

## **GlobalSMEAR (Stations for Measuring Earth Surface - Atmosphere Relations)**

Markku Kulmala<sup>1</sup> and the SMEAR team at the University of Helsinki

1) Institute for Atmospheric and Earth System Research (INAR) / Physics, Faculty of Science, University of Helsinki, FI

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The conceptual design towards a Station for Measuring Earth surface - Atmosphere Relations (SMEAR) - Concept started in 1995 and was first built on continuous, comprehensive observations of fluxes, storages and concentrations in the land ecosystem – atmosphere continuum (Hari and Kulmala, 2005). Later the concept has been enlarged to consist all kind of Earth surfaces including megacities. In 2009 Hari et al. proposed the concept of hierarchy of research stations where flagship stations, like SMEAR II (a Station for Measuring Ecosystem - Atmosphere Relations ) station in Hyytiälä, Finland, would combined with flux stations and standard stations to achieve a global and regional coverage. Later Hari et al. 2016 expanded the concept and proposed concrete actions for global station network. Kulmala (2018) has estimated that as a core of this type of station network we would need 1,000 or more well-equipped ground stations around the world that track environments and key ecosystems fully and continuously. Combining data from these well equipped stations with the data from satellite-based remote sensing, laboratory experiments and computer models would enable to us to tract and quantify land – atmosphere – ocean feedbacks and solve the air quality chemistry and physics at a regional and global scales.

The prototype of the most well equipped station implementing the SMEAR Concept is the SMEAR II station. During the past ten years, the SMEAR II station has been a major contributor to several Pan-European research infrastructure design, integrated activity and preparation projects that are currently on the ESFRI Roadmap, such as ICOS (Integrated Carbon Observation System), ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure), AnaEE (Infrastructure for Analysis and Experimentation on Ecosystems), eLTER (Integrated European Long-term Ecosystem, critical zone and socio-ecological system Research Infrastructure) and EARLINET (The European Aerosol Research Lidar Network).

SMEAR II also has served a testbed to the development instrument development and data processing system. Recently University of Helsinki has launched a commercial framework, which enables upgrading of the existing stations by adding a site specific SMEAR-concept instrument setup (block) together with technical guidance together with a detailed data exploitation / science plan.