

# EEMS Test Case Model Description

## TC\_Neckar\_Dye

### 1 Overview

This model replicates the benchmark test case described in *Prediction of Flow and Pollutant Spreading in Rivers* Rodi et al. [2]. The objective is to use EFDC+ Explorer (EE) and EFDC+ to simulate the pollutant-concentration field generated by a point discharge into a natural river and to compare the simulated velocity and dye-concentration fields against published measurements. The test case is based on data from a pollutant release originating at the Stuttgart sewage plant into the Neckar River, Germany, as reported by Rodi et al. [2]. Because the Neckar River experiment is widely recognized in river hydraulics and water-quality modeling, it provides a robust benchmark for evaluating EFDC+ performance under realistic river geometry, flow regimes, and advective–diffusive transport conditions.

### 2 Demonstration Feature

This test case illustrates EFDC+’s capability to simulate pollutant transport and lateral/longitudinal spreading in a natural river system. It specifically demonstrates how EFDC+ resolves the spatial distribution of dye concentration from a point-source discharge and how accurately the model reproduces measured cross-sectional velocity profiles at multiple downstream locations. The governing equations implemented in EFDC+ are detailed in the [EFDC+ Theory Document](#) [1].

### 3 Model Description

The model configuration is summarized in Table 1. The model domain, as shown in Figure 1, consists of 4,846 horizontal grid cells representing the Neckar River reach near Stuttgart, Germany, where the pollutant discharge from the Stuttgart sewage plant was observed and measured. The following EFDC+ modules are activated in this test case:

- **Hydrodynamics** – simulates the velocity field across the Neckar River reach
- **Dye** – used as a tracer to simulate the pollutant-concentration field induced by the sewage plant discharge

**Table 1** Model configuration summary

| Dimensions | Horizontal cells | Vertical cells | Activated modules                                                             |
|------------|------------------|----------------|-------------------------------------------------------------------------------|
| 2D         | 4,846 cells      | 1 layer        | <ul style="list-style-type: none"><li>• Hydrodynamics</li><li>• Dye</li></ul> |

