



# What's New in MIKE 2023

Mark Britton

June 13<sup>th</sup>, 2023



# Presentation Overview

- Headline Developments since the last UK Symposium
- Focus on MIKE+
  - *migration/integration of DHI's terrestrial flooding products*
- Focus on FEFLOW
  - *state-of-the-art 3D groundwater model*

# Desktop Platforms

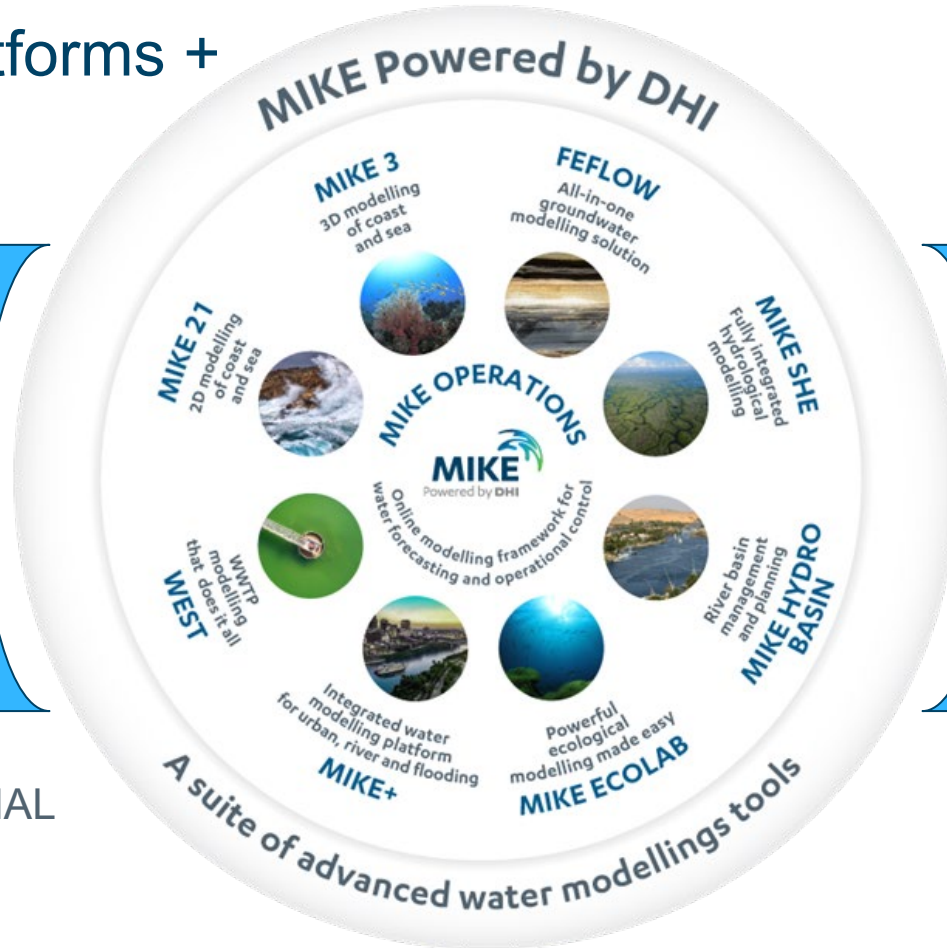


# Desktop Platforms +

....DATA

- Earth Observations
- Bathymetry Portal
- Metocean on Demand
- Global Hydrological Model
- Flood & Risk Portal

....OPERATIONAL SERVICES



....CLOUD

- Cloud Execution
- Mesh Builder
- Data Link
- Fast Wave Emulator
- Plume Cast

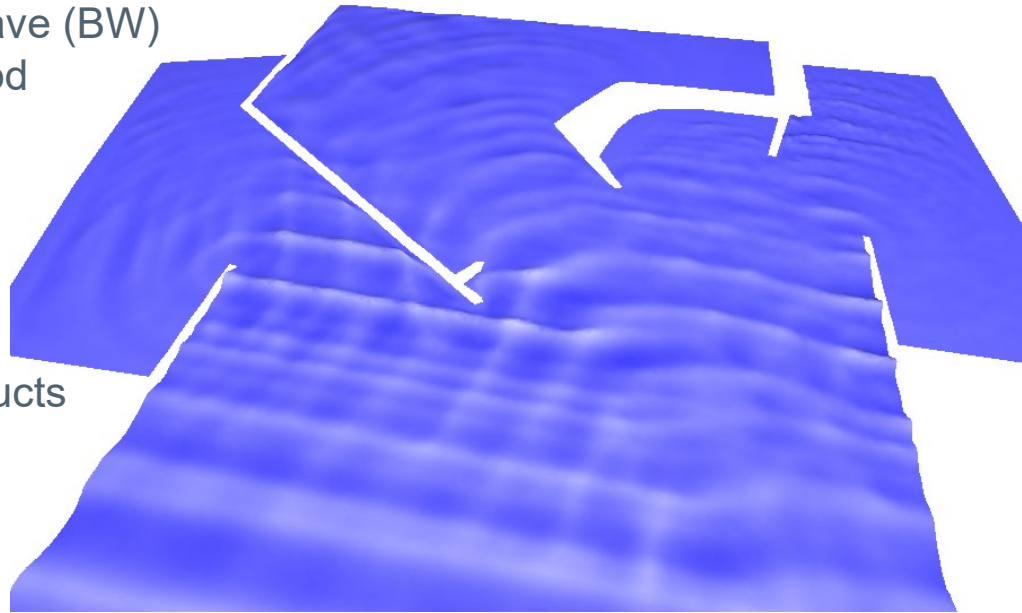
1.

