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Supplement of

Effects of dimensionality on the performance of hydrodynamic models for stratified lakes and reservoirs

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Supplementary information

Table SI 1: Instrument configurations of the acoustic Doppler current profiler (ADCP) for different deployment periods. Avg denotes settings for the average sampling mode (mean flow velocity) and HR for the settings of the high-resolution sampling mode (vertical velocity only). The profiling range of each mode refers to the distance from the ADCP head, which was deployed approximately 0.6 m above the reservoir bed at a water depth of 12 m. Mean flow velocity was measured as averages over a varying number of individual measurements (pings) within the averaging interval. In HR mode, single-ping measurements were recorded at the respective sampling frequency.

| | | Range in distance from ADCP head (m) | | Bin size (cm) | | Sampling | | |
| | | Horizontal Velocities | Vertical Velocities | | | Averaging Number of pings | Averaging Time interval (min) | Sampling Frequency (Hz) |
Start	End	Avg	HR	Avg	HR	Avg	Avg	HR
23-Feb-2018	15-Mar-2018	0.20 – 14.2	0.10 – 5.22	50	2	210	10	1
26-Jun-2018	11-Aug-2018	0.20 – 14.2	0.10 – 7.74	50	4	526	5	1
15-Aug-2018	25-Oct-2018	0.20 – 14.2	0.10 – 7.74	50	4	526	5	1
30-Oct-2018	10-Dec-2018	0.20 – 14.2	0.10 – 7.74	50	4	526	5	4
13-Dec-2018	05-Feb-2019	0.20 – 14.2	0.10 – 7.74	50	4	526	5	4
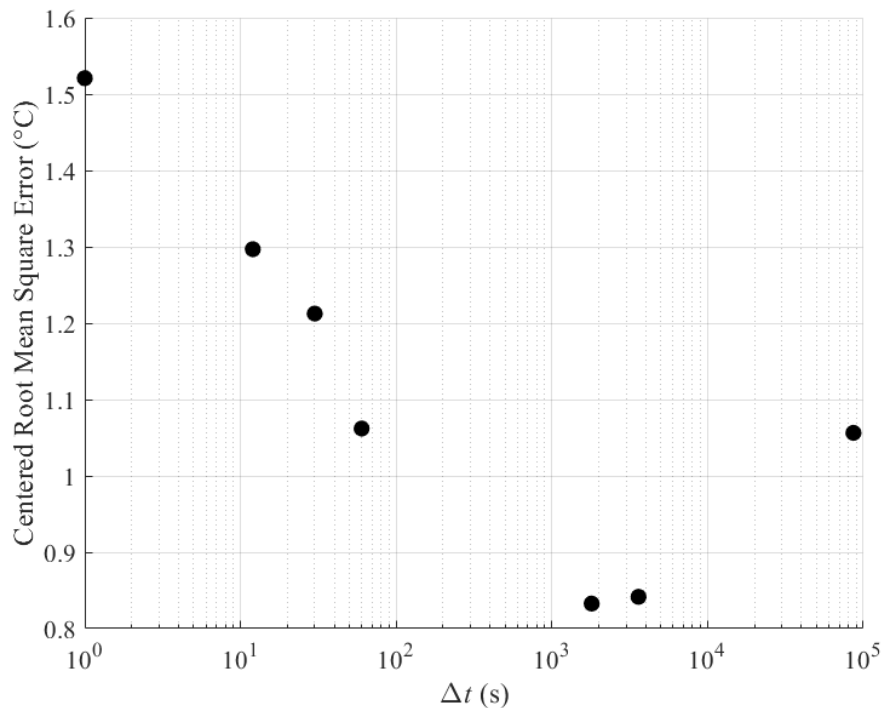
Figure SI 1: Overall centered root mean square error of temperature simulations using the 1D model (GLM) in comparison to observations fur different numerical time steps (Δt).
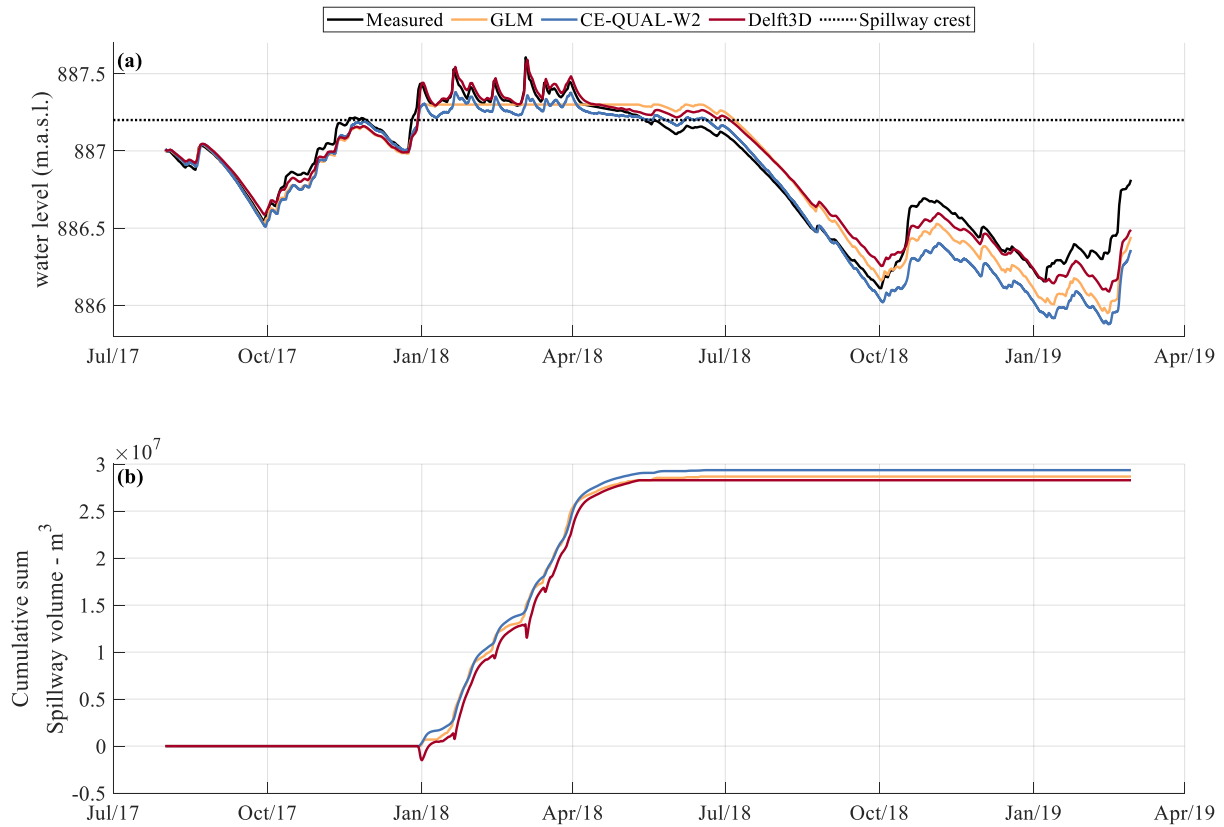
Figure SI 2: (a) **Time series of measured and simulated water level with 1 h temporal resolution. The horizontal dashed line marks the elevation of the spillway crest at the reservoir outflow.** (b) **Time series of the cumulative sum of simulated spillway discharge with 1 h temporal resolution.**
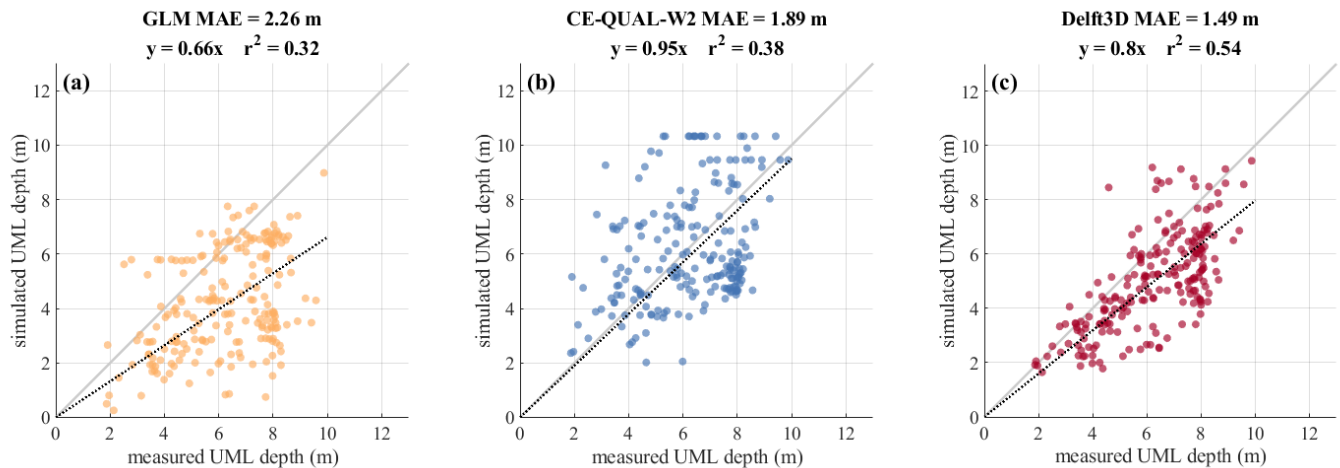

