



## **A drought index accounting for snow**

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The Standardized Precipitation Index (SPI) is the most widely used index to characterize and monitor droughts that are related to precipitation deficiencies. However, the SPI does not always deliver the relevant information for hydrological drought management when precipitation deficiencies are not the only reason for droughts as it is the case for example in snow influenced catchments. If precipitation is temporarily stored as snow, then there is a significant difference between meteorological and hydrological drought because the delayed release of melt water from the snow accumulation to the stream. In this study we introduce an extension to the SPI, the Standardized Snow Melt and Rain Index (SMRI), that captures both rain and snow melt deficits, which in effect modify streamflow. The SMRI does not require any snow data instead observations of temperature and precipitation are used to model snow. The SMRI is evaluated for seven Swiss catchments with varying degrees of snow influence. In particular for catchments with a larger component of snowmelt in runoff generation, we found the SMRI to be a good complementary index to the SPI to describe streamflow droughts. In a further step, the SPI and the SMRI were compared for the summer drought of 2003 and the spring drought of 2011 for Switzerland, using gridded products of precipitation and temperature including the entire country.