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Characterization of multiscale structure of meanders with a continuous wavelet analysis

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Meandering river planforms are easily observable features in the landscape, but the processes shaping them, act on a wide range of spatial and temporal scales. This results in meanders that curve at several spatial scales with smaller scale curves embedded in larger scale curves. Here, we show how to quantify the multi-scale structure of meanders from the valley scale until the sub-meander scale based on continuous wavelet transforms of the planform curvature. The zero crossings and maximum lines of the wavelet transform capture the main characteristics of the meander shape and their structure is quantified in a scale-space tree. The tree is used to identify meander wavelength and how meanders are embedded in larger scale features. The submeander structure determines meander shape, which is quantified with two parameters: skewness and fattening. The method is applied to the Mahakam River planform, which features very sharp, angular bends. Strong negative fattening is found for this river which corresponds to angular non-harmonic meanders which are characterized by strong flow recirculation and deep scouring.