Hydrodynamic modelling with unstructured grid using D-Flow Flexible Mesh

Case study of side channel at Afferden and Deest
Content

- Introduction
- Case study Afferden-Deest
- Local grid refinement
- Discussion
- Conclusions
Introduction

Hydrodynamic models for accurate predictions in river management.

- Water levels
- Water flow
- Water quality

WAQUA and Delft3D standard tools in Netherlands.
Introduction

WAQUA and Delft3D based on structured curvilinear grid
Introduction

Drawbacks curvilinear grid:

- High resolution extends to entire domain
Introduction
Introduction

Drawbacks curvilinear grid:

- High resolution extends to entire domain
- Staircase representation
Introduction
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Drawbacks curvilinear grid:

- High resolution extends to entire domain
- Staircase representation
- Focused grid lines in inner bends
Introduction
Introduction

Deltares developed D-Flow Flexible Mesh based on unstructured grid
Case study Afferden and Deest
Case study Afferden and Deest
Local grid refinement

- Refinement Waal channel
- Refinement side channel without alignment
- Refinement side channel with alignment
Local grid refinement

Side channel with alignment
Local grid refinement

Waal channel
Local grid refinement

Side channel without alignment
Local grid refinement

Side channel with alignment
Local grid refinement

Computation time

<table>
<thead>
<tr>
<th></th>
<th>Number of time steps</th>
<th>Mean time step (seconds)</th>
<th>Computation time (minutes)</th>
<th>Computation time per modelled time step (seconds/dt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original WAQUA grid</td>
<td>138309</td>
<td>3.75</td>
<td>383</td>
<td>0.17</td>
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<tr>
<td>2x refined grid</td>
<td>138311</td>
<td>3.75</td>
<td>456</td>
<td>0.2</td>
</tr>
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<td>4x refined grid</td>
<td>199000</td>
<td>2.61</td>
<td>785</td>
<td>0.24</td>
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<tr>
<td>8x refined grid</td>
<td>447000</td>
<td>1.16</td>
<td>2281</td>
<td>0.31</td>
</tr>
</tbody>
</table>
Discussion

- Accuracy Flexible Mesh not clear
- Input data interpolated on refined grid
- Increased computation time
Conclusions

- Large potential for local grid refinement
- Aligned grid most efficient
- Refinement not efficient for high grid resolutions