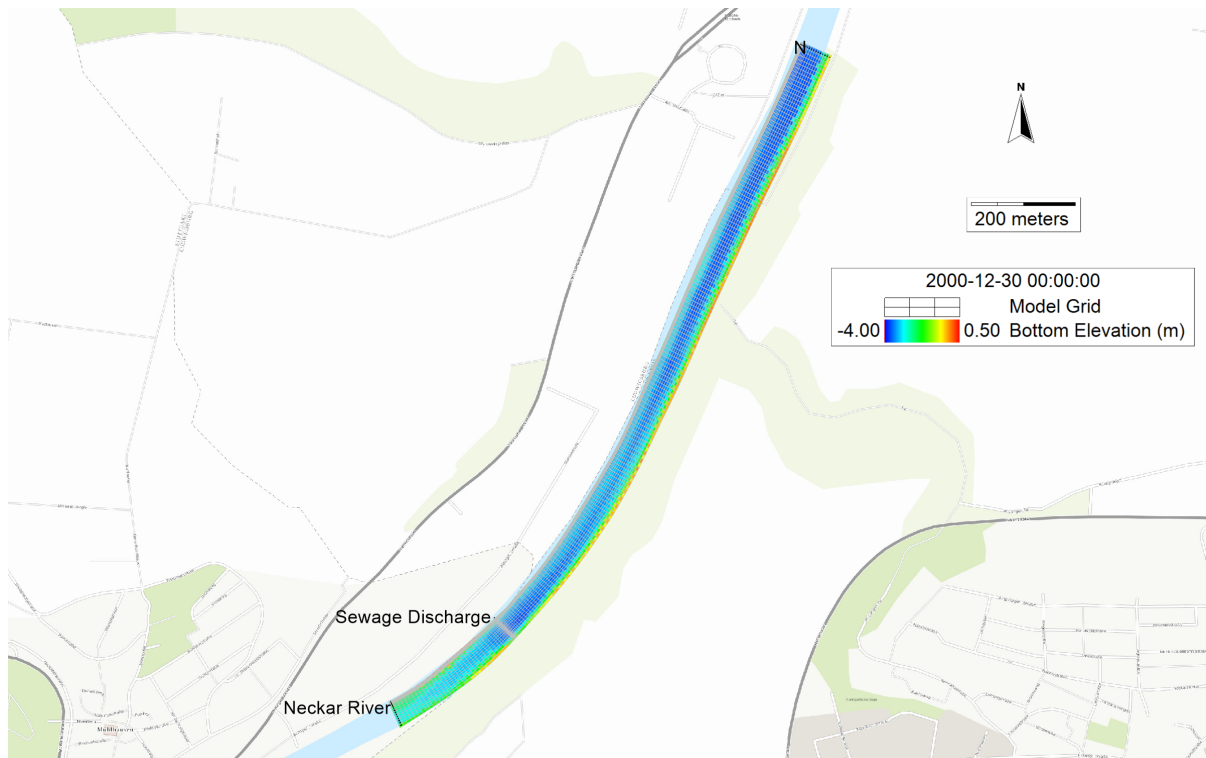


**Figure 1** Model domain

## 4 Model Results

The locations of the cross sections used for data–model comparisons are shown in Figure 2. Direct comparisons between observed and simulated velocities at each cross section are presented in Figures 3–7. The observational datasets were obtained from Rodi et al. [2]. Across all five cross sections, the model reproduces the measured velocity distributions with good fidelity.

The 2DH velocity vector field in Figure 8 illustrates the overall flow pattern along the modeled reach of the Neckar River and further confirms the model’s ability to accurately represent the observed hydrodynamic conditions.