## Headline Developments since 2018



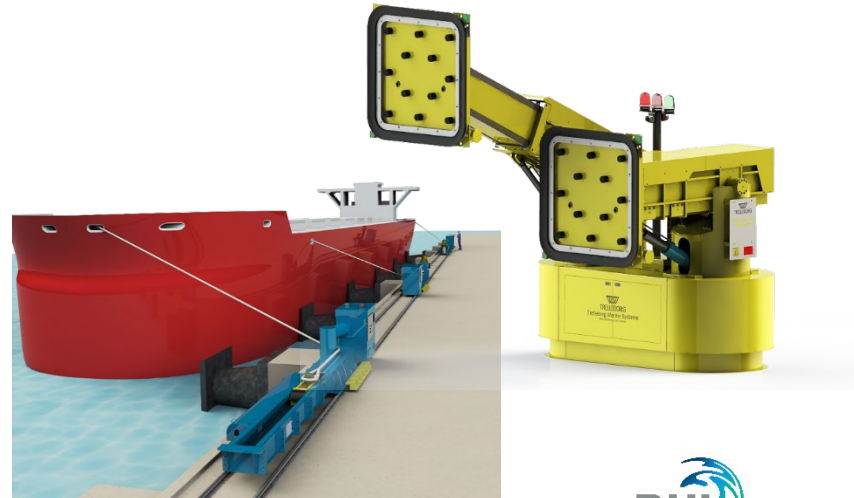
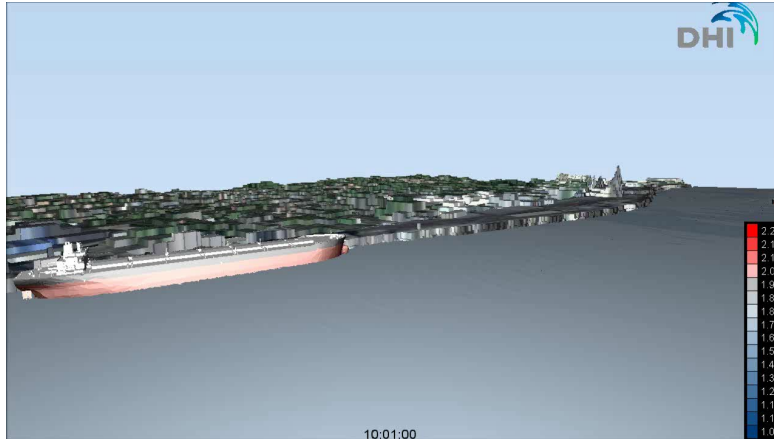
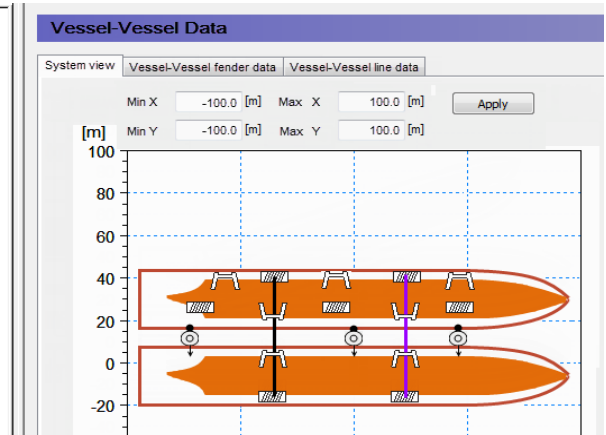
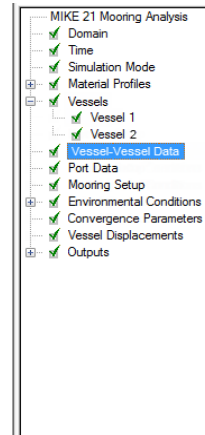
# MIKE 3 Wave FM

- Advanced 3D Phase Resolving Wave Model
- Alternative to MIKE 21 Boussinesq Wave (BW)
  - no limitations on wave height or period
  - better for deeper water
  - better for complex geometries (FM)
  - better wetting and drying
  - better workflows for porous zones
  - fully non-linear
- Easy interfacing with other MIKE products
- Extensive validation and testing



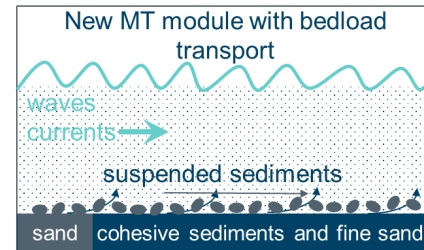
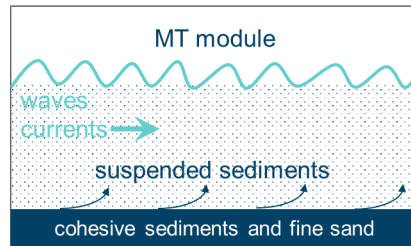
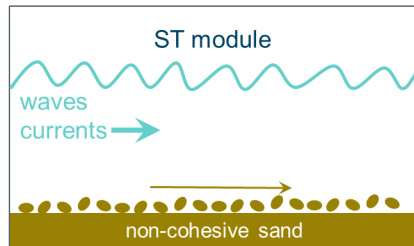
# MIKE 21 Mooring Analysis

- Multi-body simulations
  - vessel to vessel fenders and lines
- Passing vessel analysis
- Trelleborg proprietary mooring systems
  - AutoMoor™
  - DynaMoor™



# Advanced Mud Transport

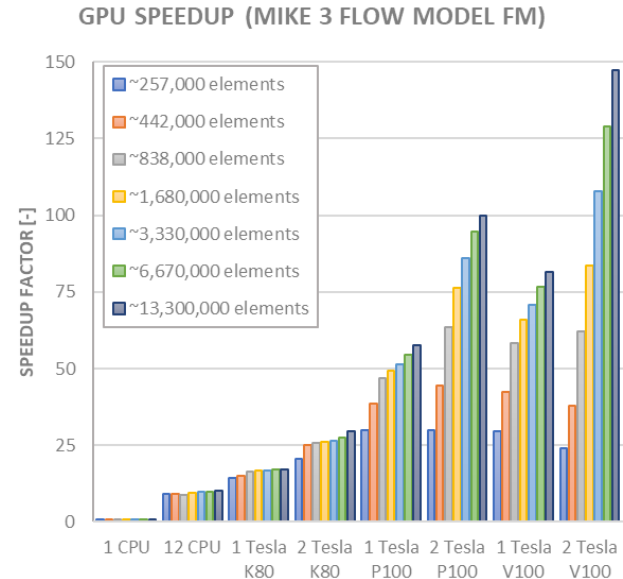
- In 2017 DHI introduced Non-Newtonian Flow (NNF)
  - Mud/Debris/Oil
  - Global “Bingham” fluid properties
- In 2021 advanced NNF was added to MIKE 3 MT module
  - varying fluid properties in time and space
  - model the mixing of a non-Newtonian fluid with water
- MIKE 3 MT can now also handle simultaneous calculation of suspended sediments and non-cohesive bedload
  - when dredging in mud and sand layers





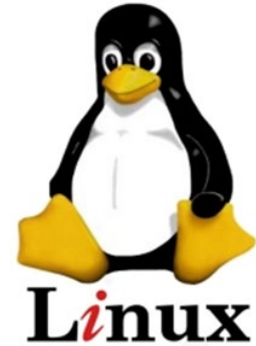
# Parallelisation – Focus on FM and GPU

- MIKE 3 Single Grid & Nested Grid was decommissioned in 2019
- Grid (DFS2) input to MIKE 21 FM engine  
- Grid (DFS2) output from FM engine
- Latest release supports NVIDIA GPU cards with CUDA compute capability of 6.0+
- GPU acceleration of pre-processing tasks  
- like structures and boundary conditions
- MIKE 21 Single Grid & Nested Grid was decommissioned in latest version (2023)



# Unlocking the power of Linux

- FM Engines have been ported to Linux
  - MIKE 21/3 HD, MIKE 21 SW, MIKE 3 Wave FM (and FEFLOW)
- Official Linux-version of MIKE 21/3 engines is now available on a dedicated download-page



## MIKE ZERO 2023 FOR LINUX (RED HAT, CENTOS)

- ▣ [MIKE Zero 2023](#)  
MIKE Zero 2023 for Red Hat Enterprise Linux 7 and 8 + CentOS 7 and 8
- ▣ [MIKE Zero 2023 additional tools](#)
- ▣ [MIKE Zero 2023 examples](#)
- ▣ [MIKE Zero 2023 prerequisites](#)

- License for the Linux-version can be added to a Professional (perpetual) License and selected Subscription Packages

# MIKE Zero Modernisation

The screenshot displays the MIKE Zero software interface. At the top, the window title is "MIKE Zero - [Start Page]". The menu bar includes "File", "View", "Window", and "Help". A "Sign on" button is highlighted with a red circle in the top right corner. The main header features the text "Welcome to MIKE Zero" and the MIKE logo with "Powered by DHI".

