Exploring the link between drought indicators and impacts

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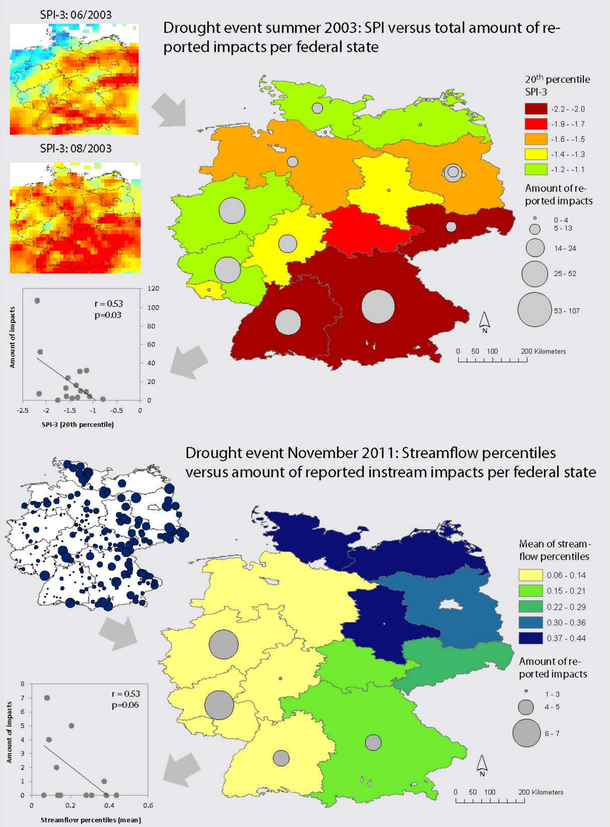
Data

Drought indicators	Drought impacts
Standardized Precipitation Index (SPI) Standardized Precipitation Evaporation Index (SPEI) Streamflow percentiles	Impact reports from the European Drought Impact report Inventory (EDII)

- Case study area: Germany
- Temporal scale: four drought events in 1976, 2003, spring and fall 2011
- Spatial aggregation: federal states (~ NUTS1 regions)

* NUTS = Nomenclature of Units for Territorial Statistics

Approach I: Visualization

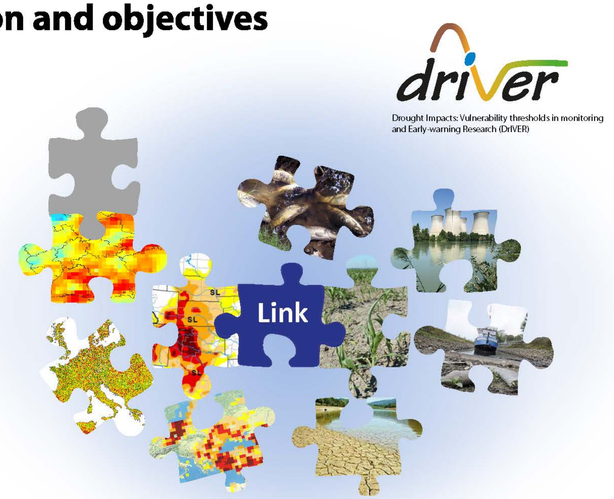


Motivation and objectives

Drought is a complex natural hazard with severe environmental and socio-economic impacts. To improve drought monitoring and early warning systems we need to better understand the linkage between drought indicators and actual impacts on the environment, the society, and the economy.

There have been very few attempts to systematically characterize the relationship between drought indicators and impacts due to the sparse and patchy information on drought impacts. The objective of this study is to develop different approaches for exploring the link between drought indicators and impacts exploiting the European Drought Impact report Inventory (EDII) for Germany as a case study. In the long term the following questions shall be answered at the global scale:

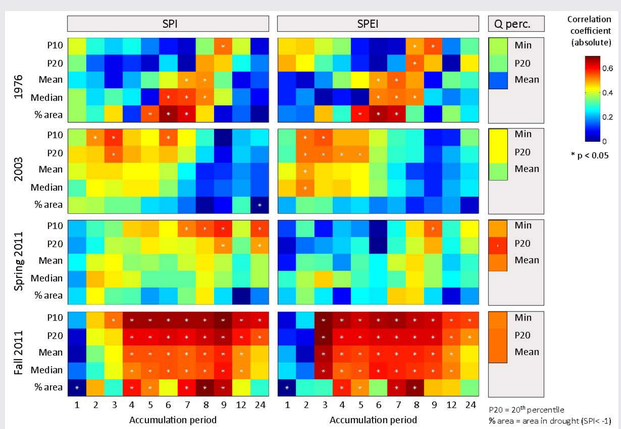
- Which indicator(s) best explain(s) drought impact occurrence for a specific area and/or sector?
- Are indicator thresholds identifiable that trigger impact occurrence?
- Do vulnerability factors enhance the explanatory power of impact occurrence?