Figure SI 3: Comparison of upper mixed layer (UML) depths estimated using the program Lake Analyzer (Read et al., 2011) using measured and simulated temperatures from (a) **1D simulations (GLM),** (b) **2D simulations (CE-QUAL-W2), and** (c) **3D simulations (Delft3D). The mean absolute error (MAE), the slope of a linear regression and the coefficient of determination (r^2) are provided in the title of each panel.**
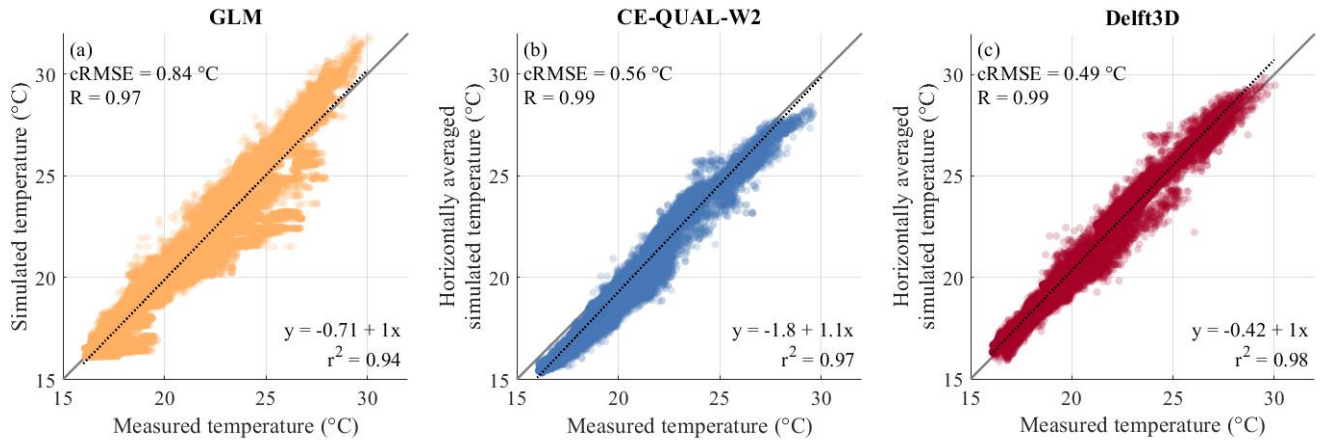
Figure SI 4: Simulated versus measured versus water temperature using different models: (a) **1D model (GLM)** (b) **2D model (CE-QUAL-W2)** and (c) **3D model (Delft3D). Simulations of the 2D and 3D model were horizontally averaged. Each panel presents the centred root mean square error (cRMSE) and the correlation coefficient (R) at the top left. The grey continuous lines indicates 1:1 relationships, and the black dotted line are linear regressions. The regression equations and coefficient of determination (r^2) are provided in the lower right corner of each panel.**
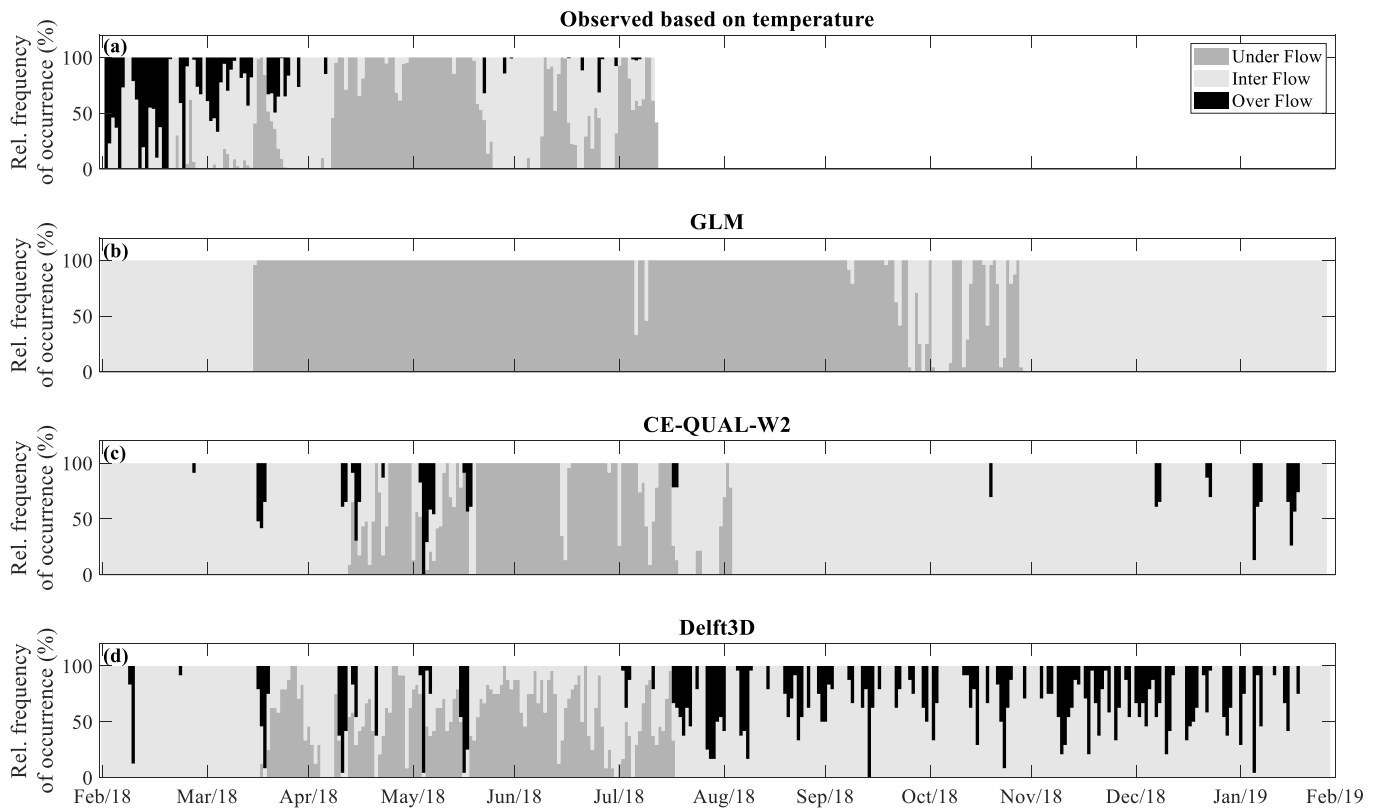

