The 36th International Symposium on Remote Sensing of Environment,
11 – 15 May 2015, Berlin, Germany, ISRSE36-734

RAPID UPDATE OF LAND COVER USING CHANGE DETECTION AND SUPERVISED MACHINE LEARNING IN SOUTH AFRICA.

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THEME: BIODIVERSITY, Special Session: Trends in operational land cover monitoring.

KEY WORDS: land cover, Landsat, automation, change detection, South Africa

ABSTRACT:

With the availability of free moderate spatial resolution satellite data, land cover monitoring systems require the ability to pre-process and classify large volumes of data. South Africa's most recent national land cover dates back to the year 2000 and therefore our research program strives to improve land cover mapping efficiency by introducing various technologies to develop highly automated and scalable systems. The objective of the study was to develop a system which can rapidly update a land cover map for a desired year from a previously produced land cover map using change detection, automated training data generation in non-change areas and random forest classifiers on Landsat time series data. The system prototype was tested for the Kwa-Zulu Natal province (KZN) of South Africa for which land cover data have been independently generated for 2005, 2008 and 2011 using SPOT4/5 images. The iteratively reweighted multivariate alteration detection (IRMAD) approach for change detection was used to identify areas from the Landsat image pairs of successive years (2005, 2008, 2011). The training samples were created from the preceding land cover map and the IRMAD change mask calculated between the preceding land cover map (e.g. 2008) and the year for which the land cover is being updated (e.g. 2011). These were then compared to independently generated SPOT-based land cover maps of the latter year (e.g. 2011). Map accuracy was between 65% and 72% depending on the level of aggregation of the original land cover classes. Most of the classification error was between spectrally similar classes with dubious class definitions e.g. degraded grassland vs. fallow fields in communal cultivation, as well as natural vegetation classes with a continuum of tree cover, e.g. thicket, medium bushland, open woodland. The approach yielded useful land cover outputs, which can be generated at more frequent intervals to address ever-increasing demands for land cover products and services.