

EEMS Test Case Model Description

TC_Bijvelds_Square_Harbor

1 Overview

This model reproduces the benchmark case from Bijvelds’ “3D Numerical Simulation of Turbulent Shallow-Water Flow in a Square Harbor” [1]. The replication is used to evaluate how EFDC+ represents diffusivity under controlled hydrodynamic conditions. The elevation vs. velocity comparison presented in Section 4 illustrates how closely the EFDC+ model replicates the published benchmark results and offers a reproducible reference for understanding diffusivity patterns in EFDC+.

2 Demonstration Feature

This test case demonstrates how EFDC+ handles turbulent diffusivity in an enclosed shallow-water harbor geometry. The governing equations and turbulence closure schemes for parameterizing both horizontal and vertical mixing in EFDC+ are described in the [EFDC+ Theory Document](#) [2].

3 Model Description

The model configuration is summarized in Table 1. The model domain is shown in Figure 1. The model employs 10 vertical layers to resolve the 3D structure of the turbulent shallow-water flow within the harbor domain. The following EFDC+ modules are activated in this test case:

- **Hydrodynamics** – simulates the 3D flow field within the square harbor
- **Dye** – used as a tracer to visualize and quantify transport and diffusivity patterns

Table 1 Model configuration summary

Dimensions	Horizontal cells	Vertical cells	Activated modules
3D	2,782 cells	• 10 layers • Using a Standard Sigma layering scheme	• Hydrodynamics • Dye

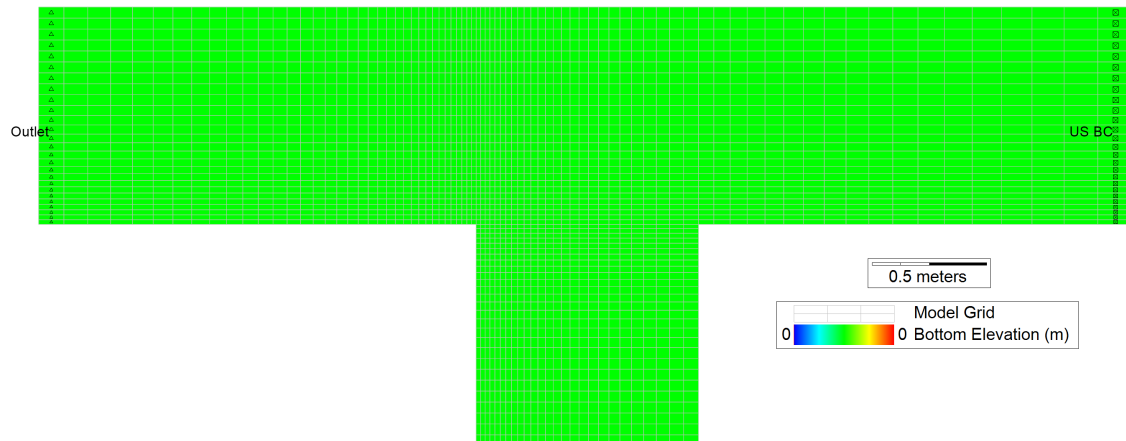


Figure 1 Model domain

4 Model Results

The model results demonstrate close agreement with the benchmark data from Bijvelds et al. [1]. The elevation vs. velocity plot (Figure 2) confirms that EFDC+ accurately replicates the flow patterns described in the reference paper and provides a clear illustration of the diffusivity behavior within the square harbor domain.

