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Building confidence in global VCF tree cover products? - A Siberia case study

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Global vegetation continuous fields (VCF) products offer a different perspective on land surface characteristics than traditional discrete classifications. By presenting each pixel as a percent coverage, spatial heterogeneity may be better represented with significant advantages for vegetation modelling. A common VCF product representing the percentage of tree canopy cover per pixel was generated from monthly MODIS composites. Currently, this product is available for 2001 with a spatial resolution of 500m. The coverage for the following four years and with a resolution of 250 m is expected to be available in the near future (http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp?productID=20). Despite the obvious potential of such global datasets, there are only limited validation and insufficient comparisons with traditional forest inventory data. Thus, this study aims at building understanding and confidence in VCF tree cover products by a systematic comparison and analysis with large scale boreal forest inventory information. In the framework of the EU funded project SIBERIA-II, the International Institute for Applied Systems Analysis (IIASA) provided a GIS based vector database of 74 test sites at scale 1:50.000 with detailed forest inventory data as well as an aggregated vegetation data base at scale 1:1 Mio. The latter covers the entire 3 Mio km^2 SIBERIA-II study region in Central Siberia. This provides unique database to verify the VCF tree cover product with detailed inventory information and for a large region covering the full range of boreal forest types. Attempts to find statistical relations between the VCF tree cover, representing canopy closure, and forest parameters are promising and show both potentials and obvious limitations of the datasets. The best linear regressions could be found between the VCF tree cover and tree height ($R^2 = 0.44$) and growing stock ($R^2 = 0.35$) including all data available. However, the regressions strongly vary for different tree species and eco-regions of this large study area. Prominent correlations between VCF tree cover and growing stock could be found for larch ($R^2 = 0.53$ for IIASA vegetation database, $R^2 = 0.46$ for inventory test sites) and VCF tree cover and tree height for aspen ($R^2 = 0.65$ for inventory test sites). Multivariate geographically weighted regressions showed even higher correlations and reveal interesting spatial patterns. 63% of large residuals found in the multivariate geographically weighted regression coincide with forest disturbances detected by satellite remote sensing. We analyse possible reasons for similarity and discrepancy of VCF and ground forest inventory data such as (1) specifics of forest vegetation in different vegetation zones, particularly, different morphological structure of forest ecosystems, (2) needs of regional multidimensional intra-ecosystem models which would be appropriate to bind remotely sensed signals and ecosystem parameters; (3) relevance of harmonizing forest-related definitions used by both forest inventory and remote sensing etc. Further investigations provided initial understanding of the link between ERS-SAR coherence, VCF tree cover, and forest inventory information.