Geophysical Research Abstracts
Vol. 18, EGU2016-6751, 2016
EGU General Assembly 2016


# CAOS: the nested catchment soil-vegetation-atmosphere observation platform

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Most catchment based observations linking hydrometeorology, ecohydrology, soil hydrology and hydrogeology are typically not integrated with each other and lack a consistent and appropriate spatial-temporal resolution. Within the research network CAOS (Catchments As Organized Systems), we have initiated and developed a novel and integrated observation platform in several catchments in Luxembourg. In 20 nested catchments covering three distinct geologies the subscale processes at the bedrock-soil-vegetation-atmosphere interface are being monitored at 46 sensor cluster locations. Each sensor cluster is designed to observe a variety of different fluxes and state variables above and below ground, in the saturated and unsaturated zone. The numbers of sensors are chosen to capture the spatial variability as well the average dynamics. At each of these sensor clusters three soil moisture profiles with sensors at different depths, four soil temperature profiles as well as matric potential, air temperature, relative humidity, global radiation, rainfall/throughfall, sapflow and shallow groundwater and stream water levels are measured continuously. In addition, most sensors also measure temperature (water, soil, atmosphere) and electrical conductivity. This setup allows us to determine the local water and energy balance at each of these sites. The discharge gauging sites in the nested catchments are also equipped with automatic water samplers to monitor water quality and water stable isotopes continuously. Furthermore, water temperature and electrical conductivity observations are extended to over 120 locations distributed across the entire stream network to capture the energy exchange between the groundwater, stream water and atmosphere. The measurements at the sensor clusters are complemented by hydrometeorological observations (rain radar, network of distrometers and dense network of precipitation gauges) and linked with high resolution meteorological models. In this presentation, we will highlight the potential of this integrated observation platform to estimate energy and water exchange between the terrestrial and aquatic systems and the atmosphere, to trace water flow pathways in the unsaturated and saturated zone, and to understand the organization of processes and fluxes and thus runoff generation at different temporal and spatial scales.