Calculating the Runoff Response of the Wolf Creek Watershed

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Abstract

The UBC Watershed Model has been used to calculate the streamflow generated from snowmelt and rain occurring on the Wolf Creek watershed. The model uses measured daily temperature and precipitation to calculate the accumulation of winter snowpacks; then estimates snowmelt rates and rainfall distribution across the watershed. Snowmelt is calculated using a temperature controlled energy budget approach which can separately represent melt for open areas or for forests, for north and south freezing aspects, and can also estimate cloud cover and snow albedo. The snowmelt and rainfall are then subdivided by the model into four runoff components and this subdivision is based on soil moisture controlled calculations. The four runoff components are (1) fast runoff which happens within a day, (2) medium runoff, sometimes called interflow, which is delayed about 3 to 6 days, (3) upper groundwater which is delayed by about 30 days, and lastly a deep groundwater component which is very slow with a delay time of the order of 100 to 250 days. The model also includes a negative melt budget, which is designed to represent and estimate the freezing in the snowpack or soil. One of the key questions of this study is whether this method is adequate for the extreme conditions in a northern watershed, such as Wolf Creek.

Computer runs have been made for 1992 to 1997 using Whitehorse meteorological data; this is intended as a preliminary test until the Wolf Creek meteorological data is available. The results for 1992 are very encouraging, but the 1993 runoff is over-estimated. For 1994 onwards, the Wolf Creek meteorological data is recently available and the results are preliminary. Full testing will require a longer data set because the present assessment is based on calibration with no independent verification. As more years of data become available, they will provide an independent check of the watershed calibration.