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Hyperscale, three-dimensional structure of the streams of the Edwards Plateau, Texas, by HAB-transformed digital orthophotoquad imagery

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The science of river processes and forms has profited enormously from the introduction of specialized remote sensing tools such as LiDAR and hyperspectral imaging, but these can be expensive and do not exist for older historical analysis of rivers. As an alternative, a new technique applied to older aerial imagery allows analysis of the three-dimensional river environment over enormous distances. In many rivers, some light often reaches the riverbed and returns to the surface, providing information about different components of the physical structure. The HAB transform combines the Beer-Lambert law of light absorption with hydrodynamic rules to estimate river depth at each image pixel, and it allows separation of the depth effect from the remaining image information. The widespread availability of aerial photos allows the use of HAB approaches to extract 3D data for large area riverscapes at scales from about a meter to that of the entire watershed. The rapid and widespread utility of river DEMs allows hitherto unparalleled investigation of geomorphic structures. As one example, processed imagery of the Nueces River watershed, USA, shows systematic deviations from the classic theory of the downstream hydraulic geometry as well as an unprecedented level of randomness at most scales.