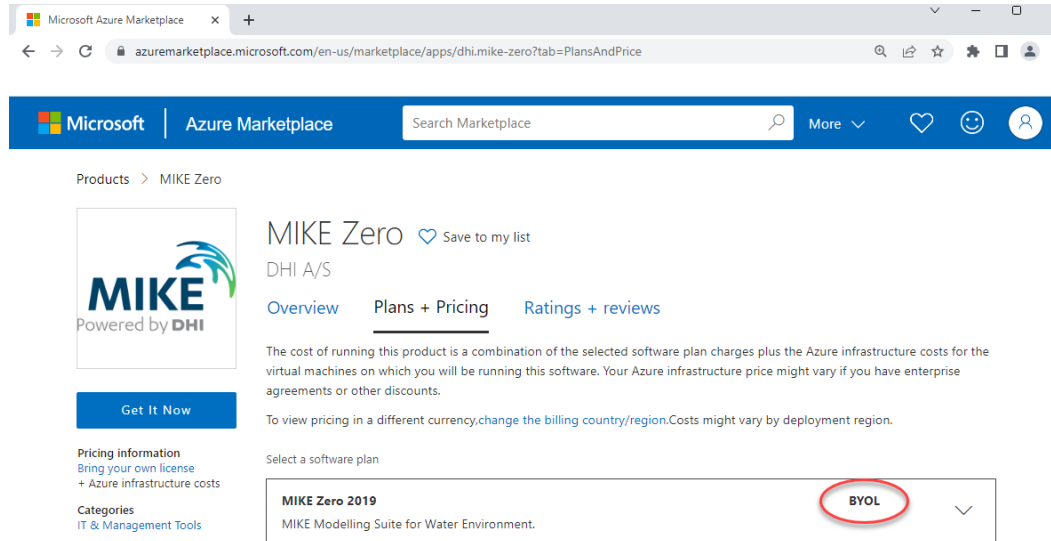
Below the header, there is a section titled "Create new model file" with two tabs: "Marine" (selected) and "Inland". Under the "Marine" tab, there are eight icons representing different model types: Data processing, Flow, Waves, Sediments and morphology, Ecology, Vessels, Simulation tools, and Results and visualisation. Below these are ten icons for other tools: Data Admin, Mesh Builder, Data Link, Time Series, Profile Series, Grid Series, Data Manager, Bathymetries, EVA Editor, Mesh Generator, Data Extraction FM, and MIKE Zero Toolbox.

The bottom section is titled "Recent files and projects" and has two tabs: "Files" (selected) and "Projects". A search bar is located to the right of the tabs. Below the tabs is a table with the following data:

Name	Type	Created	Modified	Location
oresund	m21fm	4/11/2022	4/11/2022	C:\Program Files (x86)\DHI\MIKE Zero\2023\Examples\MIKE_21\FlowModel_FM\HD\Oresund\Calibration_1

# MIKE on Azure Marketplace

- MIKE+, MIKE Zero and FEFLOW are all available on Azure Marketplace



Microsoft Azure Marketplace

azuremarketplace.microsoft.com/en-us/marketplace/apps/dhi.mike-zero?tab=PlansAndPrice

Microsoft | Azure Marketplace

Search Marketplace

Products > MIKE Zero

**MIKE Zero** [Save to my list](#)

DHI A/S

[Overview](#) [Plans + Pricing](#) [Ratings + reviews](#)

The cost of running this product is a combination of the selected software plan charges plus the Azure infrastructure costs for the virtual machines on which you will be running this software. Your Azure infrastructure price might vary if you have enterprise agreements or other discounts.

To view pricing in a different currency, change the billing country/region. Costs might vary by deployment region.

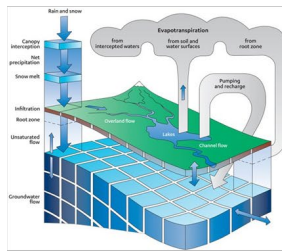
Select a software plan

<b>MIKE Zero 2019</b> MIKE Modelling Suite for Water Environment.	<b>BYOL</b>
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- In a few weeks we will release PAYG versions (software costs USD \$5-12/hr)  
- will replace MIKE SaaS (Amazon Web Services)

# FEFLOW – our fastest growing product

- New coupling options with surface water models (MIKE 21 HD and MIKE 1D engine)
- New workflow for Subsidence modelling - piHMC (Hydro-Mechanical Coupling)



Regional Hydrology  
MIKE SHE

Detailed Groundwater Modelling  
FEFLOW

Model data transfer  
(Manual or API based)

