Call for ideas SNSA 2022

Satellite-borne observations of springtime snow as indicator for industrial pollution

The spectral reflectivity of snow during springtime is determined by a combination of the snowpack properties and the amount of pollutants on and within the snow. Satellite-borne multispectral imagers cover several channels in the visible and near infrared that are sensitive to variations in the reflectivity of snow. Reflectivity changes because of melting processes and the pollution load lead to changes in the received signals which can be used to infer information on increased pollution and related melting processes.
The datasets from satellite analysis are expected to provide an improved overview on areas that are potentially affected by pollution, not only from dust and soot, but even other pollutants that are critical for the sensitive arctic environment. The results of this analysis can provide a tool for industries and authorities to monitor industrial emissions in sensitive areas with long-lasting snow cover. Additionally, the understanding of snow melting behavior due to pollution load can help hydropower facilities to plan their power production during the snow melting period.
Analysis of satellite date using indices or classification-based methods are well established, but every new application requires new developments and modifications of existing methods. Additionally, machine learning methods can be applied in an advanced stage of this study. The idea is to combine remote sensing data with field site measurements and laboratory-based simulations to better understand the influence of snow pollution and snowpack properties during springtime on spectral reflectivity of snow.

The project is expected to be an extended PhD project together with contributions from senior researchers within the affected fields of remote sensing, snow mechanics and machine learning. To apply the methods, investments in computer hardware and field site and laboratory equipment are required. The current state of this project is till that of a concept. The estimated time for this project is 5 years and the costs are estimated to be in the range of 10 – 15 MSEK including staff, computer equipment, and laboratory and field measurement equipment.

Project owner will be the Department of Computer Science, Electrical and Space Engineering at Luleå University of Technology under the lead of researchers of the research topic Atmospheric Sciences with contributions from researchers in the field of Machine Learning and Experimental Mechanics.

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