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Abstract The common practices for the planning and management of Water Resources Systems (WSSs) have been challenged in the last few decades by global climate change processes, which are observed around the world in increasing frequencies. Climate change is manifested by climate variability, temperature increase, and extreme events such as droughts and floods, which have a decisive effect on natural resource availability and in turn on water quality. Historical records may not be sufficient to reliably account for uncertain future predictions under climate change conditions. While such highly uncertain situations become the "normal" case worldwide, the traditional practices of probabilistic risk measures cannot be used to appropriately quantify the uncertain phenomena under non-stationarity conditions. To better account for uncertain future conditions, the objective of this study is to develop a water management model based on Info-Gap Decision Theory (IGDT) using optimization under deep uncertainty conditions. The Info-Gap theory is a framework that measures the confidence in the operational decisions by quantifying the robustness to uncertainty without accounting for any probabilistic data. To demonstrate the method as a tool to better guide the long-term sustainable operation of the water supply system under uncertain future conditions, we applied the Info-Gap model to the Sea of Galilee (SoG) regional WSS, which is a significant part of the Israeli National Water System (INWS). For Israel, which is, like other Middle East semi-arid regions, prone to dry conditions and limited water availability, there are well-founded concerns that prolonged periods of drought lie ahead, as a consequence of the global climate change processes. This study contributes a management tool for decision making under deep uncertainty to improve the decision-making process and better adapt to unpredictable uncertain future conditions. We demonstrate how the IGDT could be formulated and used to analyze WSSs under different settings and demonstrate how decisions could be derived from the IGDT formulation. We also show a sensitivity analysis for the obtained solutions.

Keywords Water Resources Systems; Info-Gap Decision Theory; uncertainty; climate change; Sea of Galilee.