Approach II: Correlation

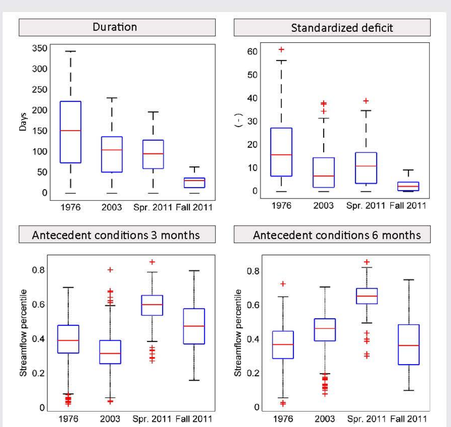
Correlation coefficients between indicators and reported drought impacts for four events:

The most suitable indicators for explainig drought impact occurrence are the 10th/20th percentile of SPI/SPEI for intermediate accumulation periods but there is strong variation among events.



Streamflow drought characteristics:

Do drought characteristics explain the differences in correlation patterns among events?



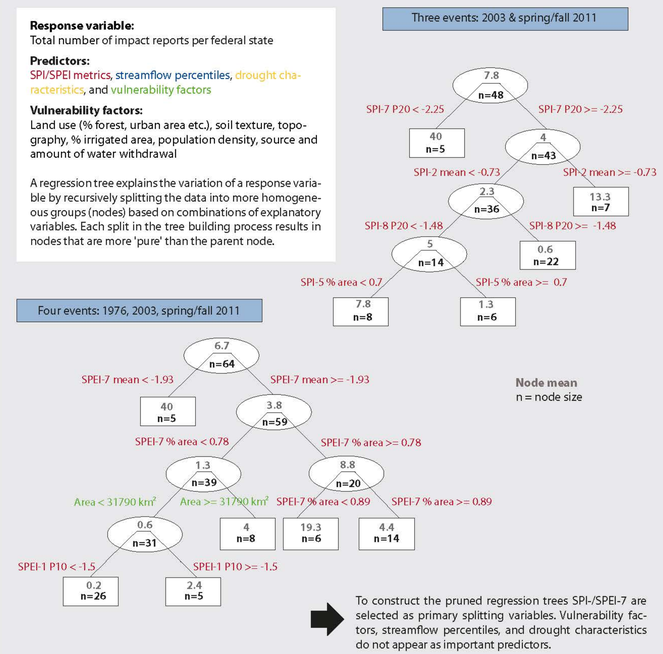
Approach III: Regression trees

Response variable:
Total number of impact reports per federal state

Predictors:
SPI/SPEI metrics, streamflow percentiles, drought characteristics, and vulnerability factors

Vulnerability factors:
Land use (% forest, urban area etc.), soil texture, topography, % irrigated area, population density, source and amount of water withdrawal

A regression tree explains the variation of a response variable by recursively splitting the data into more homogeneous groups (nodes) based on combinations of explanatory variables. Each split in the tree building process results in nodes that are more 'pure' than the parent node.



To construct the pruned regression trees SPI-/SPEI-7 are selected as primary splitting variables. Vulnerability factors, streamflow percentiles, and drought characteristics do not appear as important predictors.

Conclusion and next steps

- There is a discernible link between drought indicators (SPI/SPEI/streamflow percentiles) and number of drought impact reports at the NUTS1 level.
- According to the correlation and regression tree approach the 'best' predictors of drought impact occurrence are the indicators SPI/SPEI for intermediate accumulation periods. Nevertheless, the results are influenced by the uncertainty of identifying and quantifying drought impacts at a suitable spatial and temporal scale.
- Next steps comprise augmenting EDII data for drought events currently not well covered and applying the methodology to further study areas.

Acknowledgments

We thank Lukas Gundmundsson for providing the SPI/SPEI data. Also, we thank all contributors of the European Drought Impact report Inventory, which has been developed within the EU FP7 project DROUGHT-R&SPI. The funding of the multinational DrIVER project by the Belmont Forum's Freshwater Security scheme is gratefully acknowledged.

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Upcoming presentations:
Kohn et al. "Impacts of European drought events: insights from an international report inventory" Poster R 280 – this session!
Blauhut et al. "Towards drought risk mapping on a pan-European scale" Friday 4 pm – NH9.13 (Room G8)