

HEC-EFM 6.0

April 2025

Release Notes

Version 6.0 supersedes version 5.0, which was released in September 2020. Installing version 6.0 will not overwrite any previous software versions. Also, the new version is backward compatible, which means that any HEC-EFM project files created with previous versions are fine and ready for use with version 6.0.

Version 6.0 is available as both an install package (.exe) and an archive of files (.zip). The install package guides the user through the install process and requires computer administrative rights for successful use. Installing with the archive of files does not require administrative rights. Simply extract all contents of the archive to the desired computer location and the software will be ready for use.

During numerical testing performed at HEC, version 6.0 exactly reproduced quantitative results generated with versions 5.0, 4.0, 3.0, and 2.0, but users are encouraged to verify their existing applications.

Version 6.0 is programmed in Visual Basic .NET. It includes several new features, improved software behaviors, and bug fixes for issues that were not detected prior to release of version 5.0. Language resources prepared for version 5.0 will need to be updated for use in version 6.0. The Quick Start Guide has also been updated and is currently the most complete and comprehensive source of information about the software.

There were 26 beta versions of EFM 6.0. An estimated 55 bug fixes were completed for new features in version 6.0.

Changes incorporated in the new versions follow:

New Features

- *Multivariate Analyses.* Inclusion of multivariate analyses is the main new feature in HEC-EFM 6.0. It is an advanced feature that required significant additions to EFM's computations, data storage, and output visualizations.

Multivariate analyses are especially important for EFM applications that map habitat characterized by more than one variable. For example, if an aquatic habitat has criteria for both depth and velocity conditions, EFM 6.0 can be used to apply criteria for both variables independently and to combine those results into a single measure of suitability, which is useful for habitat mapping and when tallying habitat provided. Previous versions of EFM accommodated independent assessments only.

In EFM 6.0, multivariate analyses are applied only for compound flow regimes (2-dimensional input).

Computations for multivariate analyses are done last during an EFM run because input to multivariate analyses are generated while computing results for individual flow regime-relationship pairings.

Multivariate analyses are set up via the EFM Relationships Tab as an option associated with ecovalue summations (Figure 1).

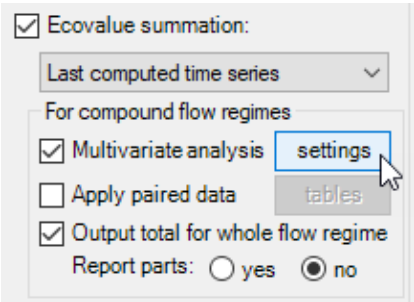


Figure 1. Multivariate analyses are created via the *Ecovalue summation* feature.

Clicking the “settings” button opens an interface that allows users to select the numeric method and flow regime-relationship pairings for the multivariate analyses (Figure 2).

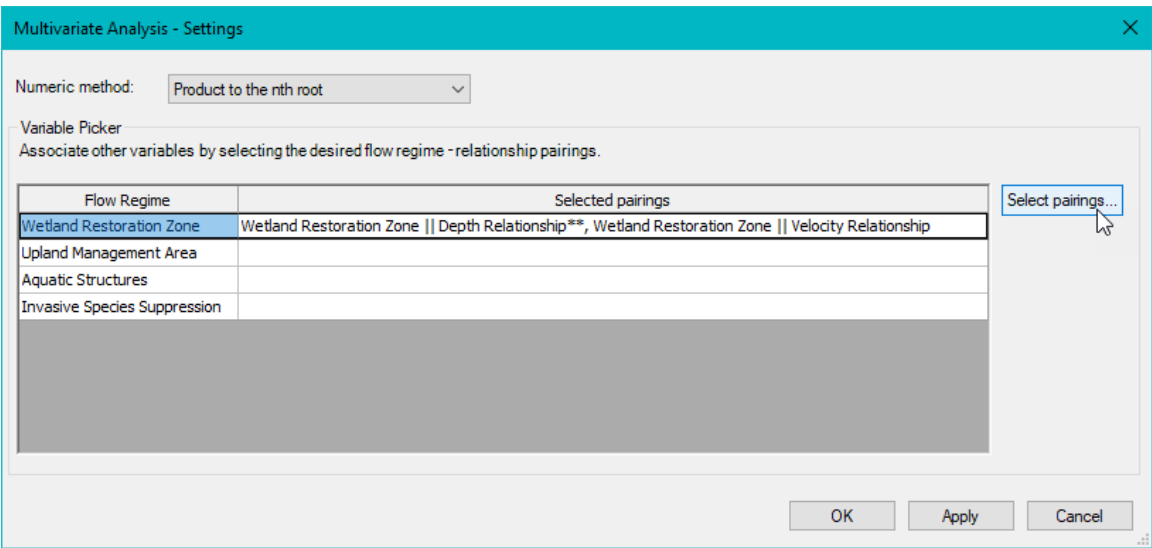


Figure 2. Multivariate analysis entitled “Wetland Restoration Area || Depth Relationship”. Four multivariate analyses could be created for the host “Depth Relationship”, one for each flow regime.

