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Assessing water table dynamics of peatland areas using Landsat TIR imagery

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Water saturation conditions in peatlands are a driving factor for the emission of greenhouse gases. Thus, the identification of long-term saturation dynamics in peatland areas is a first step towards the quantification of emissions from these ecosystems. Unfortunately, information on groundwater levels is not always available on the necessary spatial or temporal resolution. Publicly available databases of remotely sensed satellite data offer ways to close this lack of information. Previous studies have shown the potential of the thermal signature of the soil surface monitored by thermal infrared imagery to derive information about subsurface hydrology. It is also known that shallow-groundwater systems as wet peatlands are less susceptible to seasonal temperature fluctuations than drained peatlands and soils with deeper groundwater. Hence, wetter peatlands will be characterized by a smoother seasonal surface temperature curve, being cooler in the summer and warmer in the winter.
Due to the strong influence of the vegetation cover on thermal infrared radiative transfer, we here analyze temperature dynamics as relative differences between comparable vegetation cover in the same region. As satellite data we used remotely sensed Landsat TIR imagery. The archive of Landsat TIR imagery compiles records on a 16 days cycle since 1984. The present study seeks to use this archive to reconstruct the water saturation conditions in the peatland areas of the state of Baden-Wuerttemberg, Germany, over the last three decades. We restricted our analysis on grassland vegetation because of its predominance in the study area and its relative low vegetation height. Preliminary results for selected peatlands are 1) peatland characteristic annual patterns of TIR temperature differences, and 2) intra-annual variability over the years of available Landsat imagery within these patterns. In our presentation, we will further compare the resulting time series with available groundwater level and subsidence data.