A data-driven approach to predict water security and societal impacts: the risk of drought-induced internal displacement in the Horn of Africa.

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The characterization of drought hazards remains a complex endeavor, primarily due to the absence of a universally accepted definition for a “drought event.” Different deficits across various parts of the water cycle contribute to a spectrum of drought consequences, rendering the definition contingent upon the impacts incurred. Moreover, quantifying drought vulnerability poses challenges given the intricate interplay among socioeconomic, political, and environmental factors that influence the relationship between a drought event and its impacts on exposed production systems, people and nature.

Our work addresses these challenges by introducing a novel data-driven methodology employing an array of drought indices and several datasets on observed drought impacts. Applying decision tree-based AI techniques, this method identifies combinations of hydrometeorological conditions known to generate societal consequences, and as such is able to estimate probabilistic drought disaster risk.

The presented impact-based approach is generalizable and impacts evaluated include energy production losses, internal displacement, crop and livestock damage, malnutrition, ecosystem health degradation, and strains on drinking water utilities. Illustrated through a case study in the Horn of Africa, this contribution exemplifies the quantification of expected annual drought impact, whereby impact is measured as the number of drought-induced internally displaced persons (IDPs). Drawing on the latest IDMC Displacement Tracking Matrix data, we assessed drought displacement risks under current and projected climate scenarios for Somalia and Ethiopia. Both countries grapple with complex human mobility dynamics, driven by a multitude of push and pull factors. Our findings reveal average annual IDPs up to 2% in some regions in Ethiopia, rising to 3% with unmitigated climate change. In Somalia, the majority of regions are anticipated to experience on average >10,000 drought-induced IDPs annually, under all future projections. Our model demonstrates proficiency in distinguishing prolonged and flash droughts as drivers for displacement. Furthermore, it facilitates the identification of hotspot areas, thereby supporting drought disaster risk reduction decisions and proactive policies.