Clicking the “Select pairings...” button opens an interface that allows users to select the pairings relevant for the multivariate analysis (Figure 3). Pairings are offered for

each combination of (compound) flow regime and relationship (i.e., flow regime || relationship) in the EFM project.

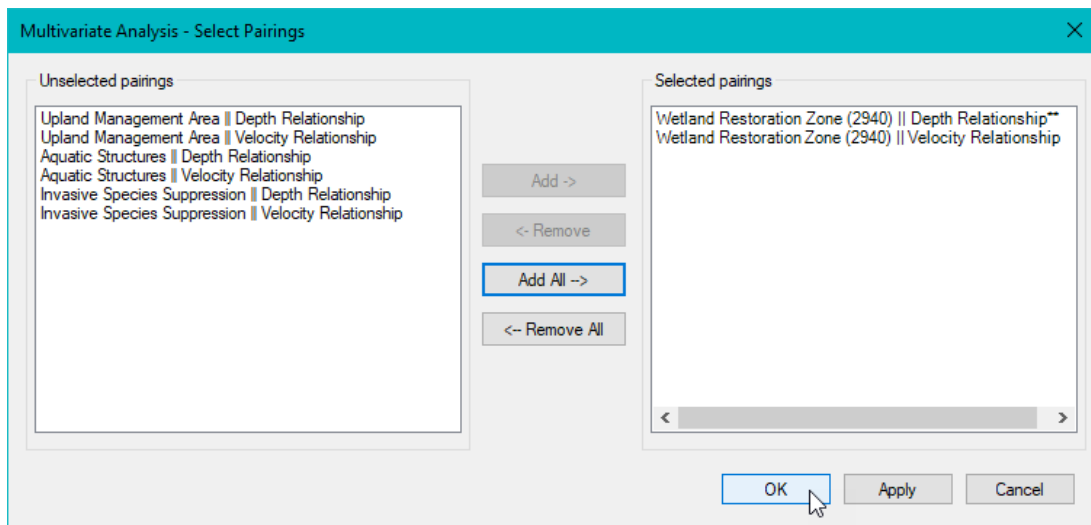


Figure 3. The “Select Pairings” interface allows users to pick which pairings to use in the multivariate analysis.

EFM 6.0 offers four numeric methods for multivariate analyses: “Product to the nth root”, “Product”, “Mean”, and “Minimum” (Figure 4). Please note that multivariate analyses in EFM and the associated numeric methods are intended to work with ecovalue time series based on suitabilities between 0 and 1.

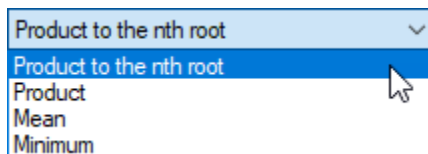


Figure 4. Numeric methods for multivariate analyses.

For each time step:

Product to the nth root combines ecovalues by multiplying the ecovalues of each selected pairing and then taking the nth root of that product.

Product combines ecovalues by multiplying the ecovalues of each selected pairing.

Mean combines ecovalues by summing the ecovalues of each selected pairing and then dividing that sum by the number of selected pairings.

Minimum combines ecovalues by selecting the minimum ecovalue of all selected pairings.

Several validations are done to help users create and manage viable multivariate analyses. There are a total of nine. All are applied at run time. The first seven are also applied as multivariate analyses are created to help preempt issues. When an invalid combination is detected, EFM notifies the user and identifies the failed validation.

Failed validations for the first seven checks are reported via the “Multivariate Analyses - Select Pairings” interface and at run time. For example, Figure 5 shows a selected pairing that failed validation “6”. The number of parts for the Aquatic Structures flow regime (20,380) is different than the number of parts for the Wetland Restoration Zone flow regime (2,940). Validation 6 checks that the number of parts for selected pairings are equal, which is a simple check intended to flag spatial discrepancies. Invalid selections can be saved, allowing users to continue working with their EFM projects, but will fail at run time.

