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The challenge to assess the impact of future extreme hydrological events on drainage systems

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When the southern part of Europe is predicted to experience more shortage of water in future climate, the northern part, including Sweden, will more likely face an increase of precipitation. This increase can impact the terrestrial hydrosphere differently, depending on the distribution of precipitation over time or in other words on the modification in frequencies/intensities of rain events. Moreover, changes in the hydrological cycle will not only be limited to precipitation patter, the problems will become even more complex when also considering an increase of evapotranspiration and a decrease of the period of frozen soil, due to a rise of average temperatures.

Climate changes will have a great influence in the variability of water partitioning between the different components of the hydrological cycle, and certainly have a direct repercussion on local water management systems. If precipitation increases one of the first systems that will be impacted are the agricultural drainage systems and thus also the hydrological network downstream (e.g. size of diches). In regions where agricultural land are subject to excess of soil water, drainage system will have a positive impact on crop productivity. However the design of a drainage system must be in accordance with extreme rain events and its adaptation to future climate conditions remain a challenge.

The Swedish University of Agricultural Sciences has conducted a study aiming to evaluate the respons of climate change on drainage demand for several small agricultural dominated watersheds across the country. An ensemble of climate models from the EURO-cordex project have been used to feed two differents agro-hydrological models: the soil and water assessment tool (SWAT) model and DRAINMOD model. SWAT was used to simulate the water cycle at watershed scale and DRAINMOD was used to simulate the water balance of drained agricultural land at field scale.

The challenge of this study lies in using projected climate data to assess the water partitioning at a reduced spatial (agricultural field) and temporal (extreme event) scales. A combined analysis of futur trends of general and extrem meteorological events, as well as the induced water partitionning using two different agro-hydrological model outputs, has brought to light adaptation needs for agricultural drainage systems.