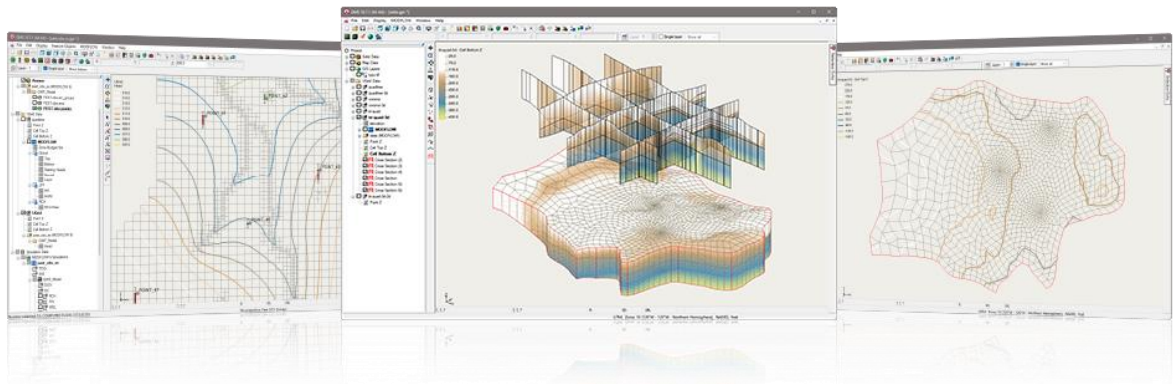


# GMS - Groundwater Modeling System



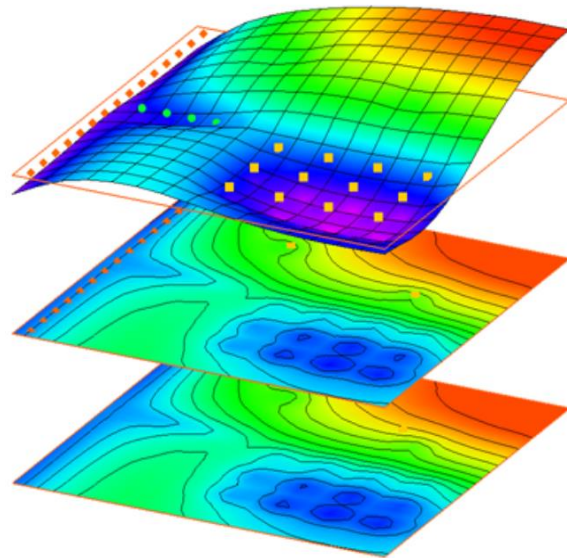
*Create 3D models with speed & simplicity using GMS - the most intuitive & capable platform for groundwater & subsurface simulations*



## Speed up & simplify model building with the conceptual model approach in GMS

Aquaveo pioneered conceptual modeling and have refined it over many years. That's why GMS is the quickest and most intuitive groundwater modeling interface available. Construct a high-level representation of the model using familiar GIS objects: points, arcs and polygons and easily update the model as needed. Conceptual modeling in GMS (including 3D visualization)

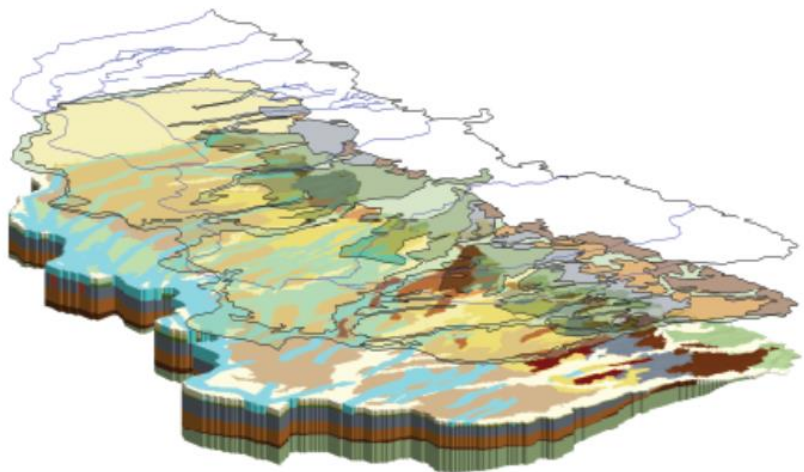
For models with simple geometry and boundary conditions, use the grid approach and edit values directly in the grid.



