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Potential data used for validation of concentration statistics obtained using analytical model for conservative transport in an estuary

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Coastal areas worldwide are important and sensitive ecosystems. Rivers are considered to be one of the most influential hydrological pathways for the waterborne transport and therefore estuaries are critical areas for a pollution hazard. To describe that hazard, the risk of exceeding the allowed concentration values of the pollution substance in such environment is often used. The analytical model calculates concentration statistics directly from the fundamental advective-diffusion equation for the case of continuous, steady conservative transport with the dominant stream flow mean velocity such is the case of low tide estuaries. Similar analytical models were previously proposed in atmosphere (Sullivan, 2004) and in groundwater (Andricevic, 2008). Knowing the main velocity and initial mass coming from the river, this kind of approach enables one a direct prediction of one-point concentration probability density function (pdf) which is then used to define the risk of exceeding the allowed concentration for certain water body. In this work we investigate how different data can be used for validation of the developed analytical model for conservative transport in an estuary. Two different types of measurement are being conducted at the local river Zrnovnica near city of Split, one measuring velocity and the other measuring salinity and temperature. Velocity data are used as an input to a numerical random walk particle tracking model to calculate the concentration moments. The salinity data are used as inverse proxy substance, hence the concentration moments are calculated directly from the inverse measured values. The results are highly affected by the scale effect, as the analytical model is developed at the point, while both numerical and measured values are smoothed over the grid size and over the sampling volume, respectively. However, the measured salinity, as concentration proxy, proved more resemblance to the concentration moment's shape, while numerical model has better quantitative overlap due to the better control of initial and boundary conditions. The presented results indicate that field measurements of temperature and salinity could be useful data acquisition technique to validate and compare different analytical and/or numerical models for conservative transport in an estuary.