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Defining fundamental units in hydro-geomorphic connectivity research: a wetland example using synthetic aperture radar (SAR) data

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Connectivity is an important concept for understanding the transport of water and sediment in hydro-geomorphic systems. In order to characterise connectivity within such systems it is vital to identify meaningful fundamental units (FU) of study, which we call 'geomorphic cells', i.e. structural entities consisting of land elements with similar hydro-geomorphic potential (Poeppl and Parsons, 2017). The hydro-geomorphic potential of such a cell is determined by factors that influence its capability to store and transfer water and sediment (e.g. topography, land cover/vegetation, soil type), while the actual hydro-geomorphic cell state depends on the degree of water saturation.

In this study it is hypothesized that in wetland systems, the hydrologic state of geomorphic cells is reflected by the degree of surface soil moisture and flooding state, which can be further used as a proxy for their hydro-geomorphic potential and thus to identify and delineate FU. Remote sensing data can provide spatially explicit information on such hydrologic variables. In particular, synthetic aperture radar (SAR) data display a high sensitivity towards changes in surface soil moisture and surface water extent. In the context of this study, SAR image time series – in combination with information on topography and land cover – are used to identify the behaviour of geomorphic cells in terms of their inundation dynamics and soil saturation. The study is carried out in the Prairie Pothole wetland system (USA). This region is characterised by a large number of individual wetlands and a high degree of surface water dynamics, which makes it an ideal testbed for demonstrating the potential of SAR data for determining changes in their hydrologic state.

Poeppl, R.E., Parsons, A. The geomorphic cell: a basis for studying connectivity. 2017. Earth Surface Processes and Landforms. DOI: 10.1002/esp.4300