## 3D visualization optimized for performance

GMS is the most advanced software system available for performing groundwater simulations in a three-dimensional environment.

- Interact with models in true 3D
- Optimized OpenGL graphics for improved hardware rendering
- Create photo-realistic renderings
- Generate animations for PowerPoint or web presentations
- Drape images over the model and control the opacity
- Annotations
  - Add north arrows, scale bars, reference images, company logos, and more



# Import a variety of data formats & imagery

Models require data from many different sources. That's why GMS is built to easily import numerous file types:

- Raster images including georeference and projection support
- Topographical maps & elevation data
- Borehole data including stratigraphy and geophysical data
- Native

MODFLOW files

- MODFLOW files from Visual MODFLOW, Groundwater Vistas and PM Win

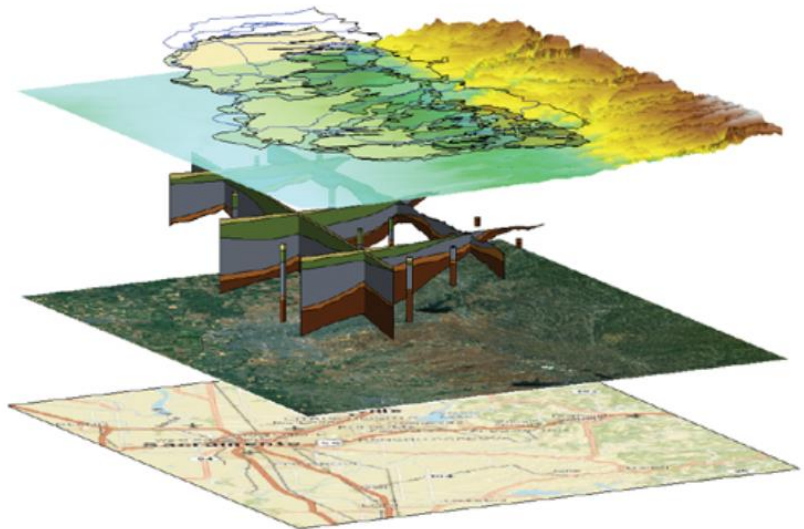
- Web data services such as TerraServer

- ArcGIS geodatabases and shapefiles

- CAD files

including .dwg, .dgn, and .dxf formats

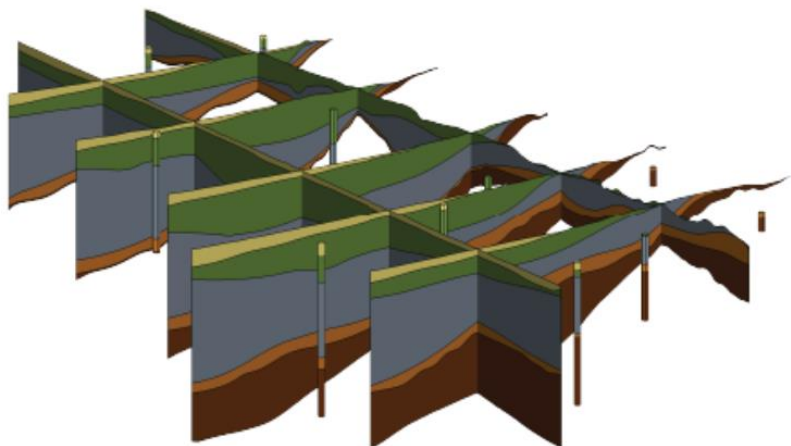
- Worldwide projection support including Cartesian and Geographic Systems
- File Import wizard for delimited text files and spreadsheets



## Advanced subsurface characterization

From cross-section editing to advanced probability statistics, GMS offers unparalleled subsurface modeling tools.