Validation with InSAR

Subsidence Modelling  
FEFLOW piHMC

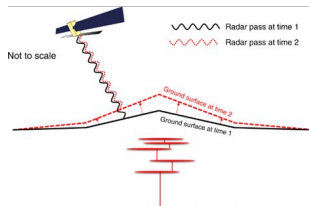
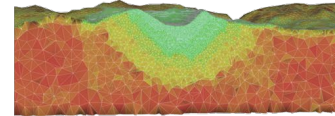
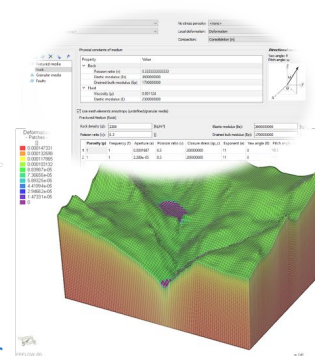
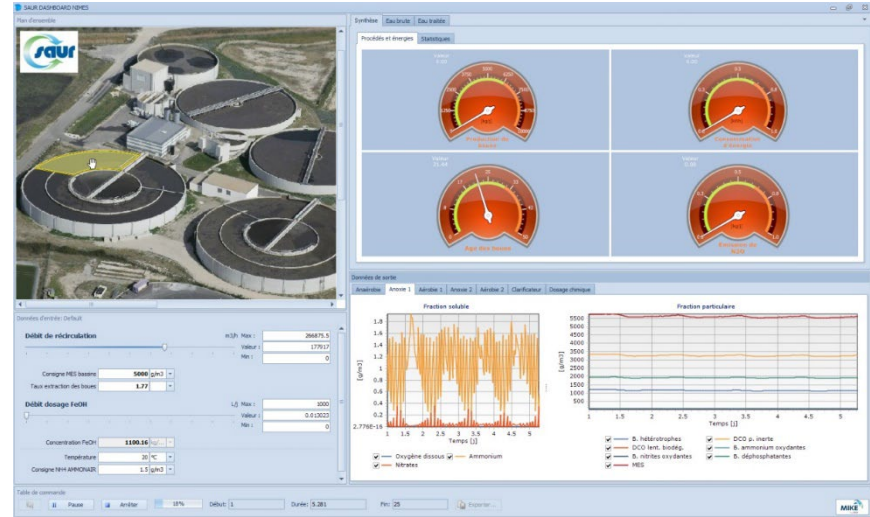
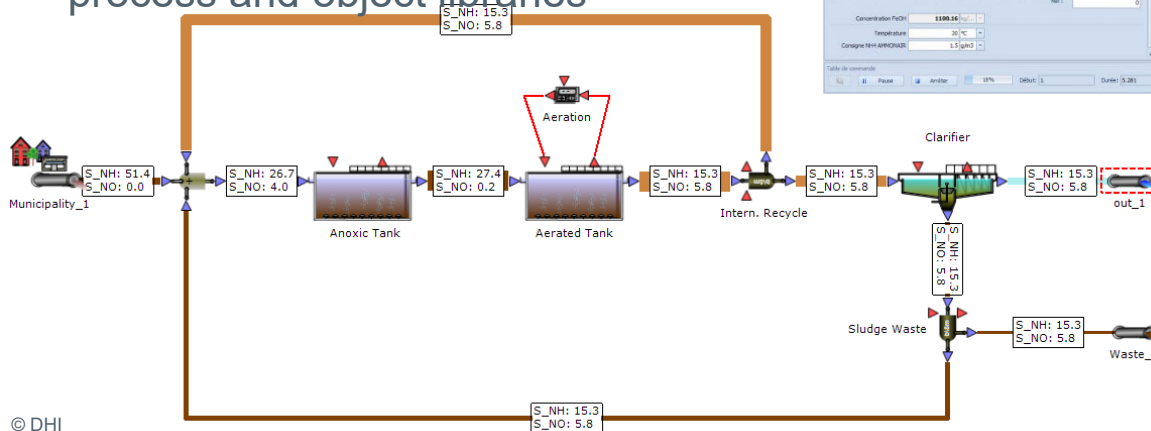


Image: <https://www.nature.com/articles/s41467-020-17587-6/figures/1>



# WEST – Digital Twin for Wastewater Treatment Plants

- Evaluate the performance of a WWTP under dynamic conditions
- Optimise treatment plant design, operations and automation by targeting effluent quality, energy and cost
- Drag and drop build environment uses process and object libraries



# MIKE OPERATIONS – focus on 2D/3D



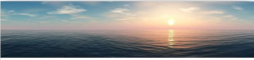



- Operational and forecasting systems are increasingly going 2D/3D
- Enhanced Script Manager now supports CPython
- New plug-in/adaptor for MIKE 21 FM
- New plug-in/adaptor for FEFLOW
- Automatically import common global datasets, including rainfall forecasts



# Subscription Packages

- In 2019, Subscription Packages replaced rental of individual modules
  - we currently have 25+ packages including 6 in Marine and 3 in Groundwater

## Coast and Sea

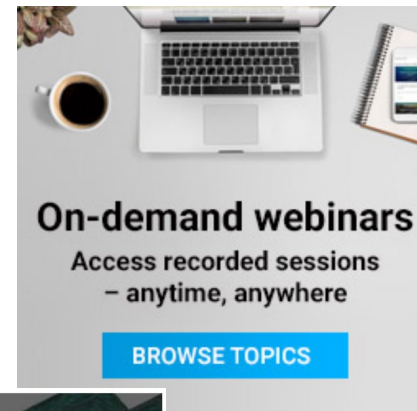
 <h3>Marine GO</h3> <p>Create a cost effective starter package for marine modelling, or select modules as an add-on package to our other Marine Subscriptions for ultimate flexibility.</p> <p>What's in the package?</p> <ul style="list-style-type: none"><li>Marine PP</li><li>+ one module of choice from MIKE 21 or MIKE 3</li></ul> <p>492€/per month*</p> <p><a href="#">Learn more</a></p>	 <h3>Hydrodynamics</h3> <p>Simulate 2D and 3D hydrodynamics in marine or terrestrial environments with this flexible subscription package.</p> <p>What's in the package?</p> <ul style="list-style-type: none"><li>Marine PP</li><li>HD (MIKE 21/3)</li><li>+ one module of choice from MIKE 21 or MIKE 3</li><li>MIKE Cloud applications:<ul style="list-style-type: none"><li>Mesh Builder~</li><li>Cloud Execution Credits***</li></ul></li></ul> <p>880€/per month*</p> <p><a href="#">Learn more</a></p>	 <h3>Ocean Engineering</h3> <p>Simulate 2D and 3D flow phenomena, spectral waves and much more with our subscription package for ocean engineering.</p> <p>What's in the package?</p> <ul style="list-style-type: none"><li>Marine PP</li><li>HD (MIKE 21/3)</li><li>MIKE 21 SW</li><li>+ one module of choice from MIKE 21 or MIKE 3</li><li>MIKE Cloud applications:<ul style="list-style-type: none"><li>Mesh Builder~</li><li>Cloud Execution Credits***</li></ul></li></ul> <p>1108€/per month*</p> <p><a href="#">Learn more</a></p>	 <h3>Ports &amp; Maritime</h3> <p>Optimise port and terminal design – from planning to construction and more – with our maritime subscription package.</p> <p>What's in the package?</p> <ul style="list-style-type: none"><li>Marine PP</li><li>MIKE 3 Wave Model FM (M3W)</li><li>MIKE 21 BW</li><li>MIKE 21 SW</li><li>MIKE 21 MA</li><li>+ one module of choice from MIKE 21 or MIKE 3</li><li>MIKE Cloud applications:<ul style="list-style-type: none"><li>Mesh Builder~</li><li>Cloud Execution Credits***</li></ul></li></ul> <p>1383€/per month*</p> <p><a href="#">Learn more</a></p>	 <h3>Coastal Engineering</h3> <p>Achieve sustainable coastal development with a range of industry-recognised applications to support coastal engineering and sediment studies.</p> <p>What's in the package?</p> <ul style="list-style-type: none"><li>Marine PP</li><li>HD (MIKE 21/3)</li><li>Littoral Processes (LITPACK)</li><li>ST (MIKE 21/3)</li><li>MIKE 21 SW</li><li>+ one module of choice from MIKE 21 or MIKE 3</li><li>MIKE Cloud applications:<ul style="list-style-type: none"><li>Mesh Builder~</li><li>Cloud Execution Credits***</li></ul></li></ul> <p>1383€/per month*</p> <p><a href="#">Learn more</a></p>	 <h3>Environmental Engineering</h3> <p>Model any aquatic ecosystem or environmental scenario – whether at the coast or at sea.</p> <p>What's in the package?</p> <ul style="list-style-type: none"><li>Marine PP</li><li>HD (MIKE 21/3)</li><li>TR/AD (MIKE 21/3)</li><li>MT (MIKE 21/3)</li><li>MIKE ECO Lab (MIKE 21/3)</li><li>+ one module of choice from MIKE 21 or MIKE 3</li><li>MIKE Cloud applications:<ul style="list-style-type: none"><li>Mesh Builder~</li><li>Cloud Execution Credits***</li></ul></li></ul> <p>1383€/per month*</p> <p><a href="#">Learn more</a></p>
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- UK is the strongest market for Marine Subscription Packages globally
  - 15% of global sales, followed by UAE and USA



