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Water temperature changes in small streams in Norway due to hydro power development

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Little knowledge exists concerning the influence of regulation (water power development) on stream temperatures in small streams in Norway. This study examines how stream temperature in small streams with reduced water discharge due to regulation fluctuate in time and space. Most of the investigations and measurements has been carried out on relatively small streams with a discharge less then about $>$ 0.01-10 m^3/s. Our measurements have shown that the interactions between groundwater influx and surface water flux in many rivers determine the stream water temperature. In many streams groundwater influx gives a significant contribution to river discharge, especially in periods or areas of low discharge e.g. downstream water intake. The temperature of groundwater may therefore provide an important contribution to river temperatures. However the effect varies with time and space and the hydrological fluxes and the river physiology. Often, the geological setting will confine groundwater influx to specific areas which then may have lower temperature fluctuations both on a diurnal and annual basis than could be suspected. Such areas are known to be of importance as refugees for fish populations during critical periods. The study is part of a project that seeks to explore the influence of catchment characteristics on stream temperatures in both unregulated and regulated Norwegian rivers, funded by the Norwegian Water Resources and Energy Directorate.