Description of the SMEAR II field station in Hyytiälä, Finland

1. The Hyytiälä field station SMEAR II (Station for Measuring Forest Ecosystem - Atmosphere Relations) has been planned and implemented to determine material and energy flows in the atmosphere-vegetation-soil continuum at different temporal and spatial scales. The station is run in co-operation of the Division of Atmospheric Sciences (from the Department of Physical Sciences) and the department of Forest Ecology in the University of Helsinki. The institutes cooperate in the research of ecosystem-atmosphere relations, and are part of the Research Unit on Physics, Chemistry and Biology of Atmospheric Composition and Climate Change, which is a Center of Excellency of the Academy of Finland, as well as the Nordic Center of Excellence Research unit BACCI (Biosphere-Aerosol-Cloud-Climate Interactions).

2. The research interests of the Division of Atmospheric Sciences include physical, meteorological and chemical processes in the atmosphere, covering
- Atmospheric aerosols: climate change and health effects
- Micrometeorology: interactions between ecosystem and the atmosphere, carbon sinks
- Meteorological modeling: climate research, development of weather forecast models, Martian gas sphere.

   The Division has extensive experience of long term continuous atmospheric field measurements. Other competences include atmospheric aerosol particle formation, flux measurements, and atmosphere-forest ecosystem interactions.

3. Description of the station infrastructure:

   a) The SMEAR II -station is located in Hyytiälä, Southern Finland (61^{o} 51' N, 24^{o}17' E, 181 m above sea level). The terrain around the station is representative of the boreal coniferous forest. The 40-year old Scots pine *(Pinus sylvestris L.)* dominated stand is homogenous for about 200 m in all directions, extending to the north for about 1.2 km. The largest city near the station is Tampere, ca. 60 km S-SW of the measurement site. The terrain is subject to modest height variation. The annual mean temperature is 3^{o}C and precipitation is 700 mm.

   b) The SMEAR II station includes a measurement building, a 72-meter high mast, a 15-meter tall tower and two mini-watersheds. Gas analyzers, computers and all the other sensitive equipment are located in the measurement building. The mast is used for measurement of meteorological variables and gas concentrations and for eddy-covariance measurements. The tower eases the installation and maintenance of gas-exchange chambers that are attached to tree branches. More information can be found in *Vesala et al., (1998)*, and *Kulmala et al., (2001)*.
   Table 1 on page 3 shows the instrumentation used for continuous measurements.

   c) We have an open data availability policy.

   d) The web site of the field station is http://www.honeybee.helsinki.fi/smear/index.htm; a detailed description of the measurement system is given at http://www.honeybee.helsinki.fi/smear/manual/index.htm . The Division of Atmospheric

Sciences' web site is at http://www.atm.helsinki.fi/

e) The field station is easily accessible by car, and also by public transport. The station has the capacity to accommodate ca. 100 persons. Technical assistance can be given by the personnel living at the station.

f) In addition to the continuous measurements, we plan field campaigns with more extensive instrumentation every March-May -period.

g) Networks: The Hyytiälä station is part of the FLUXNET network (http://daac.ornl.gov/FLUXNET/)

h) We are open to any collaboration suggestions; especially we are interested in measurements of atmospheric sulfuric acid concentrations as well as different gaseous organic compounds.

