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Potentials, Limitations and Applications of long-term and mobile ad-hoc Wireless Sensor Networks for Environmental Monitoring

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To characterize environmental systems it is necessary to identify and describe processes with suitable methods. Environmental systems are often characterized by their high heterogeneity, so individual measurements for their complete representation are often not sufficient. The application of wireless sensor networks in terrestrial and aquatic ecosystems offer significant benefits as a better consideration of the local test conditions becomes possible. This can be essential for the monitoring of heterogeneous environmental systems. Significant advantages in the application of mobile ad-hoc wireless sensor networks are their self-organizing behavior, resulting in a major reduction in installation and operation costs and time. In addition, a point measurement with a sensor is significantly improved by measuring at several points. It is also possible to perform analog and digital signal processing and computation on the basis of the measured data close to the sensor. Hence, a significant reduction of the data to be transmitted can be achieved which leads to a better energy management of sensor nodes. Furthermore, their localization via satellite, the miniaturization of the nodes and long-term energy self-sufficiency are current topics under investigation. The possibilities and limitations of the applicability of wireless sensor networks for long-term and mobile environmental monitoring are presented. A concepts and realization example are given in the field of micrometeorology and soil parameters for the interaction of biotic and abiotic processes .This long term monitoring is part of the Global Change Experimental Facility (GCEF), a large field-based experimental platform to assess the effects of climate change on ecosystem functions and processes under different land-use scenarios. Furthermore a mobile ad-hoc sensor network is presented for the monitoring of water induced mass wasting processes.