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Evaluating the Contribution of Image Fusion into the Snow Mapping in Mountainous Terrain Using Euclidean Distance

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Image fusion is a process to generate a new image by integrating different spatial, spectral and/or temporal resolution images. Main goal of image fusion is to provide detail input to the later image analysis. Snow in mountainous is challenging to map with optical remote sensing techniques because of the relief or topography may affect the image radiometry. In the context of binary classification of snow in mountainous terrain, fusion methods were applied to increase the accuracy of snow mapping. The assessment of the performance of multi-resolution image fusion method, Mean Euclidean Distance between the snowline obtained from the classification and a reference snowline was used. The methodology was applied in the mountainous terrain of east Turkey. Landsat image acquired on April 8, 2004 was used as a reference image. First the image was orthorectified and mapped to a cartographic projection. Then image segmentation was applied to obtain homogeneous tiles, where the homogeneity is defined as similarity in pixel values. The mean-shift segmentation approach, where each pixel was associated with a significant mode of the joint domain density located in its neighborhood, was applied. After segmentation, the image was classified into snow and no-snow classes with Maximum Likelihood Classification Method, which is a supervised classification method that quantitatively evaluates both the variance and covariance of the category spectral response patterns when classifying an unknown pixel/segment. Snow maps having spatial resolution of 250 m and 500 m were obtained from MODIS images (MOD09GA) with and without applying a fusion method, namely Brovey transformation and nearest neighbor re-sampling technique. Snow classification of the MODIS images was done by using the Normalized Difference Snow Index (NDSI). The boundary between “snowy” and “snow-free” pixels was extracted from MODIS images using the NDSI threshold equal to 0.68. The Mean Euclidean Distance was calculated in a two dimensional space, between the line extracted from the test snow line obtained from MODIS images and the “reference snowline” obtained from 30-m Landsat imagery. It is observed that Mean Euclidean Distance identified an improvement in the snow mapping obtained from fused images having 250m spatial resolution compared to images having 500m spatial resolution. The use of Mean Euclidean Distance as a feature based quality indicator in the assessment of snow mapping in mountainous terrain is discussed.