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Deriving global plant functional type (PFT) distributions from GLC2000, MODIS (V004/V005), and GlobCover with the Köppen climate zone classification

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The global distribution of terrestrial biogeography has a first order role on the Earth's biogeochemistry, biodiversity, and human land-use allocation. To understand the spatial pattern of climate impacts and vulnerability, earth system models require databases of ecosystem distributions for various model-data assimilation purposes, including initialization, parameterization and validation. The abstraction of earth system state variables in models means that land surface products derived from remote sensing may need to be post-processed for model-data assimilation. Dynamic global vegetation models frequently rely on the concept of plant functional types (PFT) to group common traits of thousands of individual plant species into several classes. Currently, databases of observed PFT maps are based on old data, do not correspond to many of the satellite products now being used for model-data assimilation or do not include the distribution of current land-use. Here we develop four PFT datasets based on land cover information from three satellite sensors (EOS-Terra-MODIS 1km and 0.5 km, SPOT4-VEGETATION 1km, and ENVISAT-MERIS 0.3km spatial resolution) using two internationally recognized legends (LCCS and IGBP) that are merged with a spatially-consistent Köppen-Geiger climate classification derived from >4000 weather stations (Peel et al., 2007). The new PFT datasets were developed by cross-walking satellite derived land cover and Köppen-Geiger climate zone legends. Using a metric for beta (ß) diversity to assess reclassification similarity, we find that the greatest uncertainty in PFT classifications occurs in the tropics due to differences between canopy phenology determination (deciduous or evergreen). Boreal and managed grassland PFT types have the most similar spatial and latitudinal patterns across datasets. Fine-scale features of climate zones, and their corresponding biome-types for PFTs, are accurately represented with the Köppen-Geiger classification (e.g., the highlands of Ethiopia, the alpine grasslands of the Andes and European Alps). These datasets can be used to initialize, parameterize, and validate Land Surface Models at global or regional scale using MODIS, SPOT or ENVISAT products, or for comparison of dynamic vegetation model predictions with actual PFT distribution. The datasets are available online as open source products.