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SOIL MOISTURE MAPPING BASED ON L-BAND SAR TECHNOLOGY

Abstract

Soil moisture data is essential for a wide range of fields, from agriculture to transportation and infrastructure. The ability to identify areas with high soil moisture content can be lifesaving as high soil moisture is often the root cause of such events as landslides and slope failures which can be catastrophic. While there are several methods for soil moisture measurement both in-situ and ex-situ, there is a strong need for soil moisture content for widespread areas that does not involve field measurement. L-Band SAR provides a highly efficient solution for soil moisture content estimation over large areas due to its unique penetration capabilities. Soil moisture has a high correlation on the penetration depth of L-Band SAR, creating a different backscatter in dry and wet areas. The empirically based ASTERRA EarthWorks product has finely homed in the vast capabilities of L-Band SAR for soil moisture classification. The product is based on hundreds of in-situ soil moisture measurements taken in coincidence L-Band SAR satellite imagery from JAXA's ALOS-2 PALSAR-2 CONAE's SAOCOM-1A 1B . The results were then analyzed in order to correlate between the soil moisture content and the backscatter values in the SAR imagery. Using polarimetric SAR image processing techniques and the correlations found during analysis, a strong model was built. A model validation exercise was performed around linear transportation infrastructure to find areas at high risk for failure. In all of the locations marked as high-risk by the model, evidence of high soil moisture was found in the field and tended to before causing failures. In one of the high-risk locations marked by the model, a tension crack was identified in its beginning stages and remedial work was done before the onset of complete slope failure. Additional validation was performed in retrospect on landslip and landslide data from Great Britain and Norway. Results showed that there was extremely high soil moisture in the areas where the landslides and landslips began in the months and even years leading up to the failures and in these cases, the ASTERRA EarthWorks application could have contributed to mitigating the damage.