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TERENO – A new Network of Terrestrial Observatories for Environmental Research

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Climate change and land use changes are the most important factors of global environmental change which have to be managed by the society in the next years. Global changes in terrestrial systems take place on different spatial and temporal scales. In order to address the challenges of global change, interdisciplinary research in terrestrial environmental science is of great importance. Therefore, long-term operated „Global Change Observatories“ for monitoring, analyzing and predicting changing state variables and fluxes within different environmental compartments are of special importance. Several environmental research networks have already been established in order to monitor, analyse and predict the impact of global change on different compartments and/or matter cycles of the environment. Typically these environmental research networks have focused on specific research questions, and compartments, such as CarboEurope, FLUXNET and ILTER

The infrastructure activity TERENO (Terrestrial Environmental Observatories), a research initiative of the Helmholtz Association, aims to establish a network of observation platforms linking terrestrial observatories in different sensitive and representative regions. The observed system consists of the subsurface environment, the land surface including the biosphere, the lower atmosphere and the anthroposphere. Hydrological units will be used as the basic scaling units in a hierarchy of evolving scales and structures ranging from the local scale to the regional scale for multi-disciplinary process studies.

Terrestrial systems are extremely complex. Despite of this complexity, the terrestrial component in most process-based climate and biosphere models is typically represented in a very conceptual and often rudimentary way. Remedying this deficiency is therefore one of the most important challenges in environmental and terrestrial research, and we suggest that terrestrial observatories could be an important step towards a new quality in environmental and terrestrial research. For the first phase three terrestrial observatories in Germany have been identified: the Lower Rhine Basin, the metropolitan area Leipzig-Halle, and the Northern pre-Alps including the long-term research stations Hoeglwald and Scheyern. A fourth Observatory is planned in the German Lowland region.

The concept of TERENO is illustrated by the Leipzig-Halle area. A monitoring concept for the Bode catchment – a mesoscale, lower mountain range catchment - will be described. The Bode river catchment is the central site for hydrological observation at the Leipzig-Halle TERENO study site. A integrated monitoring and research concept joining hydrological, atmospherical, biodiversity related, and soil physical research will be implemented during the next two years. This will lead to scale dependent intensive research activities on different spatial scales, allowing the development and evaluation of hydrologic scaling strategies. Hydrological monitoring will range from large scale satellite data to small scale catchment investigations on flow path, matter transport and transformation using advanced monitoring networks ranging from aerial photography and spectral analysis to non invasive geophysical investigations and sensor networks at the point scale (e.g. soil moisture).