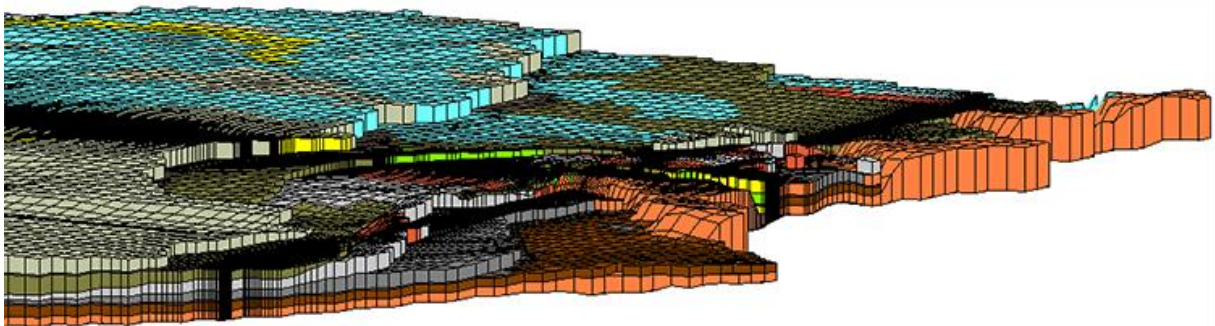
- Generate iso-surfaces from 3D data to visualize plumes



- Cut cross-sections anywhere through 3D data
- 2D & 3D geo-statistics – Kriging, IDW and Natural Neighbor
- Robust and fast algorithms to create solids from horizons

## MODFLOW Modeling with GMS

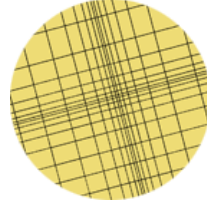
### Advanced three-dimensional groundwater modeling with MODFLOW



### Dedication to MODFLOW support

- All versions of MODFLOW supported: 6, USG, LGR, NWT, 2005, 2000, 96, 88
- Many MODFLOW packages supported (see table below) with more to come
- Guaranteed to read any model that MODFLOW can run
- Support for MODFLOW related packages such as MODPATH, MT3DMS, MT3D-USGS, RT3D, PEST, and built in ZONEBDGT
- Full suite of manual and automated calibration tools including PEST, Parallel PEST, Monte Carlo simulations, calibration targets, plots and charts
- Large model support (grid cells, stress periods) with smart memory management and caching for maintained responsiveness
- Transient data support in real date/time format
- Interpolation of transient data
- Stochastic Simulation tools including Monte Carlo, Latin Hypercube, Gaussian Field, T-PROGS (better than indicator kriging) and Risk Analysis wizard for capture zone and transport analysis.

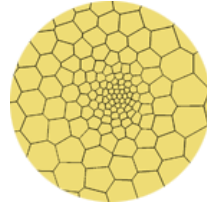
# . Structured or Unstructured Grid Options



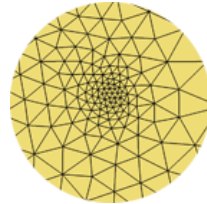
- **MODFLOW**  
**Traditional Grid**



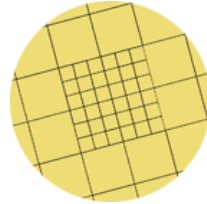
- **MODFLOW-USG**  
**Quadtree Grid**



- **MODFLOW-USG**  
**Voronoi Grid**



- **MODFLOW-USG**  
**TriQuad Grid**



- **MODFLOW-LGR**  
**Local Grid**

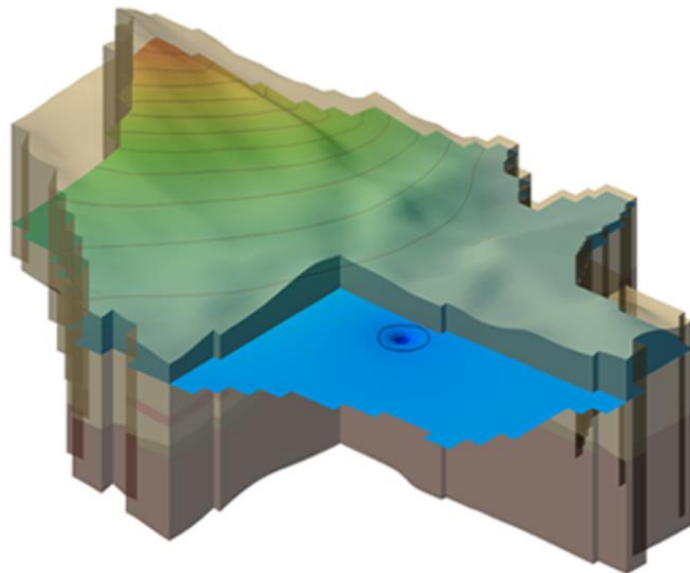


- GMS 10.7 supports a wide variety of structured and unstructured MODFLOW grids to provide the right solution for your modeling needs. Current GMS 10.7 licenses with MODFLOW receive MODFLOW-USG for free!

