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Integrating terrestrial environmental research by establishing a network of observatories: A new instrument for hydrological research?

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To address the challenges of global change, interdisciplinary and integrated research in terrestrial environmental science at multiple temporal and spatial scales is of great 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 water and matter cycles of the environment. Typically these environmental research networks have focused on specific research questions and compartments, such as CarboEurope, FLUXNET and ILTER. At present other initiatives like ICOS, Lifewatch, NOHA, and ANAEE are emerging, each of them focussing on specific research questions. We argue that there is a need to establish a network of terrestrial observatories, defined as a system consisting of the subsurface environment, the land surface including the biosphere, the lower atmosphere as well as socioeconomic aspects in order to spur and move forward all fields of terrestrial research, and hydrological research in particular. Although terrestrial systems are extremely complex, the hydrological component in larger scale process-based climate and biosphere models is often represented in a very conceptual and often rudimentary way. Addressing this issue is therefore one of the most important challenges in hydrological research, and we suggest that terrestrial observatories could play an important role. The establishment of these observatories will create unprecedented data sets by integrating existing and new measurement technologies such as remote sensing platforms, hydrogeophysical measurement techniques and wireless sensor networks that will significantly improve our understanding of hydrological processes. We will illustrate this by the recent TERENO initiative aiming at establishing a network of terrestrial observatories in Germany.