Quantifying intra- and inter-annual dynamics of river-floodplain connectivity and wetland inundation with remote sensing and wavelet analysis.

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Abstract

We used imagery from remote sensing (FORCE Time Series Analysis submodule (combining Landsat and Sentinel-2 imagery)) to derive spatially distributed times series (8 years) of NDWI data to infer patterns of floodplain inundation and river-floodplain connectivity in two contrasting polders in the Lower Oder Valley National Park. The upstream Polder A (14.4 km ^{2}) was extensively flooded for prolonged periods most winters. Wavelet analysis showed that this strong seasonality was primarily driven by winter water levels in the river Oder that could enter and leave the polder through two opened flood gates. Subsequent drainage was slow and aided by a pumping station. Inundation of the downstream Polder 10 (17.7km ^{2}) was lower and had less marked seasonality. This reflected the impact of flood attenuation by storage in Polder A upstream, but also the greater connectivity (via 10 flood gates) to the Oder and a functional network of channels which facilitated rapid drainage after flood peaks. In Polder A, secondary periods of transient inundation could also occur in response to local intense summer rainfall. Wavelet analysis also showed that groundwater recharge in and around Polder A is primarily induced by floodwater, whilst Polder 10 also reflects the influence of local rainfall-driven recharge. The flood regimes of the two polders showed marked inter-annual variation, largely dependent on flows from the upper Oder catchment. Understanding these patterns and processes of inundation is important for both managing flows and sustaining valuable wetland habitats within the National Park. Given projected climate change in eastern Europe and possible management alterations to the flow regime of the Oder, the potential implications for these habitats needs urgent attention.

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