Title: A Temperature-Index Model of Stream Flow in Taylor Valley, Antarctica.

The McMurdo Dry Valleys of Antarctica are a polar desert with alpine glaciers, ephemeral streams, and perennially ice-covered lakes. Essentially all water in the lakes and streams originates as glacier melt during the austral summer. Because summer temperatures hover near the melting point, small variations in the energy balance cause the melt water flux to vary from season to season by as much as an order of magnitude. I developed a model for stream flow volume in Taylor Valley, one of the dry valleys, for the purpose of estimating flow over decades to millennia. Three simple statistical models were developed using measured stream discharge and glacier ablation, a model based solely on air temperature, one including the additional
variable spatial variations in solar radiation and one including the additional variable summer average wind-speed. Results showed that melt-water flow increased exponentially as summer average air temperatures warmed to 0°C. A temperature-based model was sufficient to predict stream flow volume from the north-facing or south-facing glaciers but not the two together. The inclusion of spatial variations in solar radiation allowed both north and south facing glaciers to be modeled. In the Fryxell and Hoare basins, model results showed $r^2$ values of 0.60 and 0.67 respectively from the temperature-based model and 0.73 and 0.42 from the model including solar radiation. Modeling results for the Bonney Basin were poor partly due to large differences in energy balance controls on the glaciers. Glaciers in the Bonney Basin are characterized by steep slopes and rough surfaces which are important contributors towards melt and are not accounted for in the models. The third model attempted to account for the variation in wind speed throughout the valley with little improvement. The models predict melt at summer average temperatures below 0°C with threshold temperatures ranging from -4.9°C to -5.5°C.