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Landscape structure, organization and processes revealed through micro-topographic features

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High-resolution Lidar topography and Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) remote sensing data are becoming increasingly available over large regions of the Earth's surface. These data sets can be linked to reveal processes and landscape features that cannot be detected at lower resolutions. In May 2011, the Bird's Point New Madrid Floodway in southeastern Missouri was intentionally breached during extreme Mississippi and Ohio River flooding. Pre- and post-flood Lidar and post-flood AVIRIS data enable study of flood geomorphic impacts and the biogeochemical state of the floodplain. Differential Lidar quantifies erosion and deposition, while empirical, statistical and data mining techniques are employed to investigate soil properties from AVIRIS. Vegetation, soil properties, and flood exposure are linked to observed geomorphic impacts that indicate landscape vulnerability to flood events. We find that the distribution of micro-topographic depressions in the landscape, such as surface area, volume storage, and the distance to the nearest neighbor follows a power scaling law. Additionally, we develop an approach to characterize and quantify the spatial correlations of different surface textural properties and chemical constituents with the distribution of depressions using the same high resolution Lidar and AVIRIS data sets. Topographical floodplain legacies such as former meander scar ridges correlate to soil characteristics and vegetation within the floodplain, and also dictate much of the geomorphic impacts of the levee breach and subsequent inundation. This study highlights approaches in which high-resolution data sets can be linked to reveal important landscape properties and analyze impacts of extreme events and long-term legacy effects.