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Long-term monitoring of ecosystem by Phenological Eyes Network

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Satellite remote sensing (RS) is a strong methodology in the study of terrestrial ecosystems. For example, RS is used in scaling up of the ground measurements of carbon flux, water flux, biomass, etc. from a site scale to a regional or global scale. RS provides numerical regional ecological models with information for initial conditions, boundary conditions, and validation. For the sake of it, various new satellite sensors have been designed and launched. They are now delivering a lot of high-level products regarding to the terrestrial ecology, such as new vegetation indices, LAI, FPAR, phenology, GPP, and NPP.

However, in the ecological standpoint, these RS methodology has not enough checked or validated on the ground level. Because an essential characteristics of ecosystem is its dynamism (especially the seasonal change, or ”phenology”), the accuracy, quality, and interpretation of the RS data should be also studied dynamically. For the sake of it, a stable, continuous, long-term, and multi-ecosystem ground validation network is desired. Of course, the flux observation networks such as AsiaFlux have potential to contribute to it. However, because RS observes vegetation’s optical characteristics rather than carbon or heat flux, we need to include optical (spectral) observation in the validation of ecological RS. We believe that the ecological interpretation of RS data is possible only if it is based on a careful theoretical and experimental study of the relationships between optical characteristics and ecological structure (or function), using the quality-controlled RS data considering the relevant noise factors such as cloud contamination or atmospheric aerosols.

With this background stated above, we started the ”Phenological Eyes Network (PEN) in 2003. PEN is a network of ground observatories for long-term automatic observation of the vegetation dynamics (phenology), vegetation’s optical properties (such as spectral reflectance), and the atmospheric optical properties (such as aerosol optical thickness). Most PEN ground sites have been set up at the AsiaFlux sites. The collaboration of PEN and AsiaFlux is critically important in the interpretation of the optical signals captured by RS in terms of ecology (especially the terrestrial carbon/water cycles).

Keywords: phenology, remote sensing