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Effects of distribution level of hydrological models in mountainous catchments

HONG LI[1], STEIN BELDRING[2] & CHONG-YU XU[1,3]

1 Department of Geosciences, University of Oslo, PO Box 1047 Blindern, 0316 Oslo, Norway
hongli@geo.uio.no
2 Norwegian Water Resources and Energy Directorate, PO Box 5091, Majorstua, 0301 Oslo, Norway
3 Department of Earth Sciences, Uppsala University, Sweden

Abstract The main purpose of this study is to investigate the effects of distribution level of hydrological models in a seasonally snow covered and mountainous area. Five different versions of the Hydrologiska Byråns Vattenbalansavdelning (HBV) model, i.e. the lumped model ("LWhole"), semi-distributed model with 10 elevation bands ("SBand"), 1 km grid-based model without routing ("GRZero"), 1 km grid-based model with hillslope routing ("GROne") and 1 km grid-based model with both hillslope and river routing ("GRTwo"), were compared on two seasonally snow-covered mountainous catchments, the Losna (11 213 km^2) and the Norsfoss (18 932 km^2) catchments in central southern Norway. According to the Nash-Sutcliffe efficiency of daily models, the rank of the five models is "GRTwo", "GROne", "GRZero", "SBand" and "LWhole". The results show that the finer representation of input data and hydrologic process can lead to better model performance in these two catchments and the effects of distribution level of hydrological models also depend on the catchment characteristics. No significant improvement was achieved by the Muskingum-Cunge channel routing method showing that the channel routing is not necessarily required in daily flow simulation at these mountainous catchments.

Key words distributed modeling; HBV; mountainous and snow covered area; Norway