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Long-term Regional Resources Management based on Water, Energy, and Food Nexus Simulation

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Water, energy, and food security is an emerging issue due to the rapidly growing global population. The concept of Water, Energy, and Food nexus (hereafter, WEF nexus) has been widely applied to integrate the water, energy, and food in a single management framework. The nexus concept is analyzing the interconnection among the elements (not only W-E-F but also various external factors, such as environment, climate change, policy, etc.), and finding the proper management schemes to enhance the resources sustainability. In a nation-level, the resources management is more challenging since multiple regions (e.g., watersheds, cities, and counties) with different characteristics are involved, and transfer/trading of resources must be considered. This study proposes a long-term regional-scale WEF nexus simulation model that is intended to assist the decision-making process for a capital investment project. The model is equipped with three computing modules, such as local nexus simulation, regional resources trading, and optimal investment planning. The model determines a proper capital investment plan (CIP), such as infrastructure investment and resources trade plan/policy among interlinked area, to maximize the long-term national resources supply. Financial analysis of the CIP (construction and operation) and resources trade is also embedded in the model. For demonstration, a semi-real-world study area is developed, and the model is applied to suggest long-term optimal resources management plans. The model would be a useful tool for stakeholders in the decision-making process.

Keywords: Decision support tool, Resources management, WEF nexus simulation

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