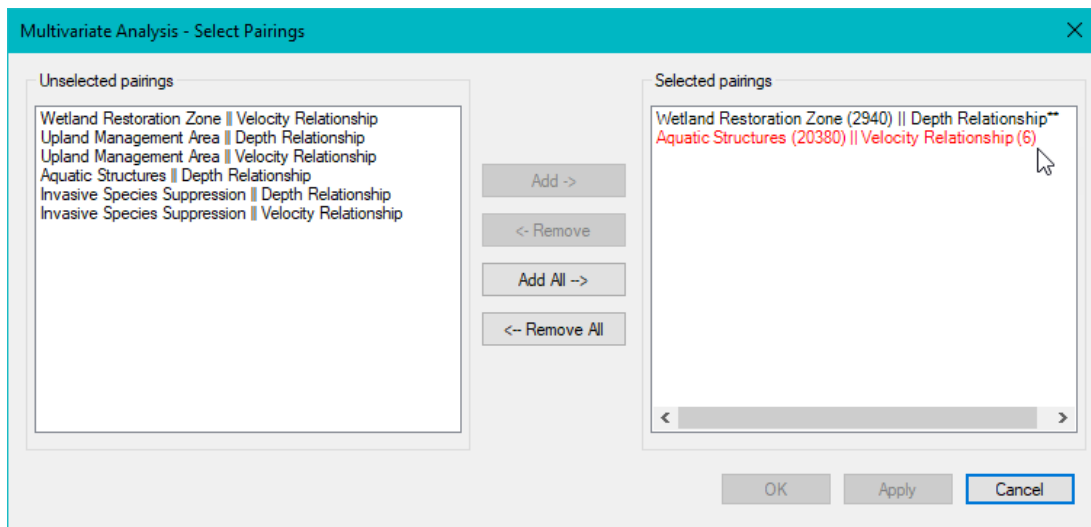


Figure 5. Failed validations are reported in the *Select Pairings* interface. Red text is used to highlight problems and includes the failed validation identifier (in this image, “6”).

Messages about run time validation fails (for all validations) are provided in EFM output tables and via pop-up windows that can be left open as a reference for users troubleshooting multivariate analyses (Figure 6).

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Ecovalue Summations – Multivariate

	Depth Relationship
Flow Regime	Ecovalue, total
Wetland Restoration Zone	Invalid (6)

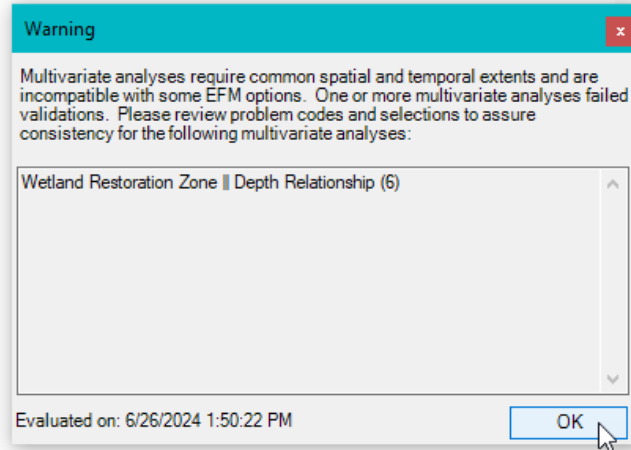


Figure 6. Validations failed at run time are reported in EFM output tables (left) and warning message windows (right).

During compute, ecovalue time series for each selected pairing are combined based on the numeric method chosen by the user. Combined ecovalue time series are then tallied in the same progression (see section 3.6.3) as done for other ecovalue summations: 1) daily combined ecovalue series, 2) tally for flow regime, 3) tally status at the end of each season, 4) tally total for flow regime, 5) tally for each season, 6) tally total for each season, and 7) a ranked set of seasonal totals from #6.

There is an *Apply paired data* option that allows the combined ecovalue series to be multiplied by a paired data set prior to tallying. For multivariate analyses, paired data associated with the host flow regime are applied via this option. The most common application of paired data in multivariate analyses is to multiply the combined ecovalue time series (in terms of suitabilities) by area per flow regime part (paired data) to compute time series of suitable habitat (in terms of area).

Results of multivariate analyses are stored in HDF and DSS and reported in EFM results tables. All DSS outputs for multivariate analyses are labeled with a c-part that includes “multivariate”.

Two style sheets (see section 5.3) are provided for rendering output tables of multivariate results, “Basic, multivariate only” and “Basic, multivariate only inverted”, the latter of which has flow regimes in rows and relationships in columns and is recommended when rendering multivariate results for numerous flow regimes or flow regime parts.

Improved Behaviors

- Several minor issues were identified and fixed, including assignment of prefixes and suffixes for EFM output naming conventions for compound flow regimes,

missing tool tips, typos in HDF preprocessor, and application of reverse lookup ranges.

