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MODELS TO INFORM DESIGN OF WATER QUALITY MONITORING SYSTEMS: A NOVEL APPROACH FOR WATER SUPPLY RESERVOIRS

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ABSTRACT

Design of water quality monitoring networks (WQMN) includes identification of the number and spatial distribution of monitoring stations. For water supply reservoirs a generally accepted method for this process has not been developed. This is especially the case where the aim of monitoring is to provide numerical models with data to increase the reliability of simulation results. As numerical models are increasingly applied in water resource management and their accuracy is influenced by the monitoring data, the demand for WQMN to be designed to better support the modelling process has increased. Here a novel approach optimising the number and spatial distribution of coupled meteorological and water quality monitoring stations within a water reservoir to achieve increased simulation performance is presented. A three-dimensional hydrodynamic and biogeochemical model (ELCOM-CAEDYM), informed and calibrated with field monitoring data from a real-world Australian subtropical water reservoir (Little Nerang Dam) was applied as a ``benchmark model'' (BM). The BM forms a system where desirable data can be sampled at any spatial location at any frequency. Via a simple root mean square error (RMSE) method BM simulation results for water temperature and dissolved oxygen are compared to those from less complex ``engineering models'' (EM). The EMs differs from the BM in being setup and simulated with a progressively increasing number (1 - 3) of initial condition profiles and meteorological stations, which are sampled from the BM. In the EMs the initial condition profiles and meteorological stations are located in cells where the sums of the RMSE between the BM and EM outcome over time are largest. The results show, that the BM-EM approach can aid determination of the number and spatial distribution of monitoring stations within water reservoirs so simulation performance increases. Further investigation is required before the method can be readily applied in management applications.