

The contributions of climate and land cover impacts on streamflow in Norway

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Located in high latitudes, Norway experienced significant changes in climate in the last 115 years. The average temperature rises at an average rate of 0.09 °C/decade while the annual precipitation increased by ca. 16% from 1900 to 2014 with statistical significance. In the meantime, the standing forest timber volume has increased continuously and almost tripled by the year 2012. Both the changes in climate and land cover would directly affect the streamflow and the hydropower production in Norway, which accounts for about 98% of the total electricity production of the whole country. However, there is a lack of understanding of the contribution of these different drivers to changes in streamflow in Norway, although such knowledge provides important information for future changes in water availability. This paper aims to quantify the relative contribution of climate and land cover impacts on the mean annual and seasonal streamflow (including total, quick and base flow) using the hydrological model HBV for 56 natural catchments in Norway. The changes in forest extend and structure are considered as the major land cover changes in these catchments. The discharge data are split into two periods (1961 – 1988 and 1989 – 2015) as the reference and changing periods. The HBV model was firstly calibrated in the reference period for all catchment separately and the simulated discharge in the changing period was used to calculate the relative contributions. The results show that the climate change played a bigger role than land cover change on annual total, quick and base flows in 62%, 48% and 82% studied basins, respectively. The climate change is the dominant driver on streamflows in winter and spring in most basins, while the land use change affected more significantly on summer flows as well as the base flow in autumn. Finally, the resulted contribution will be compared with the changes in climate and forest characteristics as external validation.