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Diagnosing drought for dealing with drought in 3D: Toolbox for increasing drought preparedness in north-east Brazil

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Drought affects more people than any other hazard today, and its impact is likely to further increase. Yet, means to induce, aggravate or alleviate drought are also in human hands. People's use of water, water management, and trade have consequences for spatiotemporal patterns of drought. For example, technologies for managing water supply and demand may create new vulnerabilities or interrupt supplies elsewhere. To manage drought better, human influences on drought must be better understood. Current frameworks for drought monitoring and water accounting focus on the natural boundary conditions and therefore offer little help in distilling human influences on drought. Therefore this project combines insights from socio-hydrology and water management to produce an entirely new approach, incorporating the study of water-related human dimensions, socio-hydrological dynamics, and the structuring of dialogues among actors. Tools based on the knowledge generated will empower actors to take timely and informed actions for anticipating and responding to drought. As such, lessons learnt from past droughts will be used to promote sustainable water management, enhance food security, and foster inclusive development. From 2019 a team of experts is working together in this 4-year project to make the urgently required progress by developing tools to adequately deal with drought and water scarcity. The project develops and tests the integrated, participatory 3D Drought Diagnosis (3DDD) toolbox. We investigate nested scale levels, related to local water resources and virtual-water transfers together with actor networks of users, managers, traders, and policymakers. Test case is the poor, drought-affected north-east of Brazil. The 3DDD toolbox should eventually enable existing drought monitors to provide contextualized information in drought-affected regions worldwide. Our interdisciplinary approach is innovative in three ways:

- 1) The innovative downstreamness concept (Van Oel et al. 2018) is used to evaluate spatiotemporal variations in drought impacts and the spatiotemporally-explicit effects of human activities. The downstreamness concept depicts the distribution of resources or activities in a river basin over space and time. The current project will further develop the downstreamness concept, to evaluate the effects of adoption of new technologies (solar pumps for irrigation, low-cost drip technologies, and artificial recharge of aquifers) on drought and its socioeconomic impacts with

regard to the equitable distribution of prosperity and well-being.

2) We will evaluate basin-scale drought evolution using empirical agent-based modelling. Since contextual relativism is regarded critically, model parameterization, calibration, and validation will benefit from our participatory modelling

3) Rather than developing these important innovations in isolation, we will integrate them to yield actionable knowledge for marginalized groups, farmers, water managers, supply-chain actors, and others.

References

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