i) An accommodation fee is charged from person living at the station

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QUANTITY	METHOD
MAST (73 m)	
Temperature (4, 8, 17, 34, 50 and 67 m)	Ventilated and shielded sensor (Pt-100)
Wind speed (six heights; see above)	Cup anemometer (Vector)
Wind direction (17, 34 and 50 m)	Vane (Vector)
Reflected radiation (70 m)	Pyranometer (Reemann)
Reflected PAR (70 m)	Li-Cor sensor
Net radiation (70 m)	Net radiometer (Reemann)
O3 concentration (six heights)	Teflon pipes and gas analyser (TEI 49)
SO2 concentration (six heights)	Teflon pipes and gas analyser (TEI 43BS)
NOx concentration (six heights)	Teflon pipes and gas analyser (TEI 42 CTL)
NO concentration (six heights)	Teflon pipes and gas analyser (TEI 42 CTL)
H2O concentration (six heights)	Teflon pipes and gas analyser (URAS 4)
CO2 concentration (six heights)	Teflon pipes and gas analyser (URAS 4)
Dew point temperature (23 m)	Dew point sensor E4
Turbulence (eddy covariance (EC); 23 m)	Ultrasonic anemometer (Solent 1012R2)
Concentration fluctuations of CO2 and H2O (EC; 23 m)	High frequency gas analyser (Li-Cor 6262)
Concentration fluctuations of aerosol particles (EC; 23 m)	CPC sampled at 10 Hz
EDDY COVARIANCE AND IRRADIANCE TOWER (18 m)	
Turbulence (c. 22 m)	Ultrasonic anemometer (Solent HS1199)
Aerosol particle flux (c. 22 m)	Relaxed Eddy Accummulation with DMPS
Concentration fluctuations of CO2 and H2O (c. 22 m)	High frequency gas analyser (Li-Cor 6262)
Concentration fluctuations of O3 ; c. 22 m)	High frequency gas analyser (LOZ-3)
Diffuse radiation (18 m)	Pyranometer (Reemann)
Global radiation (18 m)	Pyranometer (Reemann)
PAR (18 m)	Li-Cor sensor
UVA and UVB (18 m)	Solar sensors
Rain + SWS (18 m)	Raingauge (ARG) and raindetector (Vaisala)
Rain/Snow sampler (summer/winter)	Sampling with bottles/buckets
VOC sampling for FMI	Sampling twice a week
Bio aerosol sampler	Continuous sampling, Burkard sampler
TGA100 Trace Gas Analyzer	
Turbulence (c. 2.7 m)	Ultrasonic anemometer (Metek)
Concentration fluctuations of CH4 and N2O (c. 2.7 m)	TGA100
TREE TOWER (15 m)	
Exchange of five gases (NO, NOx, O3, CO2, H2O) by shoots (various levels)	Closing cuvettes
PAR distribution in the cuvette (various levels)	800 PAR sensors
Cuvette temperature (various levels)	Thermoelement
cuvette PAR (various levels)	Li-Cor / Delta
Ambient temperature (c. 15 m) [summer]	Thermoelement
LSW (c. 15 m) [summer]	Leaf Surface Wetness sensors
Sapflow (various levels [summer])	heat balance method (Dynamax, branches) Granier needles (stem base)
Diurnal diameter variations (various levels [summer])	Rigid frame + displacement transducers
WATER CATCHMENT AREA INSTRUMENTATION	
Exchange of five gases (NO, NOx, O3, CO2, H2O) by soil	Closing cuvettes
Rain (2 m)	Raingauge (ARG)
Throughfall (summer)	Throughfall gauge (Rainer) + chemical analysis
Snow collectors (winter)	Bucket collector + chemical analysis
Snow depth (winter)	At seven points
Temperature (depths of 0.5, 0.6, 0.7, 0.8, 1, 1.3, 1.6 m)	Thermistor (Philips)
Water potential (seven depths, see above [summer])	Tensiometer (Transinstruments)
Water content (seven depths)	Time domain reflectometer (Tektronix)
Soil solution (seven depths [summer])	Lysimeters (Prenart Equipment), + chemical analysis
Amount of CO2, CH4 and N2O (seven depths)	Sampling with subsequent analysis
Heat capacity and conductivity (0.8 m)	Stainless steel sonde
Outflow from the area (summer)	Flowmeters in two dams, + chemical analysis
Litter (0.7 m)	Litter collectors
Branch (litter) collectors (summer)	On the ground
AEROSOL INSTRUMENTATION (2 m)	
Size distribution (3 - 500 nm)	Two DMPS with condensation particle counters
PM 10 impactor	> 10 um, 10 - 2.5 um, 2.5 - 1 um, < 1 um particles
RADIATION MEASURMENTS (FMI)	
Radon (0.5 m)	
Ambient radiation (5 m)	
RADIOSPECTROMETER	
Solar radiation spectrum (280 - 600 nm wavelenght)	Bentham radiospectrometer
REFLECTIONSPECTRUM	
Reflected spectrum of needles	
SODAR	
Wind velocity profile	Sound Detection and Ranging

Table 1: A list of instrument used at the Hyytiälä field station.