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Combining satellite photographs and raster lidar data for channel connectivity in tidal marshes.

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High resolution airborne lidar is capable of providing topographic detail down to the 1 x 1 m scale or finer over large tidal marshes of a river delta. Such data sets can be challenging to develop and ground-truth due to the inherent complexities of the environment, the relatively small changes in elevation throughout a marsh, and practical difficulties in accessing the variety of flooded, dry, and muddy regions. Standard lidar point-cloud processing techniques (as typically applied in large lidar data collection program) have a tendency to mis-identify narrow channels and water connectivity in a marsh, which makes it difficult to directly use such data for modeling marsh flows. Unfortunately, it is not always practical, or even possible, to access the point cloud and re-analyze the raw lidar data when discrepancies have been found in a raster work product. Faced with this problem in preparing a model of the Trinity River delta (Texas, USA), we developed an approach to integrating analysis of a lidar-based raster with satellite images. Our primary goal was to identify the clear land/water boundaries needed to identify channelization in the available rasterized lidar data. The channel extraction method uses pixelized satellite photographs that are stretched/distorted with image-processing techniques to match identifiable control features in both lidar and photographic data sets. A kmeans clustering algorithm was applied cluster pixels based on their colors, which is effective in separating land and water in a satellite photograph. The clustered image was matched to the lidar data such that the combination shows the channel network. In effect, we are able to use the fact that the satellite photograph is higher resolution than the lidar data, and thus provides connectivity in the clustering at a finer scale. The principal limitation of the method is the where the satellite image and lidar suffer from similar problems For example, vegetation overhanging a narrow channel might show up as higher-elevation land in the lidar data an also as a non-water cluster color in the satellite photo.