## Full 3D visualization

From cross-section editing to advanced probability statistics, GMS offers unparalleled subsurface modeling tools.

- Real time panning, zooming and rotating in 3D
- Optimized OpenGL graphics for improved hardware rendering
- Texture mapping of images on surfaces
- Transparency of contours, texture maps, surfaces, iso-surfaces
- Light source and specularity
- Cut away views to see the inside
- 3D cross sections at any angle
- Iso-surfaces
- Create animation videos - create fly-bys, animate transient data, moving cross sections

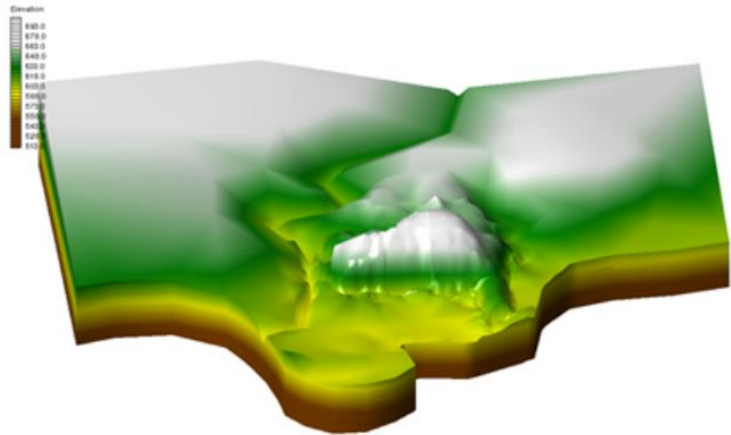


## Conceptual modeling

The MODFLOW tutorials provide step-by-step instructions for:

- Grid independent representation of model features using GIS type objects (points, arcs and polygons)
- Grid independent representation of stratigraphy using solids

- Grid independent representation of stratigraphy using point data and interpolation to MODFLOW layers
- Display of background images of maps, aerial photos etc.
- 2D and 3D interpolation and geo-statistics including kriging



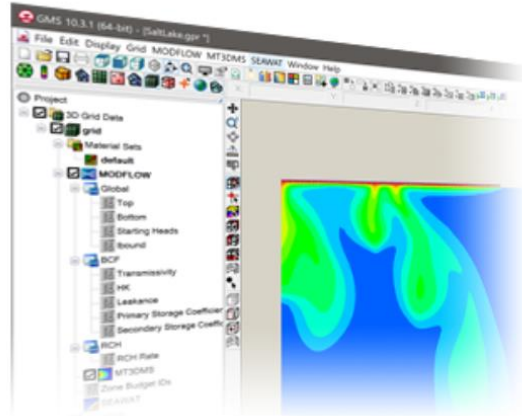
## GIS integration

- Tight integration with GIS data
- Open Geodatabases and Shapefiles directly in GMS
- Export Geodatabases and Shapefiles
- Integration with [Arc Hydro Groundwater](#) for powerful report and map generation inside ArcMap
- Worldwide global projection support including Cartesian and geographic (lat/lon)



# User friendly interface

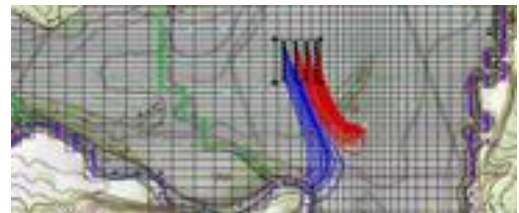
- Standard, intuitive, user-friendly windows interface
- Annotation tools for report generation
- Many step-by-step tutorials
- Complete help system
- Active forums with contributions from users and developers
- Full phone and email tech support
- Regularly scheduled training courses with expert modelers. On-site training available



## Transport Modeling with GMS

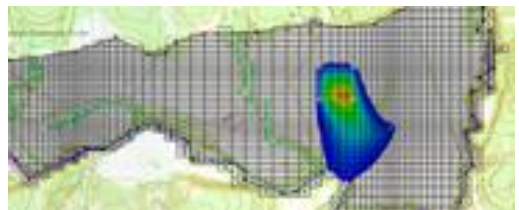
### MODPATH

MODPATH is a particle tracking code that is used in conjunction with MODFLOW. After running a MODFLOW simulation, the user can designate the location of a set of particles. The particles are then tracked through time assuming they are transported by advection using the flow field computed by MODFLOW.



