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## SIOS's Earth observation and remote sensing activities toward building an efficient regional observing system in Svalbard

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This study provides an overview of the Earth observation and remote sensing activities of Svalbard Integrated Arctic Earth Observing System (SIOS) undertaken when building an observing system for sustained measurements in and around Svalbard to address Earth System Science (ESS) questions. SIOS research infrastructures are distributed across and around Svalbard for acquiring long-term in situ observations. These in situ measurements are not only useful for various ground-based studies, but also applicable for calibration and validation (Cal/Val) of current and future satellite missions e.g. Copernicus Imaging Microwave Radiometer (CIMR), Radar Observing System for Europe - L-Band (ROSE-L) or Sentinel-1,2, Copernicus Polar Ice and Snow Topography Altimeter (CRISTAL), Sentinel-5 Precursor, and Copernicus Hyperspectral Imaging Mission for Environment (CHIME). Better integration of in situ and satellite-based measurements is crucial for building a coherent network of observations to fill observational gaps. Additionally, complementing in situ measurements with satellite data is a prime necessity to generate operational reliable geoinformation products using traditional and advanced methods, for example, mapping vegetation extent in Svalbard using Sentinel-2 data complemented with in situ measurements of spectral reflectance collected by SIOS infrastructure. SIOS's remote sensing activities are developed in SIOS knowledge centre (SIOS-KC) under the direction of the remote sensing working group (RSWG). This study highlights our current activities, goals for the next five years (2022-2026) and future activities with the intention of attracting potential collaborations to support achieving these goals. The study discusses SIOS's present activities, including (1) capacity building e.g., webinar series, online conference, and training courses on EO and RS studies in Svalbard to train the next generation of polar scientists, (2) infrastructure development (like the current infrastructure investment programme SIOS-InfraNor) that can attract Cal/Val activities to Svalbard

(3) SIOS's airborne remote sensing activities, and (4) SIOS remote sensing service tools for field scientists. Ongoing and future activities include (1) the development of unified platform for satellite data availability for Svalbard, (2) establishing an EO and RS researcher's forum on SIOS website, (3) community-based observations e.g. developing a citizen science project model for supporting satellite cal/val activities in Svalbard, (4) ongoing surveys on user requirements, product inventory and citizen science project, and (5) the 'Satellite image of the week campaign' on social media for outreach. The sustained and coordinated efforts by SIOS to develop a long-term monitoring system are expected to contribute to integrated monitoring, modelling and supporting decision making in Svalbard in the coming decades.