration.tech

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