

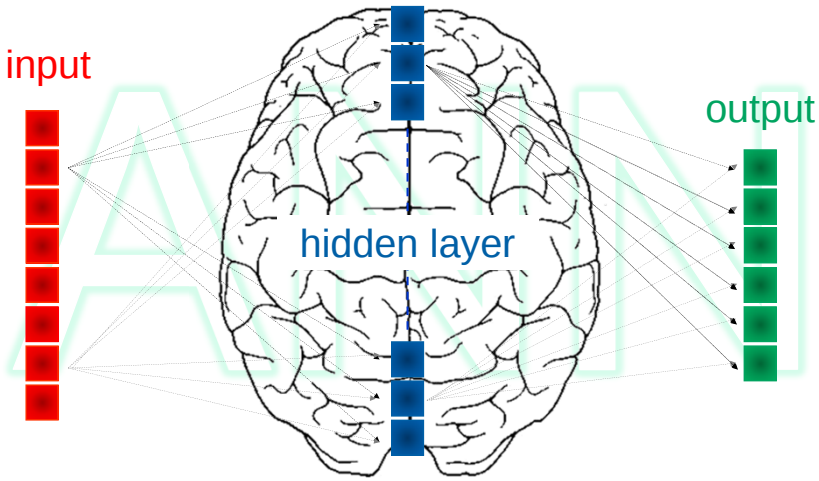
Alteration in Salinity in the Weser Estuary after 1998:

Quantification by artificial neural networks

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MOTIVATION

Growing container ships with increasing loads requires sequential adaption of access waterways of major harbors, particularly in estuaries. In Germany most of the major harbors are located in estuaries. The dredging results in consequences for nature and agriculture. For quantifying the effect of waterway deepening on salinity in the Lower Weser estuary artificial neural networks were set up.

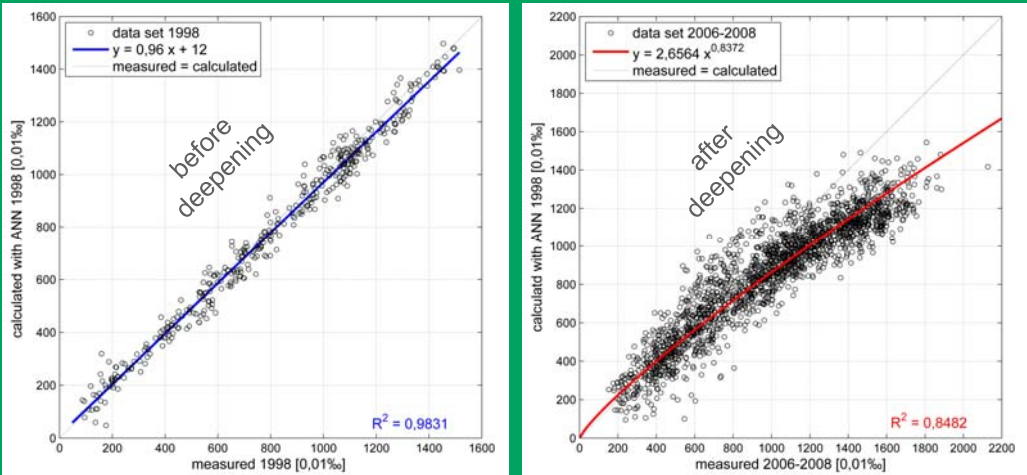


METHOD

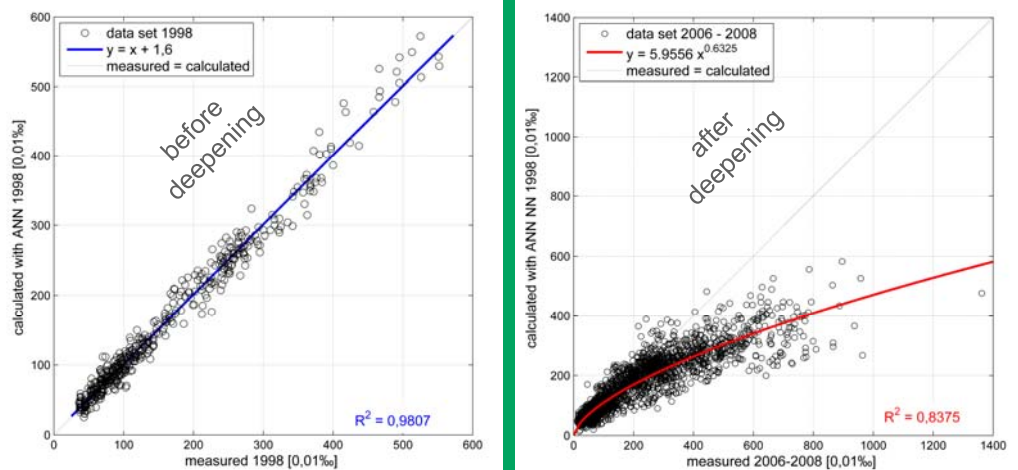
The Multi-Layer-Feed-Forward-Network has one input, one hidden and one output layer. The learning process is supervised by using the measured salinity dataset. The input layer implicates almost every time-varying influence-factor on the salinity. But one serious influence-factor is missing: the topography! The ANN learns to calculate the salinity for a non-changing topography; therefore the training is only done by the dataset of 1998. In the next step the trained ANN is used for calculating the salinity for the present channel condition.