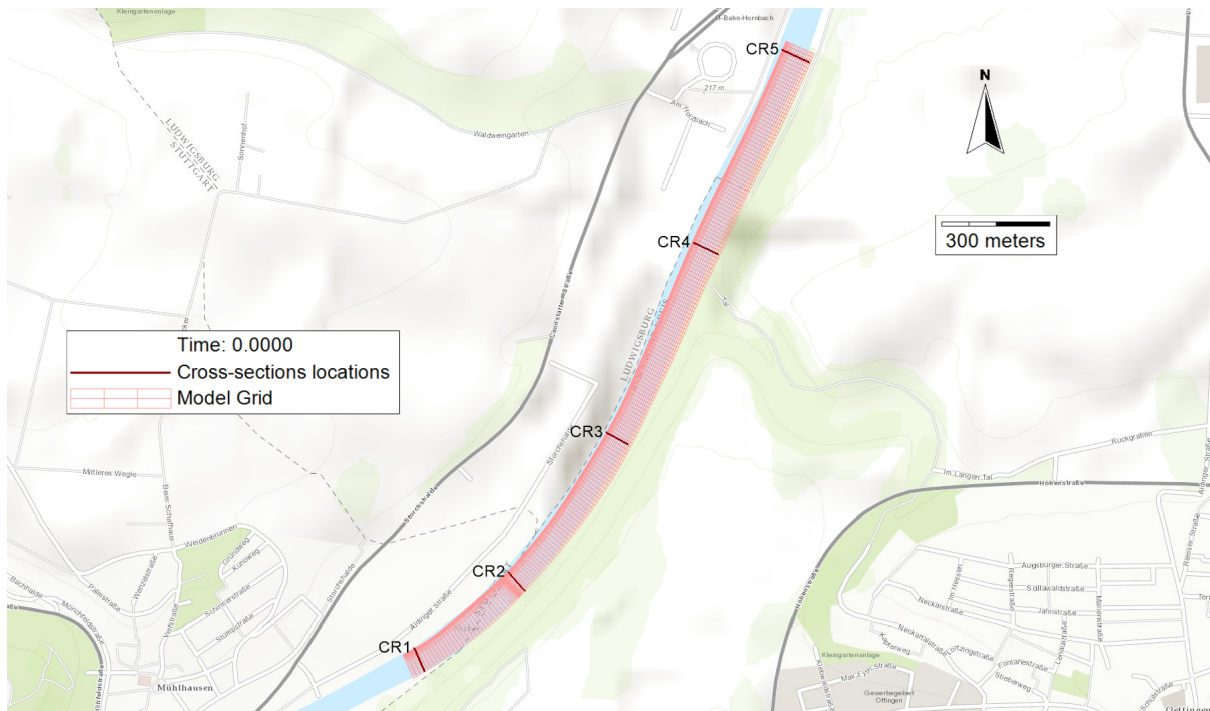


**Figure 2** Locations of cross sections

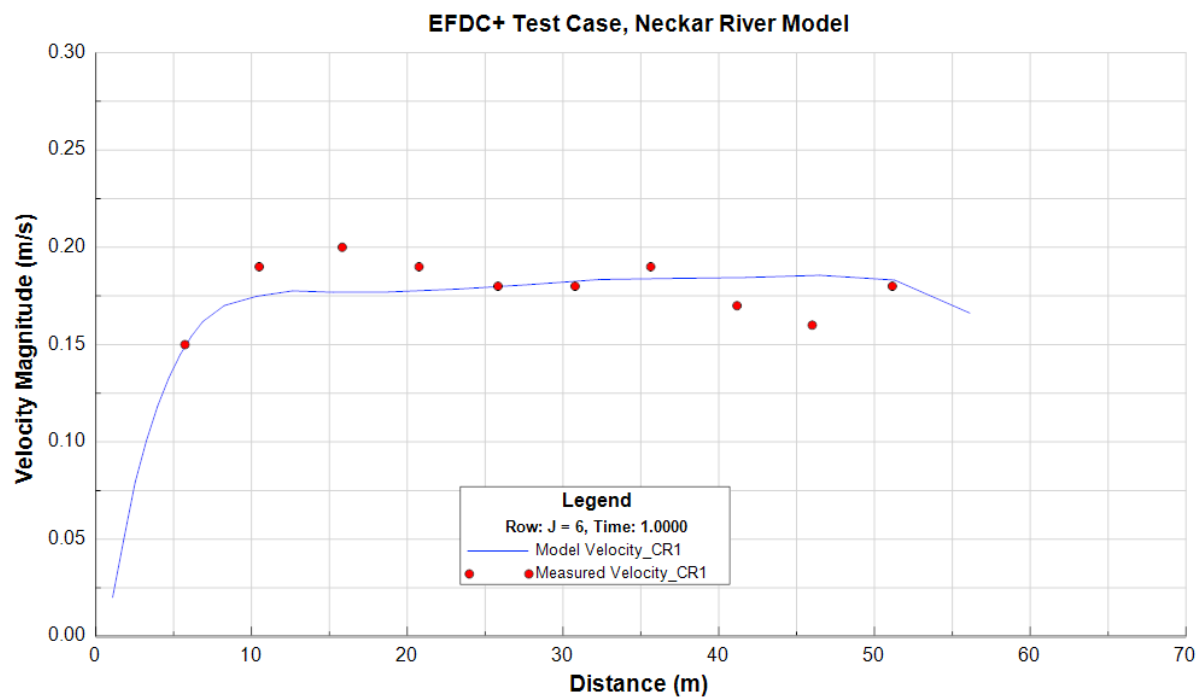


**Figure 3** Modeled and measured velocity at CR1

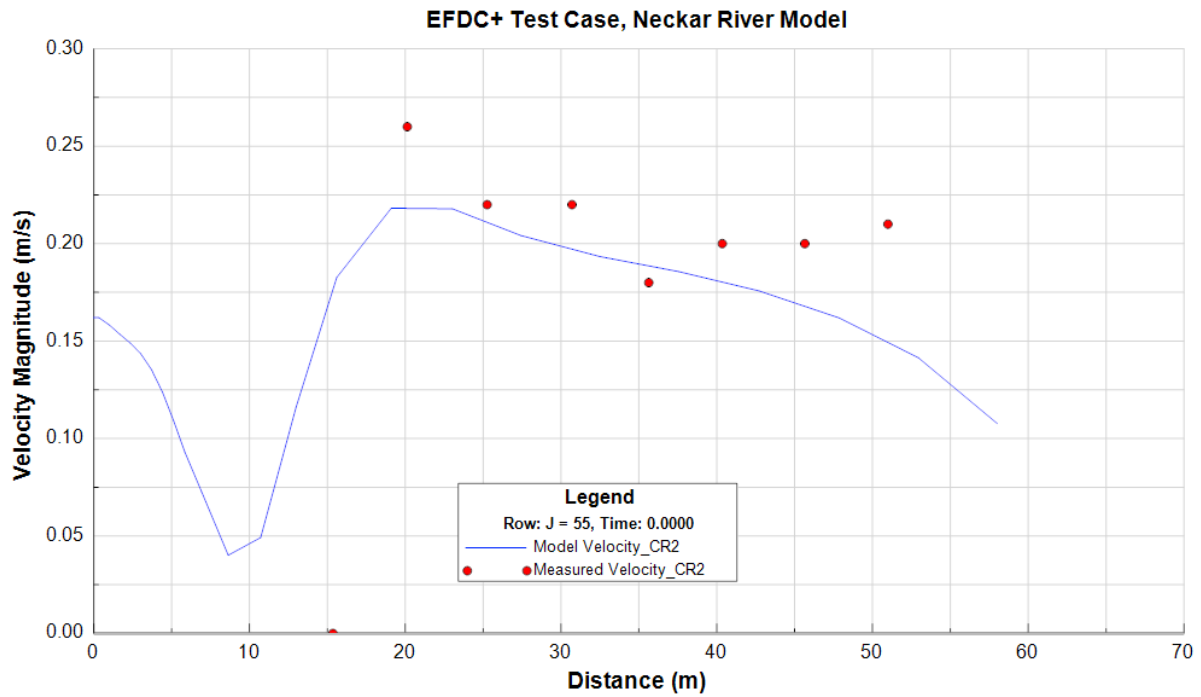