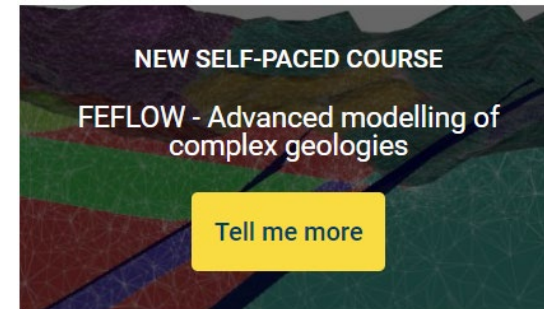
# The ACADEMY by DHI

- COVID-19 accelerated our move towards online learning
  - On-demand Webinars
  - Self-paced (free) online courses
  - Instructor lead (online) courses
  - Custom courses (we can still come to you)
- Blended courses
  - Silver Level free with a valid SMA



**On-demand webinars**  
Access recorded sessions  
– anytime, anywhere

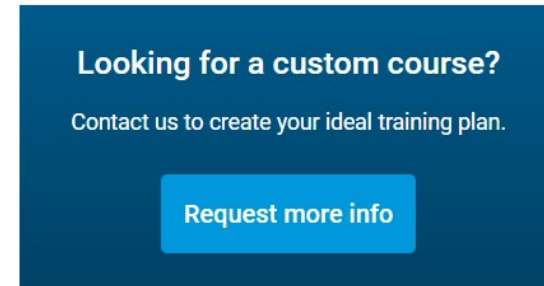
[BROWSE TOPICS](#)



**NEW SELF-PACED COURSE**  
FEFLOW - Advanced modelling of complex geologies

[Tell me more](#)

Silver starting at	Gold starting at	Platinum starting at
€ <b>49</b> excl. VAT	€ <b>199</b> excl. VAT	€ <b>399</b> excl. VAT
<ul style="list-style-type: none"><li>✓ 30-day access to all course material</li><li>✓ 30-day training license</li><li>✗ No access to personal tutor</li><li>✓ Training certificate</li></ul>	<ul style="list-style-type: none"><li>✓ 30-day access to all course material</li><li>✓ 30-day training license</li><li>✓ One 1-hr session with a personal tutor</li><li>✓ Training certificate</li></ul>	<ul style="list-style-type: none"><li>✓ 60-day access to all course material</li><li>✓ 60-day training license</li><li>✓ Two 1-hr sessions with a personal tutor</li><li>✓ Training certificate</li></ul>



**Looking for a custom course?**  
Contact us to create your ideal training plan.

[Request more info](#)

# Customer Care Portal



All ▾  [Search](#)

Are you new to water modelling or a seasoned professional seeking extra support?


DHI's Customer Care Portal provides easy access to an extensive selection of online resources including product documentation, FAQs, video tutorials and user forums.

To get started, simply type your question in the search field or click on a topic of interest below.

  
Installation  
and licensing

  
Getting started with  
your software

  
Workarounds and  
Tips & Tricks

  
Specific features of  
selected products

# Customer Care Portal

- Use anonymously

The image shows two overlapping screenshots of the DHI Customer Care Portal. The left screenshot displays search results for "install FEFLOW", with the search term circled in red. The right screenshot shows the "Contact Support" page with a user profile dropdown menu open, listing options like "Personal profile", "Forum posts", "Company profile", "Company licenses", and "Sign out". The "Company profile" and "Company licenses" options are highlighted with a red box. A "Sign in" button is circled in red in the top right of the left screenshot, and an "Open a New Case" button is circled in red in the bottom right of the right screenshot.

Home > Search > "install FEFLOW"

Products

All

FEFLOW 18+

Record Type

All 2343

Forums 2295

Knowledge Articles 47

Idea Forums 1

Modified date

All 2343

Today 0

Past Week 41

Past Month 46

Past 3 Months 82

Past 6 Months 91

Results 1 - 10 of 2343 for FEFLOW

Installing Feflow 6.1 on centOS 6.3

... I am trying to install Feflow on centOS 6.3And i get f

10.x86\_64 libircoremt.so.0(64bit) is needed by wasy-fe

6.1-10.x86\_64 libimf.so.0(64bit) is needed by wasy-fe

10.x86\_64 libirc.so.0(64bit) is needed by wasy-fe

10.x86\_64Can you please point me to which package

feflow5.0 can be installed under win

... now my pc installs windows xp, but i can not install t

windows 2000? ...

FEFLOW | Installation guide

... This video tutorial has been designed to assist our F

Re: feflow5.0 can be installed under

... The problem installing FEFLOW 5.0 on Windows XP i

Re: feflow5.0 can be installed under

... hi peter i install the dongle drive you have emailed t

dongle. can you help me? ...

Home > Contact Support

...or sign in for more access

Contact Support

What can we help you with?

My Open Cases

Search

Open a New Case

Case Title	Case Number	Created On	Modified On	
Converted Sales Order 2613638, New HYDRODYNAMICS subscription	CAS-138141-X3Q8S1	6/8/2023 4:22 AM	6/8/2023 8:49 AM	
Converted Sales Order 1149114, Global customer [REDACTED] renew SMA under Global Agreement	CAS-138011-R7Q3X2	6/7/2023 1:03 AM	6/7/2023 10:24 AM	

Personal profile

Forum posts

Company profile

Company licenses

Sign out

© DHI

# Customer Care Portal

- Manage (and extend\*) your own licenses

## Company Profile

[Personal profile](#)  
[Forum posts](#)  
**Company profile**  
[Company licenses](#)  
[Sign out](#)

**Legal Entity / Billing Address**  
**Registered Company Name**  
—  
**Address Line 1**  
Near the Little Mermaid  
**Address Line 2**  
Down by the Sea  
**Address Line 3**  
**ZIP/Postal Code**  
**City**  
Copenhagen  
**Country \***  
Denmark  
**State**

**Other Company Details**  
**Registration Id**  
**VAT Number**  
**Currency**  
euro  
**Company Type**  
Consultants  
**Company Size**  
< 10 employees

**Company Contacts**  
Portal Active Account Contacts  

Full Name	Email
Mark Britton	mfb@dhigroup.com
Tomas Paulas	top@dhigroup.com

## Licenses overview

This page provides you an overview about your licenses. Select a specific license for more actions, like SMA renewal, quote request etc. If you find any discrepancies, please contact our support

