Stochastic goal programming model for optimal blending of desalinated water with groundwater

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Abstract: A stochastic goal programming (GP) model is developed in order to determine the daily production of desalination plants to meet the requirements of water blending stations (WBS) for major cities in the Eastern Province of the Kingdom of Saudi Arabia. The WBS is assumed to be a control point in the system where water is blended to satisfy the desired water quality, downstream of the control point. The desalinated water is blended with brackish groundwater extracted from several groundwater wells. The objective of the model is to minimize the goal deviations from the following priority levels: demand for blended water, control of salinity levels, depletion of groundwater and maximize the use of brackish water, demand for brackish water at WBS, and production of desalinated water. An essential element of the model is the input data; unfortunately, available data are not accurate due to the inherent uncertainty associated with it. This uncertainty will generate uncertainty in the model output, which affects reliability and confidence associated with the decisions. Thus, reliable planning should consider uncertainties associated with model input parameters. The developed stochastic model shows how Goal Programming (GP) modeling can be used to plan the water resources in the Eastern Province of Saudi Arabia, assuming that both supply and demand are uncertain.