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Mobile Wireless Sensor Networks for Advanced Soil Sensing and Ecosystem Monitoring

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For an adequate characterization of ecosystems it is necessary to detect individual processes with suitable monitoring strategies and methods. Due to the natural complexity of all environmental compartments, single point or temporally and spatially fixed measurements are mostly insufficient for an adequate representation. The application of mobile wireless sensor networks for soil and atmosphere sensing offers significant benefits, due to the simple adjustment of the sensor distribution, the sensor types and the sample rate (e.g. by using optimization approaches or event triggering modes) to the local test conditions. This can be essential for the monitoring of heterogeneous and dynamic environmental systems and processes. One significant advantage in the application of mobile ad-hoc wireless sensor networks is their self-organizing behavior. Thus, the network autonomously initializes and optimizes itself. Due to the localization via satellite a major reduction in installation and operation costs and time is generated. In addition, single point measurements with a sensor are significantly improved by measuring at several optimized points continuously. Since performing analog and digital signal processing and computation in the sensor nodes close to the sensors a significant reduction of the data to be transmitted can be achieved which leads to a better energy management of nodes. Furthermore, the miniaturization of the nodes and energy harvesting are current topics under investigation. First results of field measurements are given to present the potentials and limitations of this application in environmental science. In particular, collected in-situ data with numerous specific soil and atmosphere parameters per sensor node (more than 25) recorded over several days illustrates the high performance of this system for advanced soil sensing and soil-atmosphere interaction monitoring. Moreover, investigations of biotic and abiotic process interactions and optimization of sensor positioning for measuring soil moisture are scopes of this work and initial results of these issues will be presented.