Title of the project
Adaptive Multipurpose Reservoir Management for the Water-Energy-Food-Ecosystem Nexus under climate change scenarios

Type
PhD Research

Duration
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Persons involved
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Summary of the research

Climate change scenarios indicate an increase in the frequency and magnitude of droughts and floods that impact water resource users across various sectors. In almost all Brazilian biomes, socioeconomic patterns are barriers to a more sustainable transition in lifestyles, with reduced/greenhouse gas emission offset, aiming to achieve the Sustainable Development Goals (SDGs). With recent water emergencies, it becomes crucial to adapt and mitigate hydrological risks. One strategy is to optimize the operation of multipurpose reservoirs combined with risk transfer mechanisms and water funds. However, these optimizations face challenges due to the high number of variables, strong coevolution of change vectors, and underlying constraints of objective functions, in the pursuit of reducing vulnerability and increasing resilience. Considering the complexity of this approach and inherent uncertainties in climatological variables, a scientific question arises: how to adopt artificial intelligence in optimizing reservoir adaptation strategies to minimize multi-sectoral water collapse risks. The objective of this research is to study the use of artificial intelligence methods in adaptable multipurpose reservoirs within the evolving dynamics of the water-energy-food-ecosystem nexus. To do so, this research is based on three stages: I. Study the use of artificial intelligence mechanisms and how they can be applied in water resources management; II. Study the coevolution of variables,

metrics, and indicators of resilience in basins with existing water reservoirs; III. Analyze the impact of climate change on the water-energy-food-ecosystem nexus, with interfaces to Water Security Index – WSI of the National Water Agency – ANA, in multipurpose reservoirs; IV. Propose a method for optimizing Hydrological Risk Transfer Models for multipurpose reservoirs. This research applies to strategic reservoirs of the National Water Security Plan /ANA, considering the four dimensions (human, economic, resilience, and ecosystem) of the Water Security Index (WSI/ANA), through dynamic coevolution related to social and economic development in the short, medium, and long term for the temporal horizon of 2100. It is expected that this approach will enhance water security for different regions of Brazil by incorporating new hydrological analysis approaches.

Keywords

Climate extremes. Water security. Multipurpose reservoirs. Multirisk insurance.

More information

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