

PREDICTIVE ANALYTICAL MODEL FOR CHLORIDE CONCENTRATIONS IN THE PORT OF ROTTERDAM

FOR ANALYSING THE EFFECT OF HUMAN INTERVENTIONS IN THE RHINE-MEUSE DELTA

Fresh water from estuaries is used for many purposes, from drinking water production to agricultural use. The water quality standards for these various applications are regulated and include standards concerning the chloride concentration. Alterations in estuaries, such as human interventions, may affect the chloride concentrations within estuaries. The Rhine-Meuse delta is such an estuary in which the fresh water is widely used for e.g. shipping but also for drinking water production and cooling. Therefore, predicting chloride concentrations in the Rhine-Meuse estuary is important.

Chloride concentrations within the estuary are affected by many processes, which can be summarized in three main factors: the inflow of salt water due to tides, the inflow of fresh water due to river discharge and the mixing processes between these flows. This research deploys measurement data of Waal and Meuse discharges, wind setup and astronomical tides to predict chloride concentrations at four chlorinity measurement locations in the Port of Rotterdam. Performance of the developed predictive analytical model of Lekhaven on the training dataset was determined at a R^2 value of 0.87 and a RMSE value of 469.4 mg/L and on the validation dataset at a R^2 value of 0.80 and a RMSE value of 579.1 mg/L. Similar results were found for the three other measurement locations.

For the analysis of the effects of human interventions on chloride concentrations within the estuary of the Rhine-Meuse Delta the developed analytical predictive models can be applied. Chloride concentrations predicted by the analytical model can be compared to data collected in the field, prior and post any human intervention. This analysis on measurement data can be used to validate results of theoretical models, and as indicator for how chloride concentrations have changed due to human intervention in the Rhine-Meuse Delta (Figure 1).

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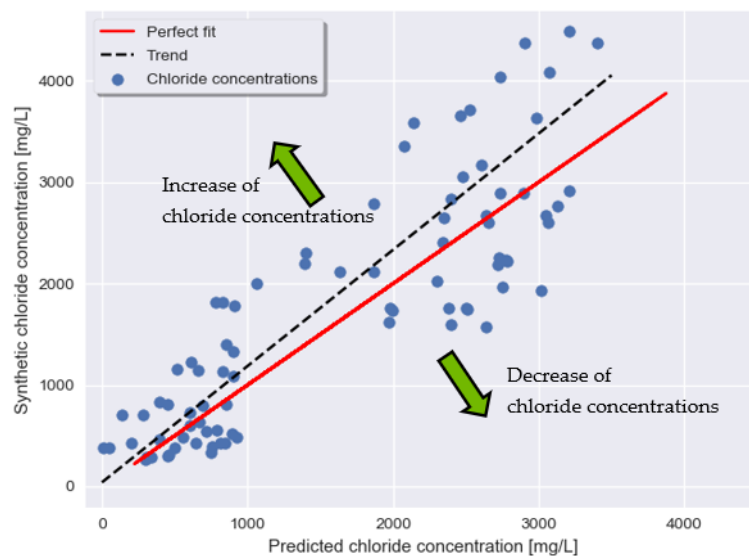


Figure 1: Result of model predictions versus synthetic observation data of chloride concentrations at measurement location Lekhaven. An upward or downward deviation of the trend (dashed black line) relative to the perfect fit (red line) indicates an increase or decrease of the chloride concentrations, respectively, which can be statistically proven with the use of a Welch's t-test.