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Multi-criteria decision analysis using hydrological indicators for decision support - a conceptual framework.

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Assessing the quantity and quality of water available in water stressed environments under various potential climate and land-use changes is necessary for good water and environmental resources management and governance. Within the region covered by the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL) project, such areas are common. One goal of the SASSCAL project is to develop and provide an integrated decision support system (DSS) with which decision makers (DMs) within a given catchment can obtain objective information regarding potential changes in water flow quantity and timing. The SASSCAL DSS builds upon existing data storage and distribution capability, through the SASSCAL Information System (IS), as well as the J2000 hydrological model. Using output from validated J2000 models, the SASSCAL DSS incorporates the calculation of a range of hydrological indicators based upon Indicators of Hydrological Alteration/Environmental Flow Components (IHA/EFC) calculated for a historic time series (pre-impact) and a set of model simulations based upon a selection of possible climate and land-use change scenarios (post-impact). These indicators, obtained using the IHA software package, are then used as input for a multi-criteria decision analysis (MCDA) undertaken using the open source diviz software package. The results of these analyses will provide DMs with an indication as to how various hydrological indicators within a catchment may be altered under different future scenarios, as well providing a ranking of how each scenario is preferred according to different DM preferences. Scenarios are represented through a combination of model input data and parameter settings in J2000, and preferences are represented through criteria weighting in the MCDA. Here, the methodology is presented and applied to the J2000 Luanginga model results using a set of hypothetical decision maker preference values as input for an MCDA based on the PROMETHEE II outranking method. Future work on the SASSCAL DSS will entail automation of this process, as well as its application to other hydrological models and land-use and/or climate change scenarios.