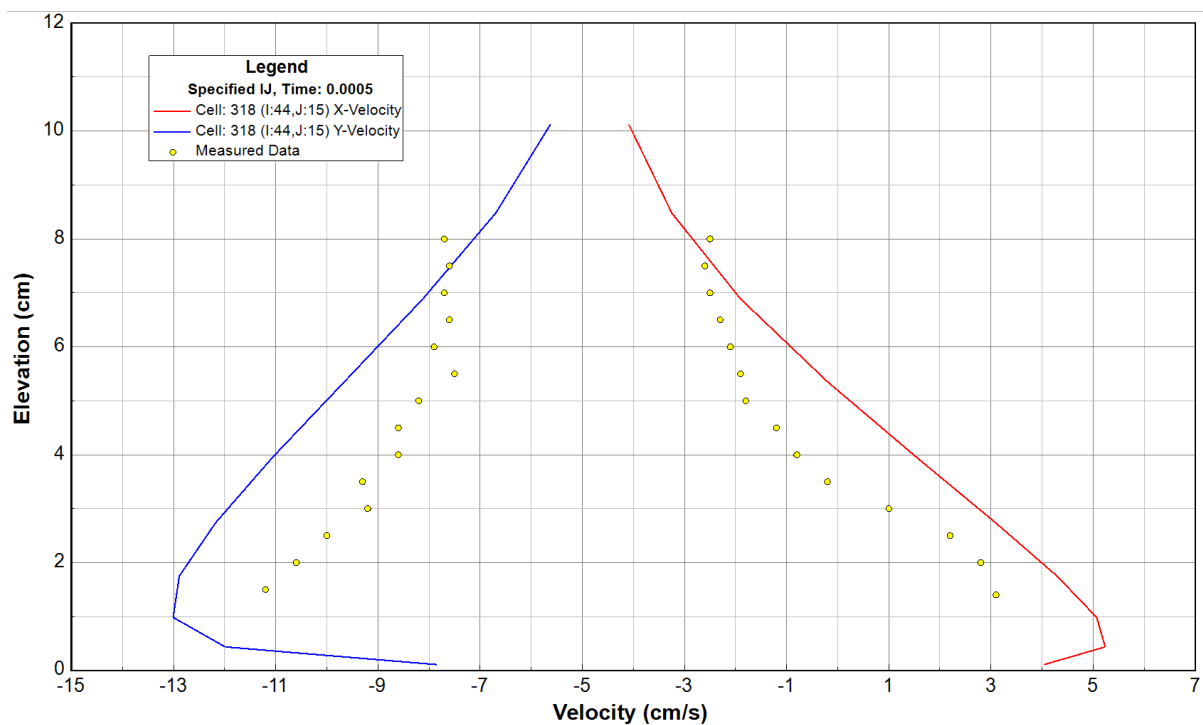


Figure 2 Observed and simulated relationships between velocity and elevation

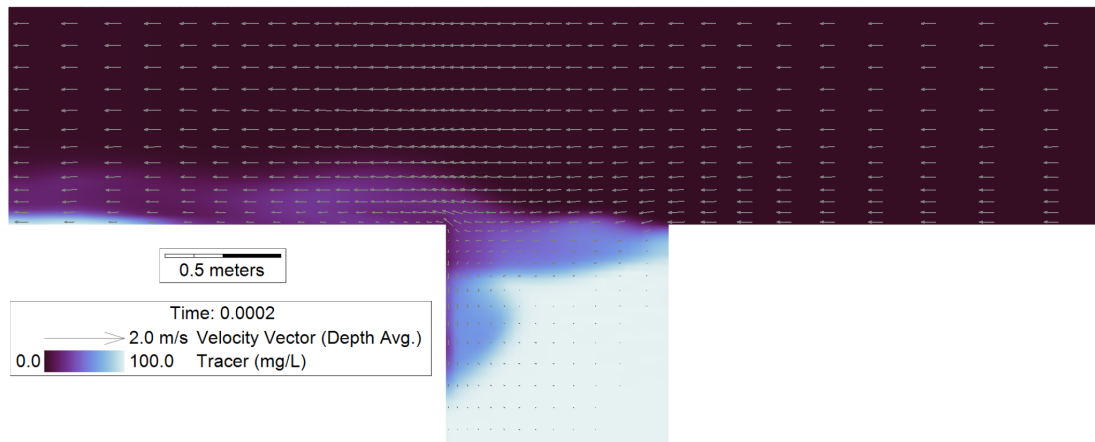


Figure 3 2DH View of dye concentration

References

- [1] Bijvelds, M., Kranenburg, C., and Stelling, G. S. (1999). 3d numerical simulation of turbulent shallow-water flow in square harbor. *Journal of Hydraulic Engineering*, 125(1):26–31.
- [2] DSI LLC (2024). *EFDC+ Theory: Version 12*. DSI LLC, Edmonds, WA, USA. Accessed: 2026-04-06.

Disclaimer: This model is provided to demonstrate that EFDC+ Explorer and EFDC+ can be used to better understand how to build this kind of model. The model is running as expected; however, it should not be considered final, as it can be modified and refined to obtain improved results.