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Data-based evidence for contrasting land cover-atmosphere interactions across Sweden.

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As humans alter landscape, vegetation, climate and atmospheric composition, changes in the terrestrial water balance and fresh water resources are likely to occur. Understanding how climate, vegetation, humans and hydrology interact and feedback to the atmosphere is key for accurate projections of future fresh water resources. To this end, we will present the results of a data-driven regionalization approach for river discharges, using 280 river discharge and over 400 meteorological records (1960-2010) in Sweden.

We related catchment runoff coefficients and change trends thereof to land-surface characteristics. With these relationships we were able to create average and change trend maps for runoff and evapotranspiration across Sweden. We summarized all this information by plotting water use efficiency (actual evapotranspiration (ET)/precipitation) against energy use efficiency (actual ET/potential ET by Priestley Taylor Eq.) for areas with unique land cover across Sweden. This plot clearly shows that wetlands tend to have lower water and energy use efficiencies compared to “open waters”, forests and agriculture, and that agriculture has water and energy use efficiencies closest to those of “open waters”. These results demonstrate how a change in land cover driven by climate change or by humans is likely to alter land-cover-atmosphere interactions, thereby changing both the water and energy balance of catchments.

Looking at the change trends during the last 50 years we see that the vegetation tended to become more efficient in using water and energy (i.e. the fractions of water and energy converted into river runoff and heat decreased). As this behavior coincides with an increase in precipitation it signals an acceleration of the hydrological across Sweden. In this presentation we will discuss the potential mechanisms explaining this increase in efficiency and discuss the implications of our findings for future water cycles.