**Figure 4** Modeled and measured velocity at CR2

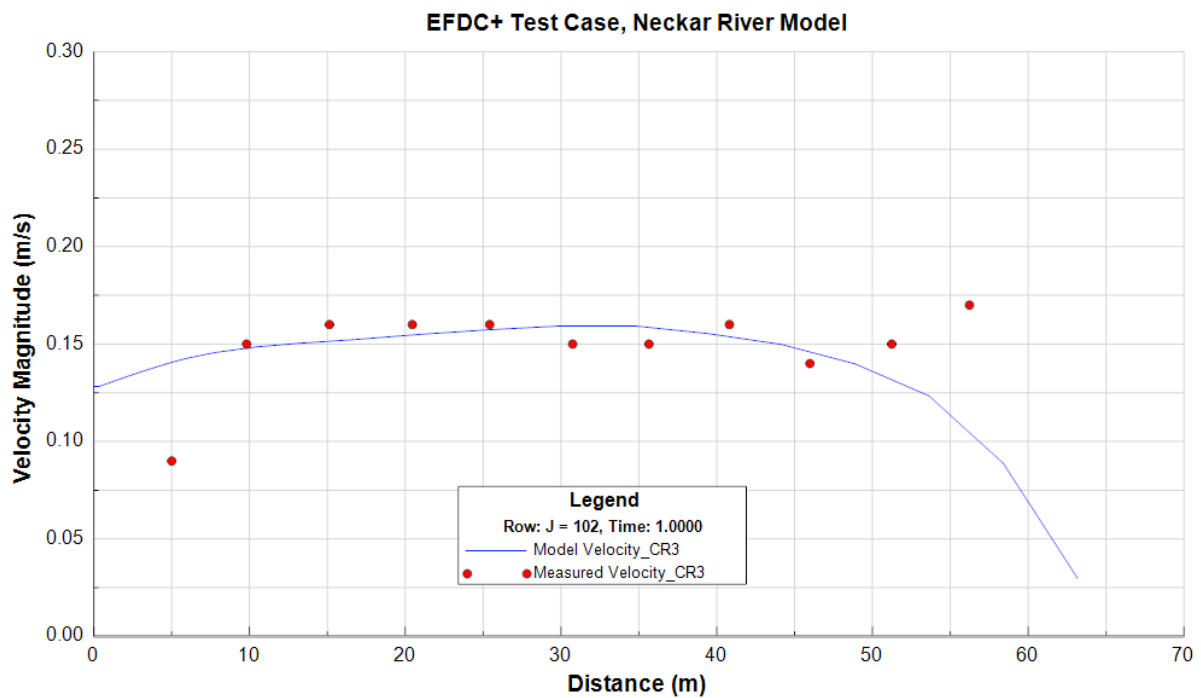


**Figure 5** Modeled and measured velocity at CR3

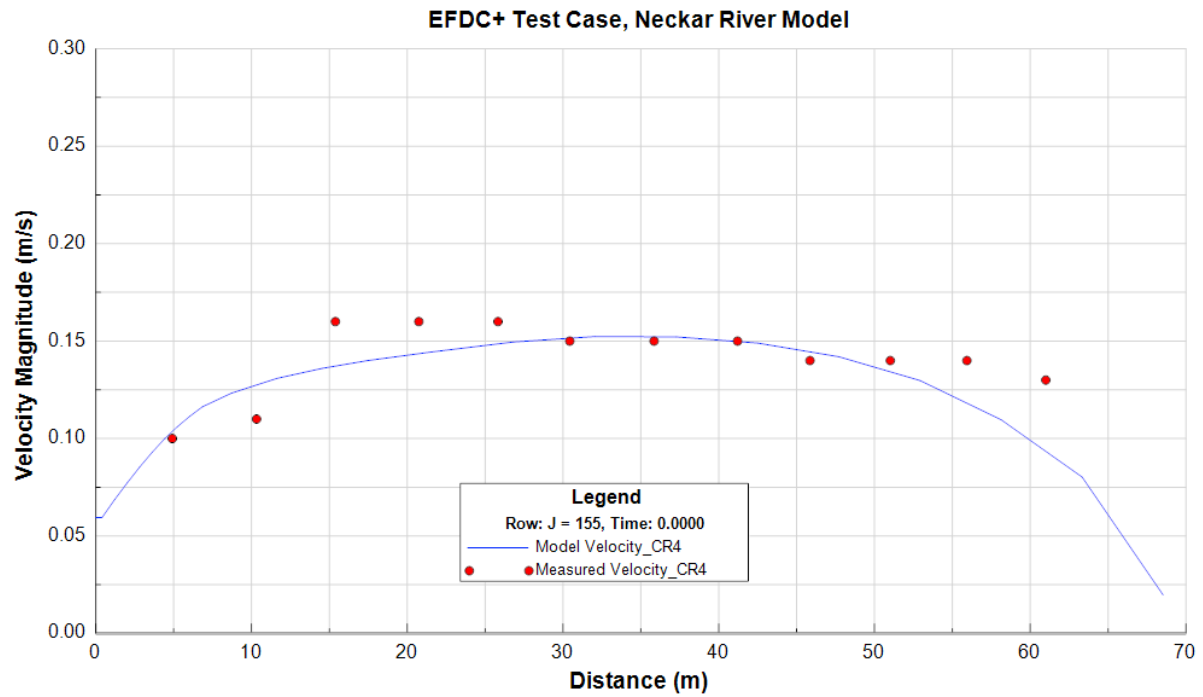


**Figure 6** Modeled and measured velocity