Geophysical Research Abstracts
Vol. 16, EGU2014-9529, 2014
EGU General Assembly 2014

Conceptual development of a comprehensive measurement system for understanding the boreal and Arctic ecosystem-atmosphere relations

Pertti Hari (1), Tuukka Petäjä (2), Jaana Bäck (1), Timo Vesala (2), Jukka Pumpanen (1), Hanna Lappalinen (2), Sergej Zilitinkevich (2), Eija Asmi (3), Tuomas Laurila (3), Yrjö Viisanen (3), and Markku Kulmala (2)

(1) University of Helsinki, Department of Forest Sciences, Helsinki, Finland (jaana.back@helsinki.fi), (2) University of Helsinki, Department of Physics, Helsinki, Finland (tuukka.petaja@helsinki.fi), (3) Finnish Meteorological Institute, Helsinki. Finland (yrjo.viisanen@helsinki.fi)

The climate change is expected to be large at high latitudes and the northern ecosystems in Eurasia will react strongly to this change. We need urgently information about the changes in the state and in the functioning of these ecosystems. The versatility of the ecosystems hampers greatly the combination of the information obtained at single measuring sites. We need a network of stations that are planned and constructed to provide coherent information over the huge area and that utilize the present rapid development of instrumentation.

Although the northern ecosystems and the atmosphere are very different they, however, have many common features that enable construction of station network that provides coherent high quality data. We identify three different ecosystems; forest, peat land and aquatic. The layered structure is characteristic for them as well as for the atmosphere. Metabolic processes convert material and energy into other forms, for example, radiation energy is absorbed and emitted in the atmosphere and converted to chemical form in photosynthesis taking place in forests, peat lands, lakes and in the ocean. The processes generate differences in temperature, concentration and pressure that give rise to material and energy flows within the ecosystems and in the atmosphere, between the ecosystems and between the ecosystems and the atmosphere. These material and energy flows convey the interactions between the ecosystems and between the ecosystems and the atmosphere.

To obtain coherent and high quality information on the present change in northern ecosystems and in the atmosphere we need network of long-term measuring stations that measure the material and energy fluxes within and between the ecosystems, between the ecosystems and the atmosphere, the processes generating the fluxes and the state of the ecosystems and of the atmosphere. These measuring stations should utilize cutting-edge measuring techniques and instrumentation.

The intensive measurements at one site characterize a limited area when compared with the huge extent of the northern ecosystems. Therefore, additional extensive measurements are needed to create a link between the measuring stations and the large area where information is needed. Systematic flights with well-equipped airplanes flying in north south direction and satellite images can provide the link between measuring stations and the large area of applications.