### MT3DMS

MT3DMS is a modular three-dimensional transport model for the simulation of advection, dispersion, and chemical reactions of dissolved

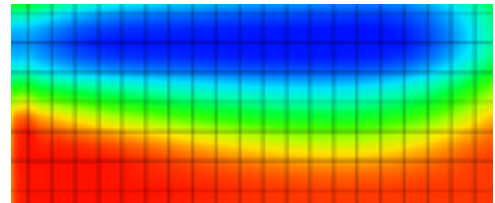




constituents in groundwater systems. MT3DMS uses a modular structure similar to the structure utilized by MODFLOW.

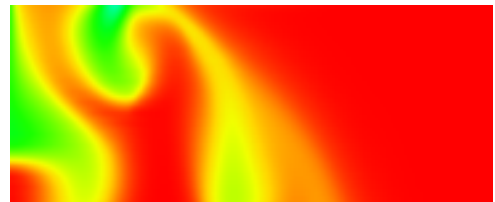
## PHT3D

PHT3D is a multicomponent transport model for three-dimensional reactive transport in saturated porous media. PHT3D is a combination of MT3DMS and PHREEQC-2. The PHREEQC component allows for a variety of low temperature aqueous geochemical reactions.



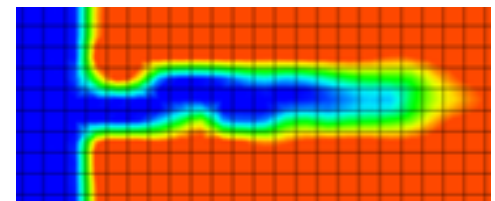
## SEAWAT

SEAWAT is a three dimensional variable density groundwater flow and transport model developed by the USGS based on MODFLOW and MT3DMS. SEAWAT v4 is based on MODFLOW 2000 and MT3DMS 5.2. SEAWAT includes two additional packages: Variable-Density Flow (VDF) and Viscosity (VSC).



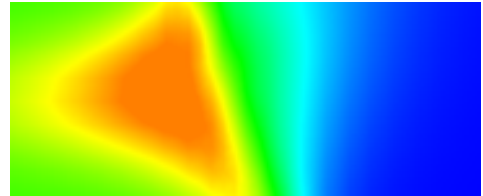
## RT3D

RT3D is a multi-species reactive transport model developed by the Battelle Pacific Northwest National Laboratory. RT3D is a modified version of MT3DMS that utilizes alternate Chemical Reaction packages.



## SEAM3D

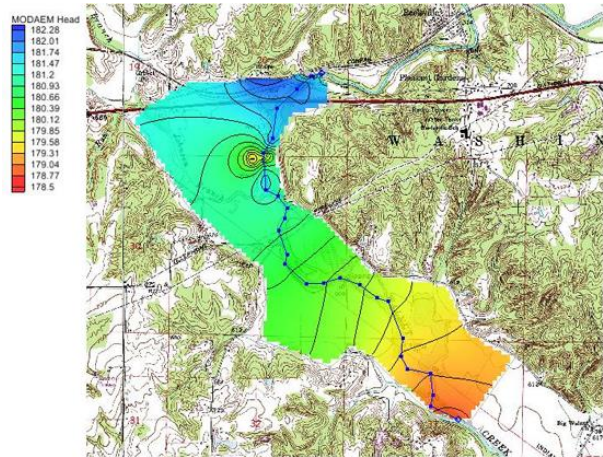
SEAM3D is a reactive transport model used to simulate complex biodegradation problems involving multiple substrates and multiple electron acceptors. It is based on the MT3DMS code.



