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Soil moisture estimation using airborne passive L-Band measurements

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The aim of the presented project was the development of an automatically algorithm for the estimation of the volumetric soil moisture from parameters routinely measured by the aerogeophysical system of the Geological Survey of Austria. Since the measurements of the volumetric soil moisture using passive L-Band-Radiometers are strongly influenced by the damping effect of vegetation cover and the roughness of the ground surface, the new algorithm should be able to compensate these effects (vegetation height < 4 m). To achieve this, four measured parameters of the airborne system were used: vegetation height, vegetation density index, surface temperature (infrared sensor) and brightness temperature (L-Band-Antenna). The Vegetation height and the vegetation density index are calculated from first and last pulse laser altimeter measurements.

In the frame of this project an aerogeophysical survey in Lower Austria was performed two times. Simultaneously to the airborne surveys soil moisture was measured by Time Domain Reflectory (TDR) and ground probes were taken. In the laboratory the gravimetric soil moisture and the grain size distribution of the ground probes was determined. For both survey times the vegetation cover was recorded cadastral and an accurate soil mapping was done.

For calculating the soil moisture from the airborne measurements an artificial neural network (ANN) was used. One part of the gravimetric soil moisture results from ground probes were used for training the ANN (supervised learning), the other part was used for testing the trained ANN.

Furthermore it was tried to use a vegetation classification parameter as an additional input-parameter. Therefore each ground probe was attributed by a vegetation class index. The results for the volumetric soil moisture showed that this extension of the ANN was not improving the outcome.

The results of this study show that
1) the correction of vegetation with this method produces a reliable, fast and exhaustive estimation of the volumetric soil moisture in a regional scale.
2) for the development of the algorithm many ground probes, taken at the same time the aerogeophysical survey is performed, are necessary.
3) the influence of the vegetation cover and roughness is much higher than the influence from other soil parameters (geology, soil type, grain size,. . .)
4) comparison of measured volumetric soil moisture at different times can give information on the water absorption capacity of the top soil.