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Longtime monitoring of groundwater levels and matric potentials in organic and inorganic soils affected by surface drainage and groundwater extraction

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Drainage of organic soils leads to severe degradation of the soil matrix due to shrinkage, oxidation and development of hydrophobicity. Also, grassland vegetation on cultivated peatland soils is adapted to water supply through capillary rise from the groundwater to guarantee good yields. Monitoring of groundwater levels and soil matric potentials was performed in a period of ten years (2003-2013) at six investigation sites in a plain tract surrounded by Saalean deposits in south-west Schleswig-Holstein, Germany. The area is under agricultural use; all monitoring sites are under grassland. The groundwater situation in the area has been strongly affected by surface drainage (since 1969) and groundwater extraction for industrial and private utilization (since 1977). Soil physical measurements on soil samples taken from six soil profiles in the investigation area (2003) showed an advanced degradation of the organic soil horizons as a result of the dewatering. Furthermore, in 2003 drainage and groundwater extraction resulted in a situation, where water supply in the root zone via capillary rise from the groundwater was no longer guaranteed on some of the investigation sites, leading to yield depressions in dry periods as the vegetation was dependent on precipitation events for water supply. In 2006 new regulations of the groundwater extraction lead to a continuously rise of the groundwater level, indicating an interaction between the surface aquifer and the deep aquifer where the groundwater was extracted, as the surface drainage management remained unchanged. Correlations between the extraction rate of the groundwater wells in the investigation area and the groundwater level in the surface aquifer were found.