## MODAEM

### Analytic Element Modeling

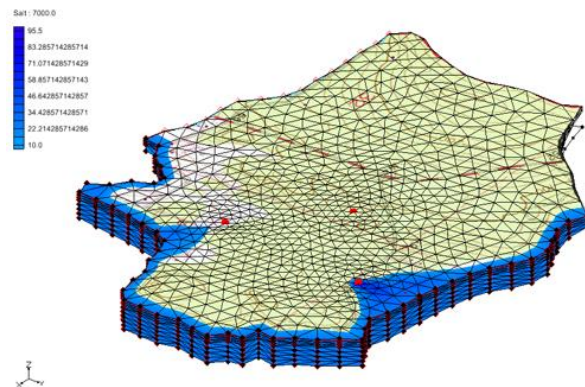
The MODAEM model is developed by Vic Kelson of Wittman Hydro Planning Associates in Bloomington, Indiana. Unlike finite difference and finite element models, analytic element models do not require a discretization of the problem domain. Rather the model is completely defined by boundary conditions, source/sink terms, and material property zones represented by points, polylines (arcs), and polygons.



## FEMWATER

### Finite Element Groundwater Flow & Contaminant Transport

A fully 3D finite-element model used to simulate density-driven coupled flow and contaminant transport in saturated and unsaturated zones. FEMWATER allows modeling of salinity intrusion and other density-dependent contaminants. Complex stratigraphy

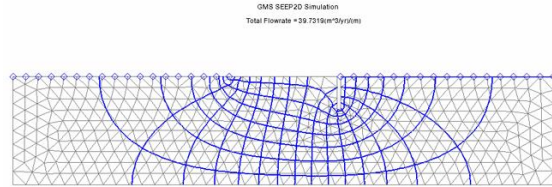


can be developed in GMS and directly represented in the model. Solutions can be displayed using realistic 3D plots and animation sequences.

## SEEP2D

### Earth Dam and Levee Analysis

SEEP2D is a two-dimensional finite element groundwater model developed by Fred Tracy of the U.S. Army Engineer Waterways Experiment Station (WES). SEEP2D is designed to be used on profile models (XZ models) such as cross-sections of earth dams or levees.

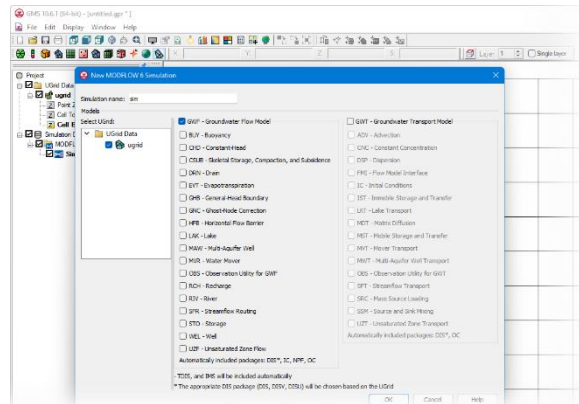


## What's new in GMS 10.7

The following is a list of the more significant changes in GMS 10.7.

### MODFLOW 6

GMS 10.7 adds support for steady state and transient PEST observations. New MODFLOW 6 features and the latest MF6 executable are also included along with updates to the MDT package as well as other improvements and bug fixes.



### UGrid Layer Visualization

Visualize the top or bottom of a UGrid layer or visualize both to make comparisons.

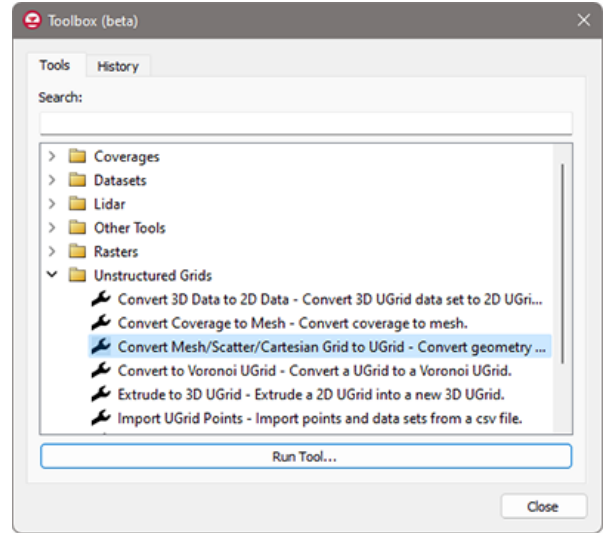
### Create Cross Sections

GMS 10.7 includes new tools for creating cross sections through a UGrid. Similar to cross sections in 3D Grids and 3D Meshes, UGrid cross sections can also be moved back and forth and rotated using the "Edit Plane" tool and can also be moved vertically above or below the UGrid.