at CR4

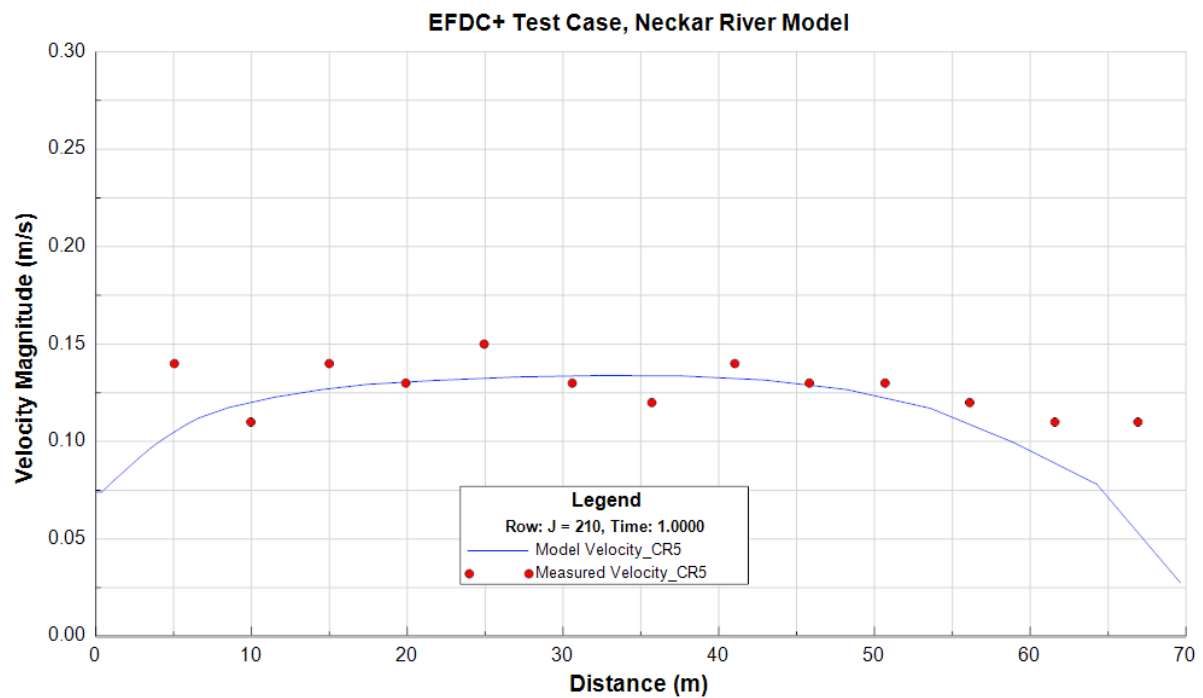


**Figure 7** Modeled and measured velocity at CR5

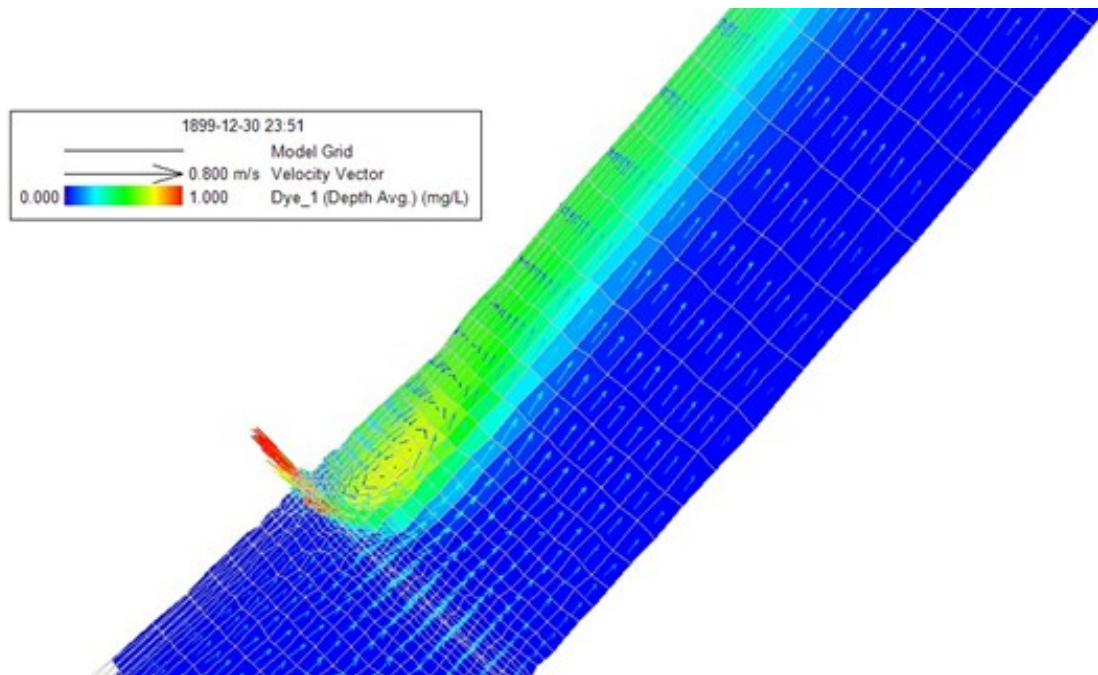


**Figure 8** Velocity vector in 2DH View

## References

- [1] DSI LLC (2024). *EFDC+ Theory: Version 12*. DSI LLC, Edmonds, WA, USA. Accessed: 2026-04-06.
- [2] Rodi, W., RN, P., and SK, S. (1981). Prediction of flow and pollutant spreading in rivers.

*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.