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Trend Analyses of Past and Future Precipitation and Runoff in Northern Tyrol, Austria

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Due to average temperature increases of approximately twice of the global mean, climate change has stronger impacts on hydrological systems in the Alps compared to those in the lowlands. Retreating glaciers, earlier snowmelt and less precipitation falling as snow result in changing runoff regimes, which add to the expected changes in precipitation sums and temperature. Thus doing trend research in alpine regions could reveal climate change signals that are not visible in the lowlands yet. In our study we focused on the Oetztal Alps, northern Tyrol, Austria, to assess the impacts of climate change in three watersheds that represent a part of the relatively dry central alpine region north of the main ridge. We conducted a regional trend analysis of observed solid and total precipitation and runoff data. To identify differences compared to future projections, the expanded downscaling method for downscaling future temperature and precipitation scenarios from general circulation models was adopted. For detecting trends and their significance, the Mann-Kendall-test and Sen‘s Method were used. By refining trends for monthly sums for each day of the year and each station, it is possible to specify the trends and get further information on the causes of these changes. Shifting intervals show the development of the trends over a period of up to the last century. Results indicate a clear decrease of snowfall in spring, depending on the altitude of the station. The higher the station, the later in the year the trend occurs, an explicit impact of a strong spring temperature increase due to climate change. Regarding total precipitation, historical data shows positive trends in spring as well. This could be a sign of smaller measurement error because of proportionately more rain and less snow. Furthermore, positive precipitation trends in summer suggest an increase of atmospheric convection. Comparisons between historical data and future projections reveal differences in the structure and the timing of the trends: The future precipitation trend projections mainly go along with results from other studies (less precipitation in summer, more in winter), but the projected trends do not correspond with the observed ones. Concerning runoff trends, historical records point to a downward shift in runoff regimes (glacial to nival, nival to pluvial etc.), which has been projected for future runoff scenarios in many other studies. As an outlook, a hydrological model will be set up and supplied with scenario data to compare past and future runoff trends directly.