MODIS Global Land Cover: Algorithm Refinements and Characterization of New Datasets

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Abstract
Information related to land cover is immensely important to global change science. Here we describe the datasets and algorithms used to create the Collection 5 MCD12Q1 MODIS Global Land Cover Product, which is substantially changed relative to Collection 4. In addition to using updated input data, the algorithm and ancillary datasets used to produce the product have been refined. Most importantly, the Collection 5 product is generated at 500-m spatial resolution, providing a four-fold increase in spatial resolution relative to the previous version. In addition, many components of the classification algorithm have been changed. The training site database has been revised, land surface temperatures have been included as an input feature, and ancillary datasets used in post-processing of ensemble decision tree results have been updated. Further, methods used to extract classifier results for bias due to input training data properties have been refined, techniques used to fuse ancillary data based on spatially varying prior probabilities have been revised, and a variety of methods have been developed to address limitations of the algorithm for the urban, wetland, and deciduous needleleaf classes. Finally, techniques used to stabilize classification results across years have been developed and implemented to reduce year-to-year variation in land cover labels not associated with land cover change. Results from a cross-validation analysis indicate that the overall accuracy of the product is about 75% correctly classified, but that the range in class-specific accuracies is large. Comparison of Collection 5 maps with Collection 4 results shows substantial differences arising from increased spatial resolution and changes in the input data and classification algorithms.

2005 IGBP Land Cover Map (MCD12Q1)

Improved characterization of high latitude vegetation extending to the Arctic Ocean

Delta of the Kolyma River, Eastern Siberia

Improved representation and detection of wetland ecotones.

Before: the proportion of global pixels with stabilization (yellow) and without (green). Above: the proportion of global pixels changing from one year to the next with stabilization (yellow) and without (green).

Updated Ancillary Data Layers
• Auxiliary data layers are used within the MCD12Q1 algorithm to aid classification results when spectral data from MODIS do not effectively separate classes. These data are derived from a variety of sources including the Collection 4 MOD12Q1 product, agricultural intensity maps, and the MODIS land water mask.
• A 150 km x 150 km moving window was used to compute the approximate regional frequency of classes based on MODIS collection 4 data. This provides local likelihoods for each class at each pixel.
• To prescribe the likelihood of agriculture or agricultural mosaic, we used a new data set from Ramankutty et al. (2008; see below).

Updated Classification Algorithm
• A 500 m x 500 m moving window was used to compute the approximate regional frequency of classes based on MODIS collection 4 data. This provides local likelihoods for each class at each pixel.
• To prescribe the likelihood of agriculture or agricultural mosaic, we used a new data set from Ramankutty et al. (2008; see below).
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References