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Comparison of the event and seasonal hillslope-stream hydrologic connectivity in an agricultural headwater catchment

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In agricultural catchments, subsurface runoff is an important process for streamflow generation and the transport of nutrients and pollutants within and out of the catchment. Where and when subsurface runoff occurs is linked to the hydrologic connectivity in the catchment. This study compares spatial patterns of the connectivity between the hillslope and the stream on the event and seasonal scale. We analyse streamflow and groundwater responses to 53 precipitation events and their seasonal dynamics over two years in the Hydrologic Open Air Laboratory (HOAL), a small (66 ha) agricultural headwater catchment in Lower Austria. We quantify the connectivity in terms of Spearman correlation, hysteresis index and peak-to-peak time between streamflow and groundwater dynamics. It shows a clear spatial pattern, i.e. the connectivity is greatest in the riparian zone and diminishes further away from the stream where the groundwater table is deeper. This is reflected in the significant correlation of connectivity to the topographic indices and groundwater depth. Groundwater connectivity to the stream on the seasonal scale is higher than that on the event scale, indicating that groundwater contributes more to the baseflow than event runoff.