The Value of Satellite Retrieved Snow Cover Images to Assess Water Resources and the Hydropower Potentials of Ungauged Mountain Areas

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The estimation of water resources in ungauged areas is of major importance to cope with the challenges of a changing climate. Remotely sensed snow cover images provide important information on the snow cover area in remote mountain areas. Complementary, hydrological modelling can provide powerful tools to assimilate satellite retrieved snow cover data and estimate the total amount of water resources available from ungauged areas. In this study the conceptual lumped Hydrologiska Byråns Vattenbalansavdelning model (HBV) is used to estimate the total amount of snow-, ice and rainfall runoff in two ungauged areas in north-eastern Iceland (Leirdalshraun, a 274 km2 area above 595 m asl and Heljardalsfjöll, a 946 km2 area above 235 m asl) that could potentially be used for hydropower production. The model parameters were determined by calibrating the model against satellite derived snow cover images and discharge data of gauged sub catchments. Runoff from the entire area potentially used for hydropower exploitation was estimated using the parameter sets of the gauged sub-catchments. Snow melt in the ungauged areas was validated with satellite derived snow cover images, revealing a robust simulation of snow melt in the entire area. Based on the hydrological modelling the total amount of snow-melt, ice-melt and rainfall runoff available in Leirdalshraun and Heljardalsfjöll amounts up to 700 M m3 a-1 and 1000 M m3 a-1, respectively. These results suggest that the total hydropower potential of the two sites amounts up to 1.2 TWh a-1 hydroelectricity, accounting for about 10% of the current production in Iceland.