Installation No	Key No	Expiration Date ↓	SMA Expiry	Product	Module Name	Version	Seats	Installation Type	License Type
9922347	3422	12/30/2023	12/30/2023	Cloud Platform	Company Subscription	2022	1	Internet	Subscription

## License detail

<b>Order No</b>	<b>Key No</b>
9922347	3422
<b>License Type</b>	<b>Att</b>
Subscription	—
<b>Product</b>	<b>Seats</b>
Cloud Platform	1
<b>Module Name *</b>	<b>CPU's</b>
Company Subscription	—
<b>Expiration Date</b>	<b>Installation Type</b>
12/30/2023	Internet
<b>SMA Expiry</b>	<b>Version</b>
12/30/2023	2022

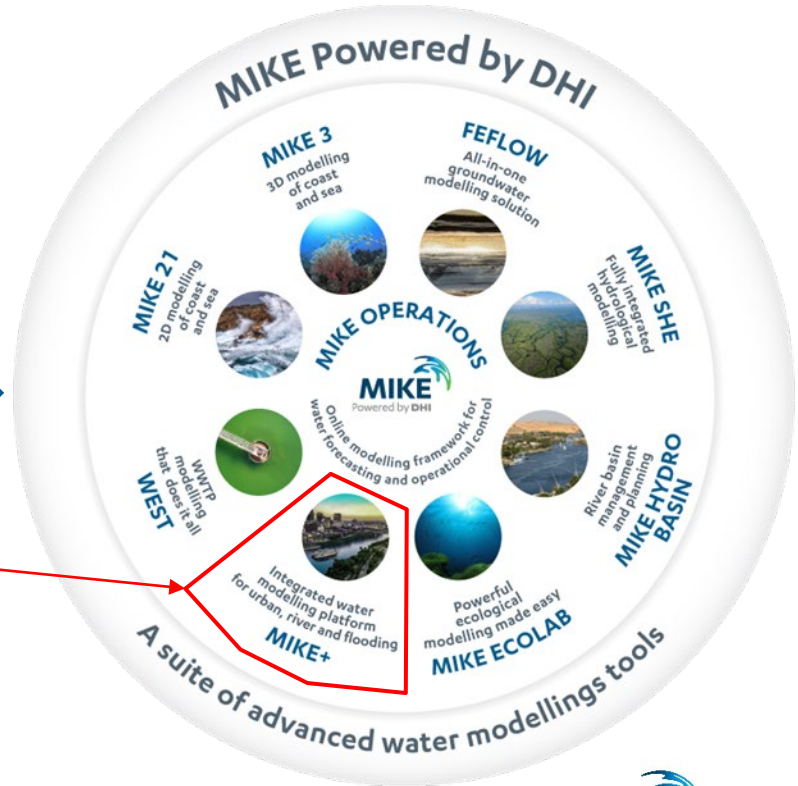
[Request quote](#)

# 2.

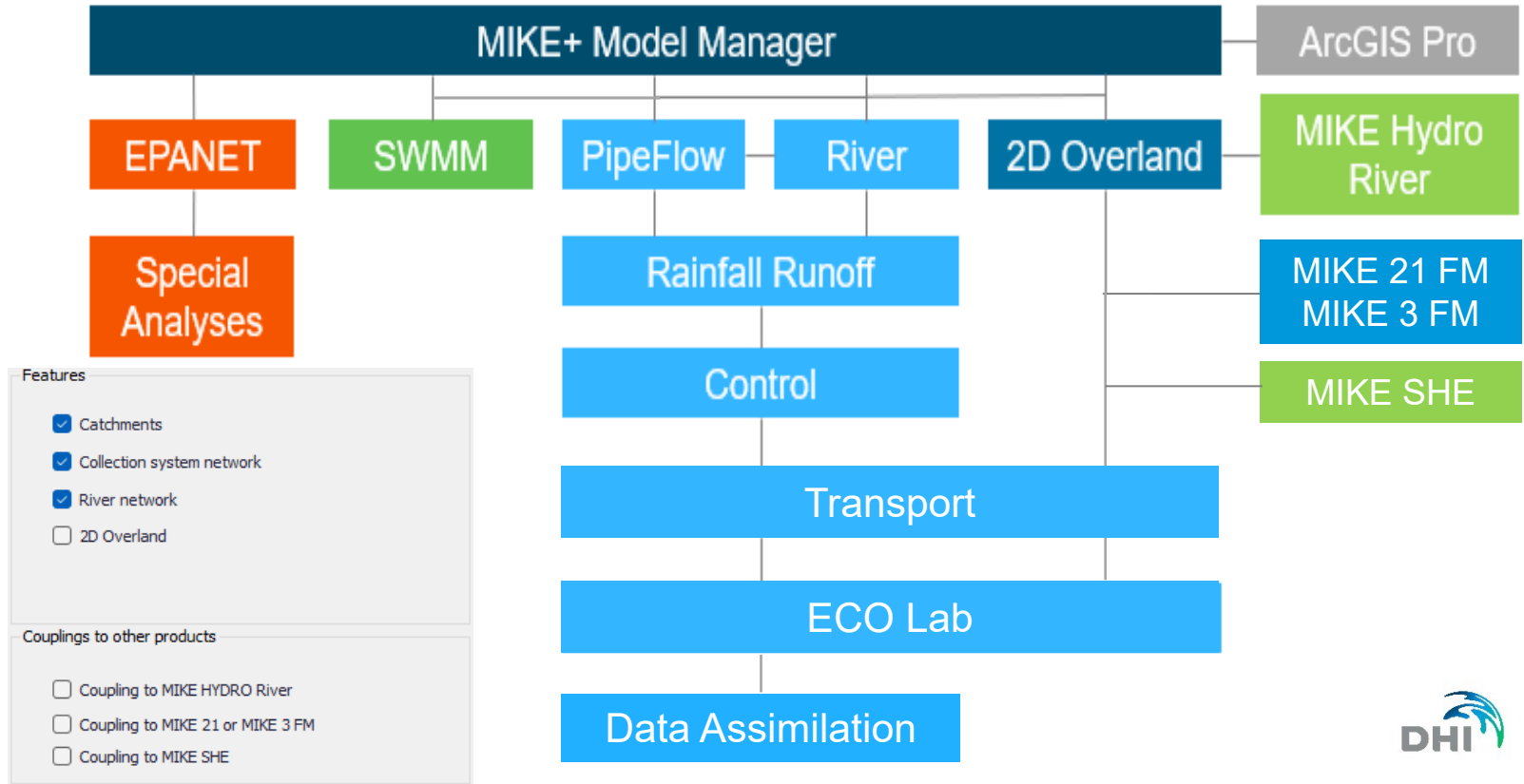
**Focus on MIKE+ (the new MIKE FLOOD)**



# MIKE+ Product Evolution



# MIKE+ Modules Today







# Latest Developments in MIKE+ Release 2023

- EPANET 2.2 for Water Distribution (pressurised systems)
- Auto-calibration to optimise Water Distribution networks
- New Water Hammer model with steady-state and transient engines
  