Figure SI 5: Time series of density currents classification in bar graphs. Each vertical bar represents one day and the length of each color represents the relative occurence of the respective density current over the 24h. (a) **time series of density currents classification based on observed temperature at Ferraria Bridge and compared to observed temperature profile at the Intake. Time series of density currents classification based on the simulation of tracers at the Intake for** (b) **GLM,** (c) **CE-QUAL-W2, and** (d) **Delft3D.**

Table SI 2: Statistical parameters describing the overall performance of the three models in simulating different hydrodynamic variables (first column) in Passauna Reservoir. The statistical measures include the mean absolute error (MAE), centred root mean square error (cRMSE), standard deviation (σ), and Pearson correlation coefficient (R).

Hydrodynamic variable	Model	MAE	cRMSE	σ	R
Lake level	Delft3D	7.4 cm	9.8 cm	41.0 cm	0.97
	CE-QUAL-W2	10.8 cm	13.0 cm	46.9 cm	0.97
	GLM	10.5 cm	12.9 cm	43.7 cm	0.96
Temperature	Delft3D	0.67 °C	0.50 °C	3.37 °C	0.99
	CE-QUAL-W2	0.60 °C	0.56 °C	3.45 °C	0.99
	GLM	0.60 °C	0.84 °C	3.35 °C	0.97
UML (Upper mixed layer) depth	Delft3D	1.49 m	1.86 m	1.79 m	0.69
	CE-QUAL-W2	1.89 m	2.24 m	2.08 m	0.33
	GLM	2.26 m	2.79 m	1.86 m	0.42
Horizontally averaged temperature	Delft3D	0.52 °C	0.49 °C	3.31 °C	0.99
	CE-QUAL-W2	0.73 °C	0.56 °C	3.38 °C	0.99
Flow velocity	Delft3D	1.3 cm s^{-1}	1.7 cm s^{-1}	1.4 cm s^{-1}	0.50
	CE-QUAL-W2	1.7 cm s^{-1}	2.1 cm s^{-1}	0.8 cm s^{-1}	−0.04