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# Event-oriented observation across scales and environmental systems: MOSES started operation.

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The novel observing system „Modular Observation Solutions for Earth Systems (MOSES)“, is an initiative of the Helmholtz Association of German Research Centers that aims at investigating the interactions of short-term events and long-term trends across environmental systems. MOSES is a mobile and modular infrastructure and its component measuring systems are managed by the participating research centers. By quantifying energy, water, nutrient and greenhouse gas states and fluxes during events such as heat waves, droughts, heavy precipitation, floods, rapid thaw of permafrost or of ocean eddies, and subsequently along the related event chains, the system delivers data to examine potential long-term impacts of these events and to gain a better understanding of extreme events that are expected to increase in frequency and intensity in a changing climate. In order to obtain comprehensive data sets, a cross-system approach is followed, covering the atmosphere, land surface and hydrosphere. These event-related data sets complement long-term and/or large scale data sets of established national and international monitoring programs and satellite data such as TERENO, ICOS, eLTER, SENTINEL, etc. After a 5-year setup period, MOSES was successfully put into operation in 2022 (Weber et al., 2022, https://doi.org/10.1175/BAMS-D-20-0158.1).

While long-term trends are typically assessed with stationary observation networks and platforms specifically designed for long-term monitoring, proven event-oriented observation systems and strategies are still missing. Event-oriented observation campaigns require a combination of a) measuring systems that can be rapidly deployed at “hot spots” and in “hot moments”, b) mobile equipment to monitor spatial dynamics in high-resolution, c) in situ measuring systems to record temporal dynamics in high-resolution, and d) interoperable measuring systems to monitor the interactions between atmosphere, land surface and hydrosphere. We will present the observation system and the observing strategy on examples from two past test campaigns: 1) The “Swabian MOSES campaign” of 2021 that captured the formation and evolution of supercells, hail and heavy precipitation and the resulting local flash floods (Kunz et al., 2022, https://doi.org/10.3389/feart.2022.999593). 2) The MOSES campaign of 2019 that captured the historical low flow situation along the Elbe River and into the German Bight (e.g., Kamjunke et al., 2021, https://doi.org/10.1002/lno.11778). As an outlook, upcoming national and international campaigns and potential future deployments will be presented.

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