

An optimisation approach for planning preventive drought management measures

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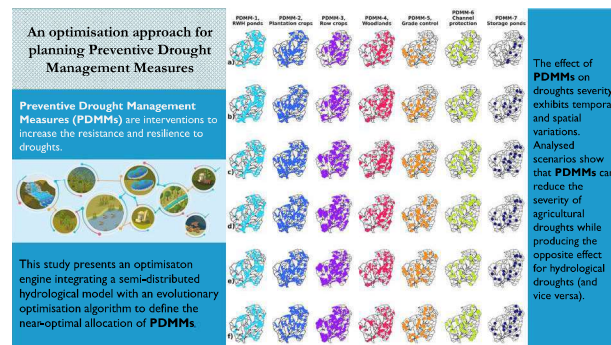
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HIGHLIGHTS

- Preventive drought management measures can reduce the severity of droughts.
- Allocating drought management measures is a multi-objective problem.
- This study uses an optimisation approach to allocate drought management measures.
- Management measures' effect on droughts exhibits temporal and spatial variations.
- Management measures show contrasting impacts on different types of droughts.

GRAPHICAL ABSTRACT



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ABSTRACT

While drought impacts are widespread across the globe, climate change projections indicate more frequent and severe droughts. This underscores the pressing need to increase resistance and resilience to drought. The strategic application of Preventive Drought Management Measures (PDMMs) is a suitable avenue to reduce the likelihood of drought and ameliorate associated damages. In this study, we use an optimisation approach with a multi-criteria decision-making method to allocate PDMMs for reducing the severity of agricultural and hydrological droughts. The results indicate that implementing PDMMs can reduce the severity of agricultural and hydrological droughts, and the obtained management scenarios (solutions) highlight the utility of multi-objective optimisation for PDMMs planning. However, examined management scenarios also illustrate the trade-off between managing agricultural and hydrological droughts. PDMMs can alleviate the severity of agricultural droughts while producing opposite effects for hydrological droughts (or vice versa). Furthermore, the impact of PDMMs displays temporal and spatial variabilities. For instance, PDMMs implementation within a specific subbasin may mitigate the severity of one type of drought in a given month yet exacerbate drought conditions in preceding or subsequent months. In the case of hydrological droughts, the PDMMs may intensify streamflow deficits in the

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