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Assessing the effects of climate change and agricultural management on evapotranspiration in alpine and sub-alpine grasslands by lysimeter measurements and modelling approaches

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Climate change is expected to alter the share of water balance components in mid-latitude environments towards higher evapotranspiration rates. To understand and predict future catchment hydrological characteristics, it is important to quantify the magnitude of change in evapotranspiration, soil water storage, percolation and runoff generation.
The study makes use of evapotranspiration measured at lysimeters which are part of the TERENO preAlpine observatory in southern Bavaria (Germany). Soil cores with an area of 1 m^2 and a depth of 1.5 m have been excavated and translocated to lower elevations. Furthermore, soil cores from the same area (that have not been translocated to lower elevations) act as control plots in the lysimeter network. In total, 36 lysimeters at three different elevations (864, 769 and 695m a.s.l.) are monitored. The elevation gradient between the highest and lowest lysimeter station accounts for a temperature increase of approx. 2°C, while precipitation decreases from 1350 mm a-1 to approx. 960 mm a-1. Following local agricultural practice, intensive as well as extensive grassland management is applied at the lysimeters: intensive management refers to a higher frequency of cutting (up to five times per year) and manure application (approx.. 250 kg N ha-1 a-1) than extensive management (two cuts and approx. 80 kg N ha-1 a-1).
The study a) compares the effects of increased temperature and different agricultural management regime on evapotranspiration measured at the lysimeters (plot scale) and b) compares the measured evapotranspiration from lysimeters with model outputs from the LandscapeDNDC model. The latter one provides information on the potential of plot scale measurements to feed into larger scale eco-hydrological applications, e.g. at the catchment scale or beyond.