From sensing to data visualization, a full stack Wireless Sensor Network solution for remote northern regions

Simon Filhol, Norbert Pirk, John Burkhart, Thomas Schuler, David Ibanez, and John Hulth
University of Oslo, Oslo, Norway (simon.filhol@geo.uio.no)

Collecting data in remote areas of northern latitudes is challenging and historically concentrated in few selected locations chosen for their representativeness. The need for high temporal and spatial resolution, as well as redundancy is increasing due to growing demand for validation of and completing remote sensing and model products. Due to scaling and representativeness issues, these are often difficult to compare to or to assimilate single point measurements. With the recent advent of open-source software and hardware technologies, we developed a full stack solution, collecting selected variables from a Wireless Sensor Network (WSN) distributed over 100 km2, handling data from the collection point to a final database for storage, visualization and further analysis. We configured and developed a new suite of sensors to measure basic meteorological variables, and designed to autonomously operate in terms of power and data management. The platform we developed allows flexibility in the choice of sensors, and communication (radio modules, 4G, or Iridium) to transfer in near real-time data to a server validating their arrival, and parsing them into the final database. The database includes raw data, metadata, maintenance operation on the network, user access rights to the data, and a devoted Application Programming Interface (API). Developed and tested in Finse, an Alpine research site in Norway, our solution is going to be used in a variety of scientific applications in topics related to snow, permafrost, glacier, surface energy balance, rivers and boundary layer physics in a variety of locations in Norway and Svalbard.