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Hybrid Process and Data Driven Models for Salinity Management in Rivers

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Abstract: Salinity modelling in river systems is complicated by a number of processes, including in-stream salt transport and various mechanisms of saline accession that vary dynamically as a function of water level and flow, often at different temporal scales. A generic framework for developing hybrid process and data-driven models of salinity in river systems is introduced that enables models to be tailored to a specific application based on consideration of model purpose, degree of process understanding and data availability. The approach is applied to a 46 km reach of the River Murray in South Australia, which is affected by high levels of salinity. In this reach, the major processes affecting salinity include in-stream salt transport, accession of saline groundwater along the length of the reach and the flushing of three waterbodies in the floodplain during overbank flows of various magnitudes. Based on trade-offs between the degree of process understanding and data availability, a process-driven model is developed for in-stream salt transport, an artificial neural network model is used to model saline groundwater accession and three linear regression models are used to account for the flushing of the different floodplain storages. The resulting hybrid model performs very well on approximately three years of daily validation data, with each component of the hybrid model resulting in noticeable improvements in model performance corresponding to the range of flows for which they are developed. The hybrid model also has advantages in terms of greater ability to support management decisions.

***Keywords**:* Process-driven model; data-driven model; artificial neural networks; hybrid model; salinity.