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## Optimization of an Integrated Water Resources Model in tropical regions

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Water resources management must be in all cases, effective, efficient and sustainable, especially when considering the effects of climate change and variability effects. The challenge tackled in this research was to build a hydro-economic optimization model, which can be used as a decision-making tool for water assignment between several users in a tropical region. The model has been developed by integrating hydrological aspects (surface water and groundwater) in an economical optimization framework for water allocation and water quality management.

We study a basin of 17 000 km<sup>2</sup> located in the Colombian Middle Magdalena Valley (MMV), a central area with important economic activities, as oil and gas exploration and production (O&G), agriculture and livestock.

A regional optimization model that integrates multiple water supplies and demands were designed. The main purpose of the model is to maximize the value of water consumption. Consequently, the hydro-economic model was solved through a lineal optimization process, that links all available water resources and all water demands under the limitations of: (i) demand rising, (ii) water quality variance and (ii) offer decrease.

The system considers the monthly water demand from each user and a penalty for no satisfy it. For hydro-economic analysis, the model contemplates four main study scenarios: (i) current mean condition (ESC1), (ii) at thirty years (ESC2), (iii) at fifty years (ESC3) and, (iv) at hundred years (ESC4). These scenarios show fluctuation in water demand, and water supply based on the population increase. The results show significant differences between the user's allocation regimes. This has been identified between domestic and agricultural sectors, but not between commercial activities. According to the later, it is important to include variable rates for each sector according to its productivity, in the general analysis.

The defined objective function maximizes the profit in the MMV basin during a planning period of a year. It is important to highlight that the whole system was optimized under an equitable distribution in allocation and costs, and thus, the resulting profits would improve results to satisfy all economic sectors.