

ON THE SALINITY INTRUSION EMPIRICAL MODELS IN ESTUARIES AND THEIR APPLICATION IN THE BAHMANSHIR ESTUARY

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Empirical models are developed as an easy-to-use tool for predicting the salinity intrusion length in estuaries. Existing empirical predictive models have an empirical component and are either inaccurate or limited to special conditions (Savenije, 1993). Some of these models, such as Sanmuganathan and Abernethy ones (1975, 1979), can only be used after determining the values of the calibration coefficients from field measurements. Another set of the empirical models, that can be used without calibration, have been presented by some investigators. The methods of Van der Burgh (1972), Rigter (1973), Fischer (1974) and Van Os and Abraham (1990) are of these models. The latest model of this category is the Savenije model (1993) that has more capabilities for predicting the salinity intrusion in natural estuaries.

Although these models have been developed based on laboratory and field data, one of the important issues for estuarine managers is the validity of these models. All these models have empirical parameters that are usually estimated by directly measurable quantities. These empirical relationships between functional parameters and measurable ones have been obtained using theoretical assumptions and experimental as well as field data. However, before using these models, it is necessary to evaluate their applicability.

Savenije (1993) investigated 45 salt intrusion cases in 15 estuaries worldwide by his model and the other models. Considering the data used by Savenije, it is possible to find the range of application of empirical models. To do this, the estuarine dimensionless parameters such as Canter Cremers' estuary number, N , and International estuary number, E_p , (Thatcher and Harleman, 1972) can be used. The values of these parameters are $0 < N < 0.1$ and $E_p > 8$ for well-mixed state and $0.1 < N < 1$ and $0.2 < E_p < 8$ for partially-mixed state (Van der Tuin, 1991). In this paper first the above mentioned dimensionless parameters are calculated to find the applicability range of the models of Van der Burgh (1972), Rigter (1973), Fischer (1974), Van Os and Abraham (1990) and Savenije (1993).

The computed values for Canter Cremers and International estuary numbers are between 0.001 to 0.67 and 0.22 to 739.4, respectively. These values correspond to well and somewhat partially-mixed states. Therefore, the above mentioned empirical models can be used in other estuaries with the mentioned range of these parameters. Then the above mentioned models are applied to the Bahmanshir estuary.

Bahmanshir estuary is located in south-west of Iran and has a free connection with the Persian Gulf. This estuary is the vital water supply for Abadan and Khorramshahr cities. In recent years construction of multi-purpose dams in the upstream river of Bahmanshir has decreased riverine flow and therefore, the salinity intrusion into Bahmanshir has increased. The salinity intrusion lengths predicted by different models are compared with field measurements in Fig. 1. As indicated in this Figure, the intrusion length obtained by

the methods of Rigter (1973), Fischer (1974), Van Os and Abraham (1990) and Savenije (1993) are less than the observed value of intrusion length while the method of Van der Burgh (1972) performs the best. Consequently the model of Van der Burgh (1972) was found as the most suitable model for the prediction of the salinity intrusion in this estuary.

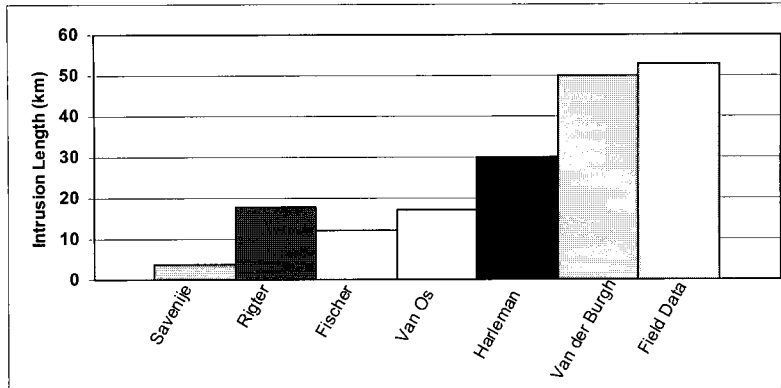


Fig. 1 Comparison of the empirical model results and the field data.

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