WARPLAM DSS: using Cluster Analysis as an approach to delineate water resources planning and management regions

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Abstract. The lack of uniform and integrated water resources regions is a critical issue, especially in transboundary water regions and federative countries. Overlaying levels of planning and management, as a result of uncoordinated water resources regions, hamper Integrated Water Resources Management (IWRM). In addition, the process of delineating those regions has often been executed without sufficient scientific support. Despite the fact this is usually a result of political and historical circumstances, it is possible to have better results by using knowledge from prior experiences, modern techniques and improved decision support systems (DSS). In order to harmonize multiple objectives and better represent the interaction between environmental, socio-economic, political and historical aspects, it becomes imperative to define appropriate territorial limits for water resources planning and management.

The present study introduces an approach to support the process of delineating water resources regions based both on recognition of more comprehensive aspects and incorporation of those aspects into a DSS. The proposed Water Resources Planning and Management Regions (WARPLAM) DSS is designed to be used by federal and state governments, international commissions and water councils. Considering that river basins are the most suitable boundaries to attain IWRM goals, the DSS simulation model offers the option for decision makers to include socio-economic, political and environmental aspects into the analysis. It intends to promote a better understanding about the reasoning related to this process, and to reinforce the principles of IWRM. WARPLAM DSS is also a very flexible solution to support the delineation of regions in multiple levels of subsidiarity and to be adaptable to regional circumstances.

This paper describes how cluster analysis is applied in the model design; combined with geographic information systems (GIS), expert systems (ES), and multi-criteria decision analysis (MCDA), which are used to develop the DSS. Both Dynamic Programming and Genetic Algorithm are evaluated as methods to improve the model's algorithm efficiency.

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