IAF EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Data Management Systems (4)

Author: Dr. Rushi Ghadawala
B R Aerospace Solutions and Services, Inc. (BRASS) - Canada, Canada, info@br-aerospace.com

Mrs. Prachi Mehrotra
B R Aerospace Solutions and Services, Inc. (BRASS) - Canada, Canada, info@br-aerospace.com
Mr. Rahul Sable
B R Aerospace Solutions and Services, Inc. (BRASS) - Canada, Canada, info@br-aerospace.com
Dr. Balbir Singh
B R Aerospace Solutions and Services, Inc. (BRASS) - Canada, Canada, info@br-aerospace.com

# CLIMATE MODELLING AND PROJECT APES - SOIL MOISTURE MEASUREMENT IN CANADA

**Abstract**

Earth is a complex system encompassing many different processes such as climate change, cycles of water and carbon, and human development. For successful management, this system requires Earth Observation for monitoring a wide range of variables. Efforts are being made by different countries to coordinate their monitoring of the Earth's environment. Several "essential climate variables" have been identified; one of the most difficult to measure is soil moisture. The research challenges are (1) to measure soil moisture despite other effects such as soil roughness change and vegetation, and (2) to develop data assimilation methods which achieve the benefits of classical methods such as Kalman filtering while being practical to implement numerically. This project focuses on the first of these, and explores the potential of frequent measurements to separate soil moisture changes from other effects. More frequent EO data are becoming available as the number of operational systems increases and also may be enabled through new systems such as using High Altitude Solar Powered UAV - which is an innovative project by BRASS Inc (Canada) to perform Earth Observation in Canada.The project starts with a review of the concept of System of Systems in Earth Observation and a review of data fusion and data assimilation techniques. Soil moisture will be measured using C-Band sensors, and data will be validated using land observation as well as data obtained through RADARSAT and Sentinel satellites. Kalman filtering is a classical data assimilation method in engineering and allows system parameters (e.g. soil moisture and its rate of change in this case) to be estimated from a time series of measurements. A simulation of the radar backscatter measurement from a soil surface by Kalman filtering has been developed to quantify the soil moisture estimate uncertainty as a function of radar measurement accuracy and frequency. From the model experiment, it can be observed that good estimates of soil moisture require accurate and frequent measurements. Techniques for separating slow changes such as soil roughness from faster processes such as soil moisture changes are being investigated. Operationally, the changes in moisture level can be helpful in predicting situations like drought and vegetation growth, which can be useful especially in Canada, where weather events are extreme and can cause significant impact in agriculture sector. This project aims to address operational gaps to provide efficient data to the government and agriculture sector in Canada.