## GMS Toolbox

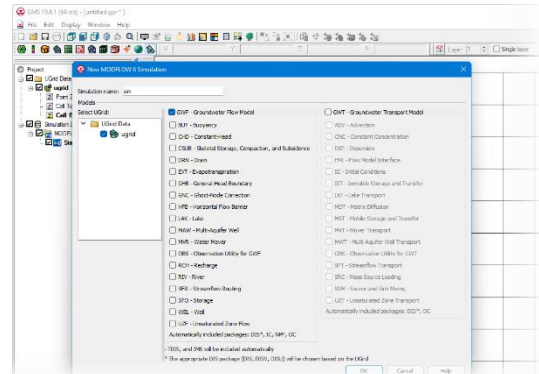
A new, general-purpose toolbox is now available in beta that allows GMS to execute Python scripts. These new tools help automate and simplify many workflows.

- Geometric Data: Manipulate and edit UGrids
- Map Module: Manipulate coverage data, trim arcs using polygons, convert arcs to polygons
- GIS Data: Manipulate raster and Lidar data, blend rasters, and perform multisource raster interpolation
- Datasets: Perform mathematical operations and operate on datasets attached meshes, scatter sets, or UGrids
- Other tools: Numerous additional tools are available and new tools will be added in future updates of GMS



## MODFLOW 6

GMS 10.6 supports all flow and transport capabilities in MODFLOW 6 in a more responsive user interface with improved map coverage functionality. All packages in v6.2.1 are supported.



## MODFLOW-USG-Transport Updates

The latest version of MODFLOW-USG-Transport (v1.8) is now supported in GMS 10.6 and includes support for the following packages:

- [MDT package](#) (matrix diffusion)
- [SMS package](#) - SOLVEACTIVE, DAMPBOT, SHIFT, TRUNCATEDNEWTON
- [RIV package](#) - MERGE\_BED\_K1
- [WEL package](#) – WELLBOT

## Customer Feature Requests

[Raster Display Options](#) - Separate contour options for each raster (first introduced in 10.5.5).

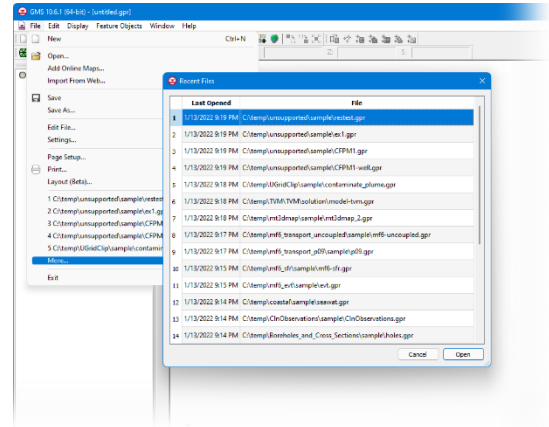
[Recent files list](#) - "More" option to see an expanded list of recently opened files.

## MODFLOW-NWT v1.2

The latest version of MODFLOW-NWT (v1.2) is now supported in GMS 10.6.

## mod-PATH3DU v2.1.5

The latest version of mod-PATH3DU (v2.1.5) is now supported in GMS 10.6.



## GMS 10.7 System Requirements

- **Operating System:** Windows 10
- **RAM:** 16GB or more recommended
- **CPU:** GMS software is CPU intensive. Some models and utilities integrated with GMS can take advantage of multiple processor cores simultaneously. We recommend the fastest CPU your budget allows.
- **Storage:** Recommended storage amount will vary depending on individual data requirements. Latest versions of GMS are very disk I/O intensive.
  - Mechanical hard drive: Basic performance
  - SATA solid state drive: Better performance
  - NVMe solid state drive: Best performance
- **Graphics:** A dedicated graphics card is better than integrated graphics. A basic or mid-range nVidia card designed for gaming works best.
- **Display Resolution:** 1920 x 1080 or greater