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Do mining lakes in the Lusatian lignite mining region (Eastern Germany) affect regional precipitation patterns?

Yasemine Brück (1), Ina Pohle (1), Klaus Keuler (2), Eberhard Schaller (2), and Christoph Hinz (1)

(1) Hydrology and Water Resources Management, BTU Cottbus-Senftenberg, Cottbus, Germany, (2) Environmental Meteorology, BTU Cottbus-Senftenberg, Cottbus, Germany

Due to the flooding of former open-pit mines, Europe's largest artificial lake district is created in Eastern Germany. Between 1990 and 2006 more than 80 km^2 of new lakes have already been formed. These large-scale land cover changes may impact regional meteorological characteristics, therefore it is of interest, whether effects of the mining lakes can already be observed.
We especially focus on whether the evaporation from the mining pit lakes leads to a higher precipitation on their lee side. To detect changes in the precipitation patterns, we analysed daily precipitation data (1980-2014) of 25 stations in an area of 10 000 km^2 widely around the lake district. Under the assumption that the influences of the lakes should be detectable either directly as trends in the observed data or as a deviation from a general measure for precipitation we combined statistical tests and principal component analysis (PCA). We applied pre-whitening Mann-Kendall tests to detect precipitation trends and Mann-Whitney tests to detect differences between split samples (before and after the flooding of most of the lakes). The PCA was applied based on the correlation matrix of daily precipitation at the different stations.
As the daily precipitation can sufficiently be explained by the first five principal components, the recombination of these five principal components was used as a general measure of precipitation in the region. By regression trees (random forests) a relationship between the eigenvectors of the first five principal components and physiogeographic characteristics of the stations (e.g. altitude) was shown. Both the observed data and the deviations between the measurements and the recombination of the first five principal components showed divergent trends with high spatial variability and also interannual variability, but a pattern consistent with the lee side of the lake could not be detected.
Therefore, it has been demonstrated that the emerging lakes had no influence on the daily precipitation at the stations considered in this study. This may be explained by the coarse spatial and also temporal resolution of precipitation measurements. Still, the approach presented here can be applied to (i) detect changes in the spatial pattern of climate variables by a combination of statistical tests and PCA and (ii) to analyse the relationships between such changes and physiogeographic characteristics by regression trees.