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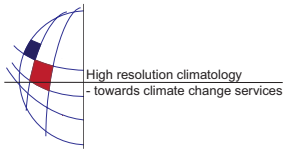

Atmospheric conditions measured by a wireless sensor network on the local scale

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Atmospheric conditions close to the surface, like temperature, wind speed and humidity, vary on small scales because of surface heterogeneities. Therefore, the traditional measuring approach of using a single, highly accurate station is of limited representativeness for a larger domain, because it is not able to determine these small scale variabilities. However, both the variability and the domain averages are important information for the development and validation of atmospheric models and soil-vegetation-atmosphere-transfer (SVAT) schemes. Due to progress in microelectronics it is possible to construct networks of comparably cheap meteorological stations with moderate accuracy. Such a network provides data in high spatial and temporal resolution.

The EPFL Lausanne developed such a network called SensorScope, consisting of low cost autonomous stations. Each station observes air and surface temperature, humidity, wind direction and speed, incoming solar radiation, precipitation, soil moisture and soil temperature and sends the data via radio communication to a base station. This base station forwards the collected data via GSM/GPRS to a central server.

The first measuring campaign took place within the FLUXPAT project in August 2009. We deployed 15 stations as a twin transect near Jülich, Germany. To test the quality of the low cost sensors we compared two of them to more accurate reference systems. It turned out, that although the network sensors are not highly accurate, the measurements are consistent. Consequently an analysis of the pattern of atmospheric conditions is feasible. The transect is 2.3 km long and covers different types of vegetation and a small river. Therefore, we analyse the influence of different land surfaces and the distance to the river on meteorological conditions. For example, we found a difference in air temperature of 0.8°C between the station closest to and the station farthest from the river. The decreasing relative humidity with increasing distance to the river meets our expectations. But there are also some unexpected anomalies in the air temperature, which will be discussed in detail by selected case studies. By analysing the correlation of the fluctuation of the meteorological conditions, we want to detect clusters depending on different land surfaces and distance to the river.

Since April 2010 a second deployment is set up at the Airport Hamburg. It consists of 14 stations placed along the two runways in northward and in eastward direction. The aim of this project is to analyse whether the atmospheric conditions in such an uniform environment are really homogeneous. To do so we will apply the same analyses for these measurements we used for FLUXPAT.