- SWMM5 engine added for Collection Systems (gravity form for sewer and stormwater)
- Rivers are now fully implemented including advanced Sediment Transport model
  
- Infrastructure (buildings, roads) and Depth Average roughness calculation in 2D are now GPU enabled
- Connect directly with MIKE SHE models

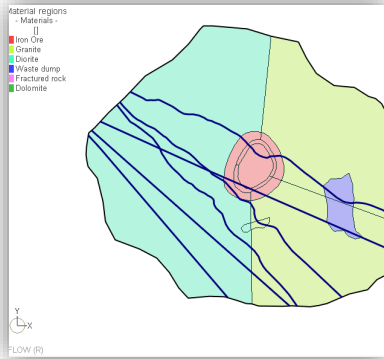
**3.**

**Focus on FEFLOW 8.0**

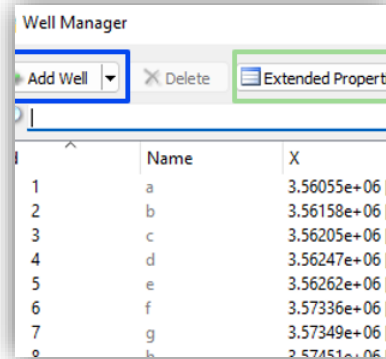


# FEFLOW 8.0 - next generation of groundwater modelling

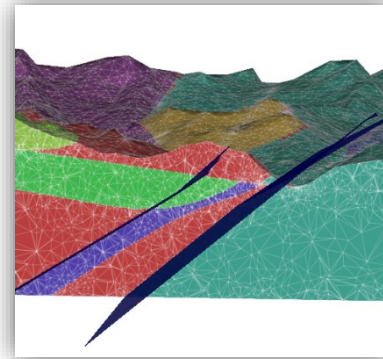
- The first major FEFLOW release since 2015, focused on model conceptualization.



Conceptual modelling and new workflow for 3D model building



New Well Manager editor



3D Supermesh Repair

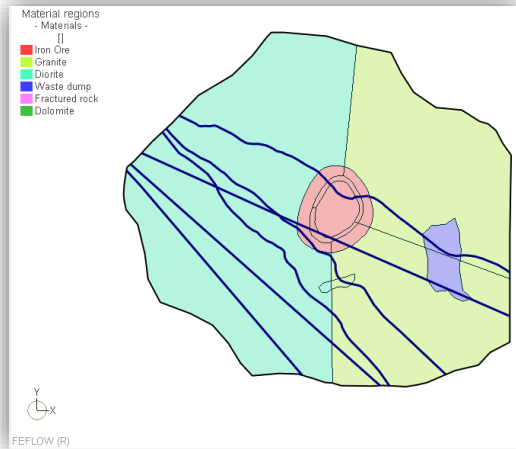


MIKE Cloud for FEFLOW and FePEST

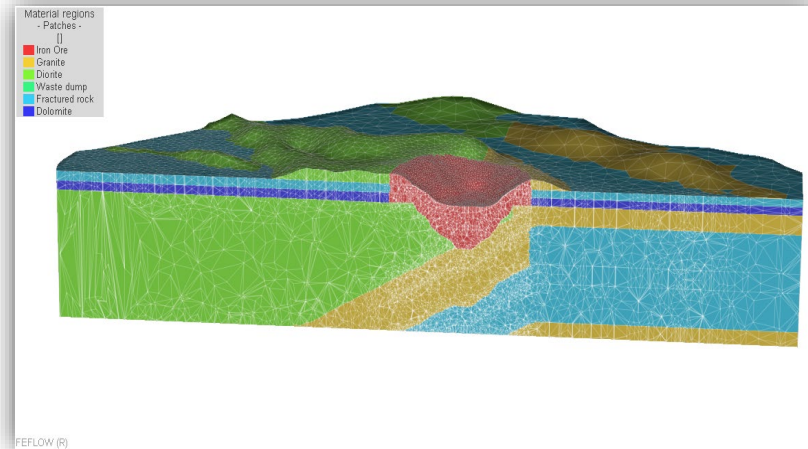
# Conceptual Modelling

- Allows users to focus on the **concepts** rather than on the **technicalities** of meshes
- Geometries (points, lines and polygon) assigned a “meaning” even before mesh exists

1) Concepts first



2) FEFLOW “just” does the rest...



# New Well Manager

- New functionality and UI component dedicated to the management of well objects
- Quickly create groundwater and **geothermal** wells by selection and/or coordinates

The screenshot shows the 'Well Manager' window with a toolbar containing 'Add Well', 'Delete', 'Extended Properties', 'Import', and 'Export'. A search bar is active with the text '(504 out of 504)'. Below the search bar is a table with the following columns: Id, Name, X, Y, Z [Top], Z [Bottom], Well Type, and Rate (Flow). The table contains 10 rows of data, with the Z [Top] column highlighted with a grid pattern.

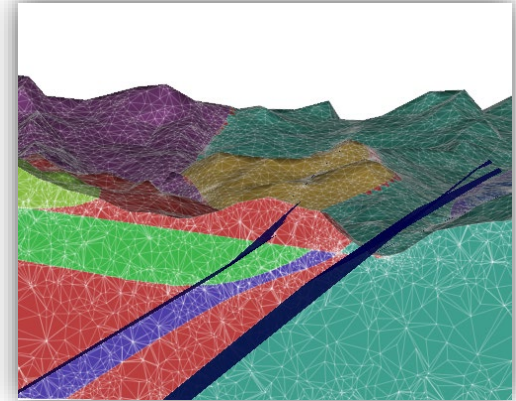
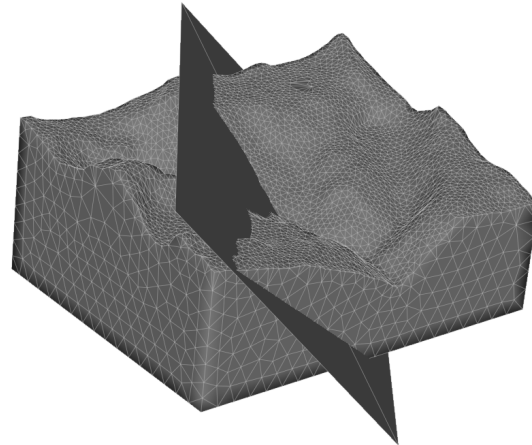
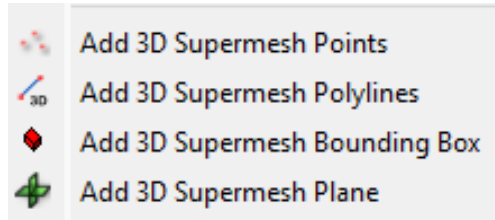
Id	Name	X	Y	Z [Top]	Z [Bottom]	Well Type	Rate (Flow)
1	a	3.56055e+06 [m]	5.63742e+06 [m]		430.589 [m]	Well BC	0 [m <sup>3</sup> /d]
2	b	3.56158e+06 [m]	5.63925e+06 [m]		369.358 [m]	Well BC	0 [m <sup>3</sup> /d]
3	c	3.56205e+06 [m]	5.63253e+06 [m]		378.897 [m]	Well BC	0 [m <sup>3</sup> /d]
4	d	3.56247e+06 [m]	5.63957e+06 [m]		334.335 [m]	Well BC	0 [m <sup>3</sup> /d]
5	e	3.56262e+06 [m]	5.63962e+06 [m]		328.746 [m]	Well BC	0 [m <sup>3</sup> /d]
6	f	3.57336e+06 [m]	5.62892e+06 [m]		429.299 [m]	Well BC	0 [m <sup>3</sup> /d]
7	g	3.57349e+06 [m]	5.629e+06 [m]		386.769 [m]	Well BC	0 [m <sup>3</sup> /d]
8	h	3.57451e+06 [m]	5.64957e+06 [m]		243.122 [m]	Well BC	0 [m <sup>3</sup> /d]
9	i	3.59181e+06 [m]	5.62875e+06 [m]		243.75 [m]	Well BC	0 [m <sup>3</sup> /d]
10	j	3.59189e+06 [m]	5.62843e+06 [m]		242.133 [m]	Well BC	0 [m <sup>3</sup> /d]

