Urban Mapping Validation in Venice Using Satellite and Aircraft Data.

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As part of a validation project for EO-1 satellite data, a large number of data sets were analyzed to map the urban environment of the city of Venice. Satellite data included 30-m EO-1 Advanced Land Imager (ALI) data with 9 broad bands in the 0.43-2.35 micron region; 30-m EO-1 Hyperion hyperspectral scanner data with 192 bands in the 0.45-2.35 micron region; 30-m Landsat Thematic Mapper data; 15 and 30-m ASTER data with 9 bands in the 0.52 to 2.4 micron region; 8-m MIVIS hyperspectral aircraft scanner data with 102 bands in the 0.4 to 12 micron region; and 4-m Ikonos data with 4 bands in the VNIR. The data were analyzed to isolate different instrument factors: spatial resolution and spectral bands. The materials looked for were: old tile roofs, new tile roofs, zinc roofs, asphalt pavement, trachyte pavement, limestone pavement, grass and trees. In the 30-m data, all pixels were spectrally mixed, so materials that were identifiable were not pure classes. New roofs, old roofs, grass, and trees form large enough areas to be separable, though materials were mixed with shadows and other materials. Increased spatial resolution improved classification accuracy, and allowed more different materials to be identified. Similarly, more spectral bands improved classification accuracy. The best results were obtained with MIVIS 102-channel, 8-m data, that allowed all types of materials to be mapped both spatially and spectrally. EO-1 ALI data were better than Landsat TM due to the improved signal-to-noise, and the additional spectral bands. Hyperion data suffered from low signal-to-noise, and so the full advantage of hyperspectral data was not available for this site. Operational multispectral satellites generally do not have sufficient spatial resolution to be extremely effective for mapping urban areas. The data are good for separating general classes of materials, useful for runoff models. Higher spatial resolution (<10 m) is necessary to spatially separate urban materials. Most classes can be separated with Ikonos, for example, with 4-m pixels. But the limited number of spectral bands prevents separation of subtle differences, such as the presence of limestone.