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Trends in the magnitude and frequency of rainfall vs. snowmelt generated floods in Norway

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The literature reveals evidence for recent changes in the intensity and frequency of heavy precipitation and in the duration of the snow season in many parts of Norway. The questions whether these changes in the hydrometeorological triggers have led to modifications in the magnitude and frequency of flooding and on the processes that produce high flows are addressed within this study. For up to 211 catchments in six distinct runoff regions in Norway we applied the at-site Mann-Kendall test and the Regional Average Mann-Kendall test to analyze trends in peak flow discharge series for three different time periods (1962-2012, 1972-2012, 1982-2012). Peak Over Threshold (POT) discharge events were classified into rainfall *vs.* snowmelt dominated floods, based on a water balance approach that makes use of a nationwide 1x1 km² gridded data set with daily observed rainfall and simulated snowmelt data. Results suggest that trends in flood frequency are more pronounced than trends in flood magnitude. Furthermore, trends in flood frequency show higher spatial consistencies with observed changes in the hydrometeorological drivers than trends in flood magnitude. Positive trends in the frequency of rainfall dominated events affect regional patterns of increasing flood frequencies in southern and western Norway, while decreasing flood frequencies in northern Norway mainly result from negative trends in snowmelt dominated events. Regarding flood magnitude, negative trends are more dominant than positive trends, and trends in western and coastal Norway can be linked to changes in rainfall dominated floods, while trends in northern and eastern Norway primarily reflect changes in the magnitude of snowmelt dominated floods. Rainfall has gained an increasing importance for the generation of floods in most parts of Norway, while the role of snowmelt has been decreasing. Systematic shifts in regional flood regimes, however, have not yet been detected. The results highlight the advantage of applying trend analyses for floods distinguished by their generation processes instead of applying seasonal trend analyses.