Mapping plant functional types over broad mountainous regions: A phenological hierarchical time-space classification

Danlu Cai (1,2,3), Yanning Guan (2), Shan Guo (2), Chunyan Zhang (2,3), and Klaus Fraedrich (1)

(1) Max-Planck-Institute for Meteorology, Hamburg, Germany, (2) Institute of Remote Sensing Applications Chinese Academy of Sciences, Beijing, China, (3) University of Chinese Academy of Sciences, Beijing, China

Research on global climate change requires plant functional type (PFT) products. Although several PFT mapping procedures for remote sensing imagery are being used (MODIS PFT), none of them appears to be specifically designed to map and evaluate PFTs over broad mountainous areas which are highly relevant regions to identify and analyse the response of natural ecosystems. The limitations of existing methods to generate PFT (uncertainty of accuracy and limited expandability to broad geographic areas) suggest the development of a new method to determine PFT distributions, which is based on a hierarchical strategy by integrating time varying biomass and phenological information with topography:

(i) Temporal variability: Fourier transformation of MODIS Normalized Difference Vegetation Index (NDVI) time series (2006 to 2010) to the frequency domain (five year of five half month scenes). (ii) Spatial partitioning: The harmonics are used to partition the study area into four mapping zones using phenological information based on the harmonics and digital elevation data. (iii) Classification: A similarity measure (Euclidean distance) is employed to obtain the phenological hierarchical time-space plant type classification. Applicability and effectiveness is tested for the eastern Tibetan Plateau. Comparing with the MODIS PFT product and evaluation with the Vegetation Map of the People's Republic of China (1:1000000) reveal a gain on overall accuracy (13081 random samples) by about 7% from 64.5% compared to 57.7% by the MODIS PFT product.