At the bottom of the window, there are buttons for 'Verify', 'Reset', 'OK', 'Cancel', and 'Apply'.

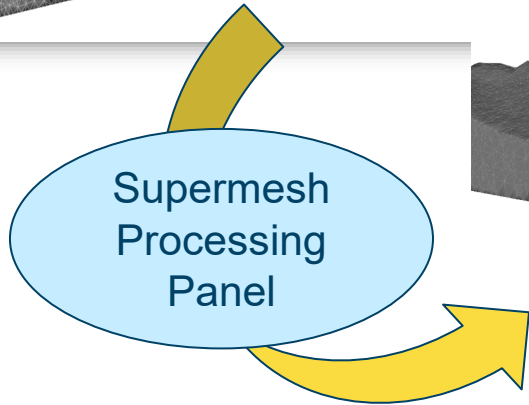
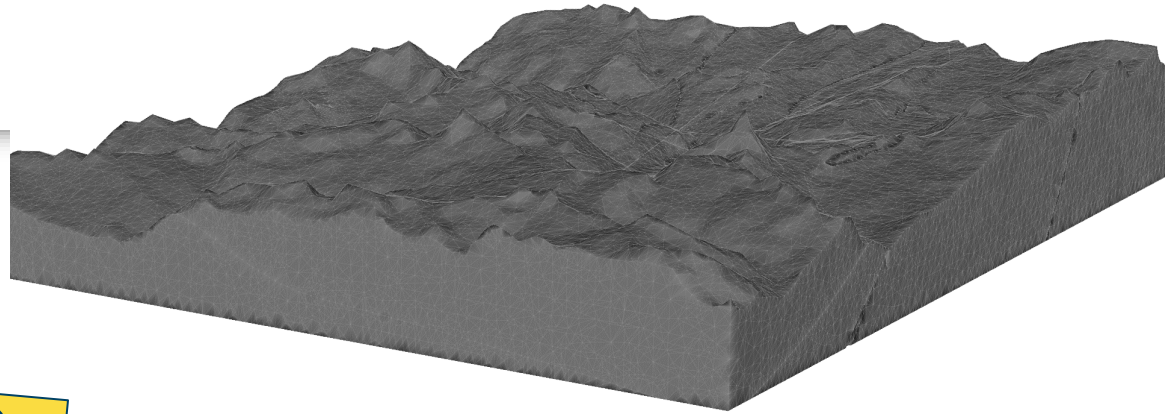
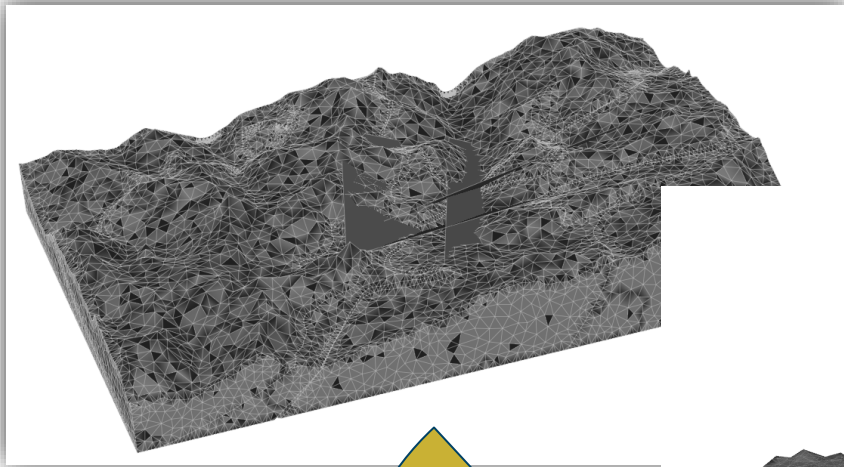
Easy access to all relevant well properties  
Just one-click to import hundreds of wells

# 3D Supermesh – Create and Repair

- A partnership with Geode-solutions, a technology company tackling future modeling challenges using advanced meshing techniques
- Repair any improper 3D data (geometries with non-conformities) such as surfaces and polylines to increase your success rate building a complex 3D mesh
- Easily integrate new datasets to the 3D Supermesh
- Included with all FM3/FMH3 licenses having valid SMA



# 3D Supermesh – Create and Repair



# Cloud Execution Panel

- New panel connects FEFLOW Desktop with Cloud resources
- Minimal user intervention and real-time monitoring of model results

Cloud Simulations

Remaining Credits: 825082

MIKE Cloud project folder: TEST

FEFLOW Model:  current  user-defined (local)  user-defined (cloud) ClosedloopReverseFlow.fem

FEFLOW Version: FEFLOW 7.5.01 Configuration: VM-S-40 (32 GB, 16 CPUs, 0 GPUs)

Buttons: Add Simulation, Delete Simulation(s), Import..., Export...

Buttons: Open result, Download result(s), Save result as..., Open Project in Browser, Upload and Run, Stop Run(s)

Show all simulations

Model	Status	Simulation time	Elapsed time	Cloud Output Folder	Progress	Download
exercise_cloud.dac (cloud)	Success	8000 d (# 139)	00:05:59 (simulation 00:00:07)	exercise_cloud_output (1)	Completed	Completed
Model-list	In progress		00:08:36	joblist_output	35.2 %	
3DVertical_v2.fem (cloud)	In progress	19.5 d (# 88)			48.7 %	
ClosedloopReverseFlow_budgets.fem (cloud)	In progress	3337.36 d (# 493)			57.1 %	

Cloud Simulations | Navigation | Autopilot | Planes | Scene Library | Log

<https://www.mikepoweredbydhi.com/products/mike-cloud/cloud-execution/>



**Thank you**