RESULTS

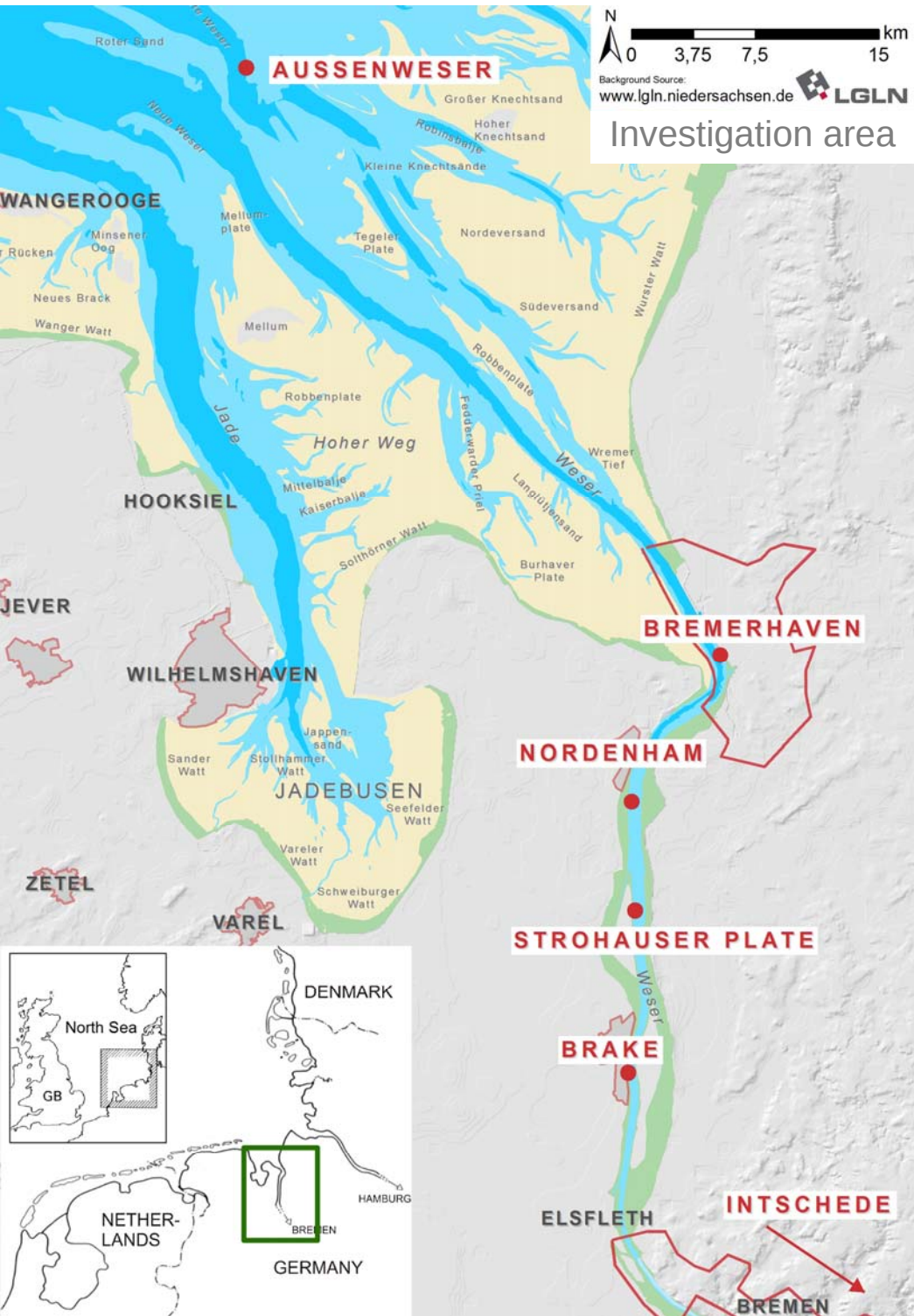
BREMERHAVEN



The ANN calculates the salinity very precisely for the data set of 1998. By using this ANN for the data set of 2006 the calculated values are too low. The fact that the topography has changed between 1998 and 2006 and this new situation is not implemented in the network directly shows the alteration in salinity caused by the channel deepening. It can also be seen that higher salinities intrude much deeper into the estuary.



STROHAUSER
PLATE



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