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Runoff generation following a prolonged dry period

J. Lange (1) and A. Haensler (2)

(1) Universität Freiburg, Inst. of Hydrology, Freiburg, Germany (jens.lange@hydrology.uni-freiburg.de, +49 761 2033594),
(2) Helmholtz-Zentrum Geesthacht, Climate Service Center (CSC), Hamburg, Germany (andreas.haensler@hzg.de)

Several techniques were chosen to study changes in the hydrological response of a 1.53 km2 forest headwater to the exceptional climatic situation in summer 2005, when an intense early summer drought was followed by a wet summer. Nine consecutive after-drought runoff events were investigated. Hydrograph separation by electrical conductivity and direct observations of streamflow temperature suggested that immediately after the drought, storm runoff generation was dominated by event water, predominantly from the surface (permanent saturated areas and forest roads). Only during following events did subsurface runoff components regain their importance, causing higher fractions of pre-event water and a longer term increase of base flow. This was manifested by increasing fractions of delayed flow per event and by smoother recession limbs of event hydrographs. Deep soil moisture sensors showed a retarded response to after-drought rainfall. In hillslope springs above 510 m, an almost contemporaneous, delayed increase of nitrate concentrations was found. Water quality data from the stream permitted insights into catchment scale runoff generation processes. Already in the very first water sample after the drought, diluted silica and enriched 18O-isotopes documented the importance of event water. One week later, suddenly increasing nitrate concentrations suggested the resumed participation of soil pathways, and hence subsurface components, in runoff generation after the drought. Thus, nitrate traced the after-drought transition from a surface- to a subsurface dominated runoff response, which soil moisture data had already indicated.