- A synchronization issue related to changes in a shared code library was fixed that prevented EFM from generating a rating curve that was needed to translate flow results to stage and vice versa.
- A bug related to assignment of integer identifiers to geographical query tags was resolved. This was not a concern for EFM applications, but would affect batch geoprocessing actions in GeoEFM.
- An unusual workflow where an EFM flow regime was created using a flow time series and a rating curve, and the rating curve was initially declared as a stage time series by the user, led to missing data messages in EFM was patched to ensure that the rating curve was properly recognized.

Documentation

- The Quick Start Guide was updated to include descriptions of new features (sections added or revised: 6).

Language Resources

- Existing language files for EFM 5.0 would need to be updated prior to use in EFM 6.0. The following labels were altered or added in EFM 6.0:

Altered - 66, 302, 314, 1376

Added - 1456 to 1482

HEC-EFM Plotter Status

EFM Plotter helps users view EFM output and compare results. EFM and Plotter are separate software, but are intended for tandem use with Plotter opened via the *Plot – Activate HEC-EFM Plotter* menu option in EFM.

The latest version of Plotter (4.0) and corresponding release notes are available via HEC’s website. Changes incorporated in that version are summarized here to provide a convenient status update for EFM readers. For more detail about changes to Plotter, please see the Plotter 4.0 release notes.

- Multivariate Analyses (new feature). Output from EFM multivariate analyses are now accessible in EFM Plotter. A new “Multivariate” option was added to the “View results for:” list, which users can select to view multivariate results for whole or parts of the flow regime hosting the multivariate analysis (Figure 7).

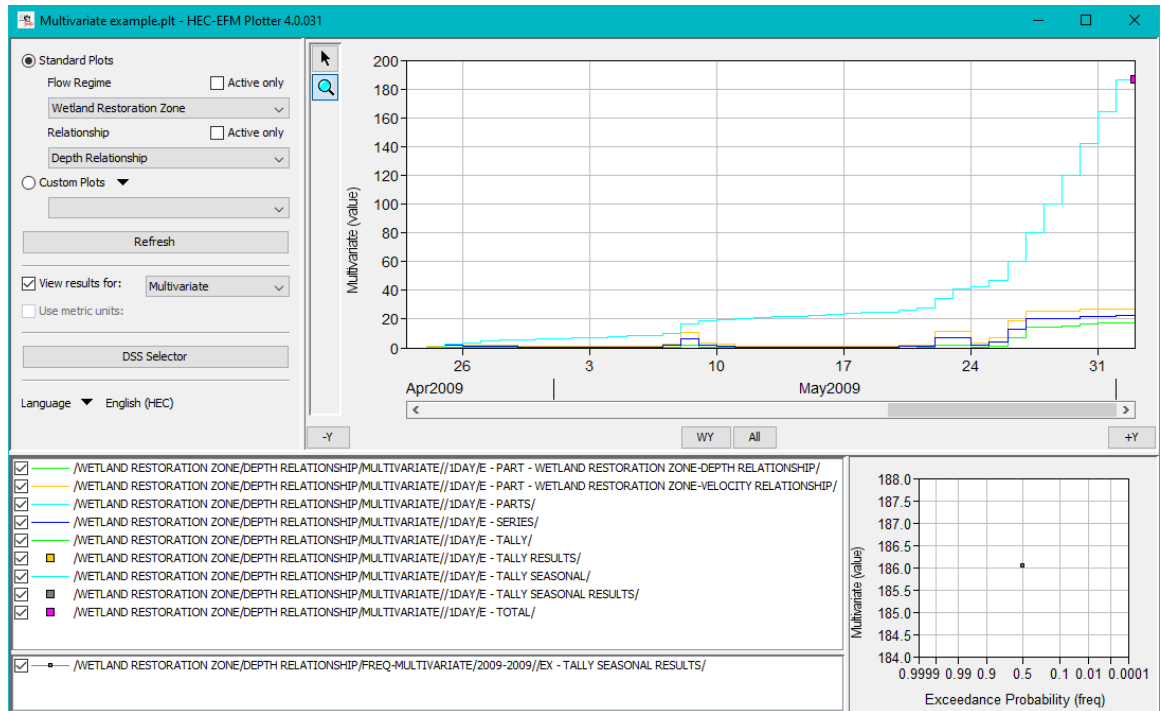


Figure 7. Multivariate results displayed in EFM Plotter.

- Viewing results for data types other than flow or stage (new feature). Plotter 4.0 allows users to specify the desired data type (i.e., c-part of the DSS output). This allows results of EFM analyses that use inputs other than flow or stage time series to be displayed such as storage, temperature, elevation, etc. (Figure 8). Flow and stage are already accommodated and do not need to be specified anew.

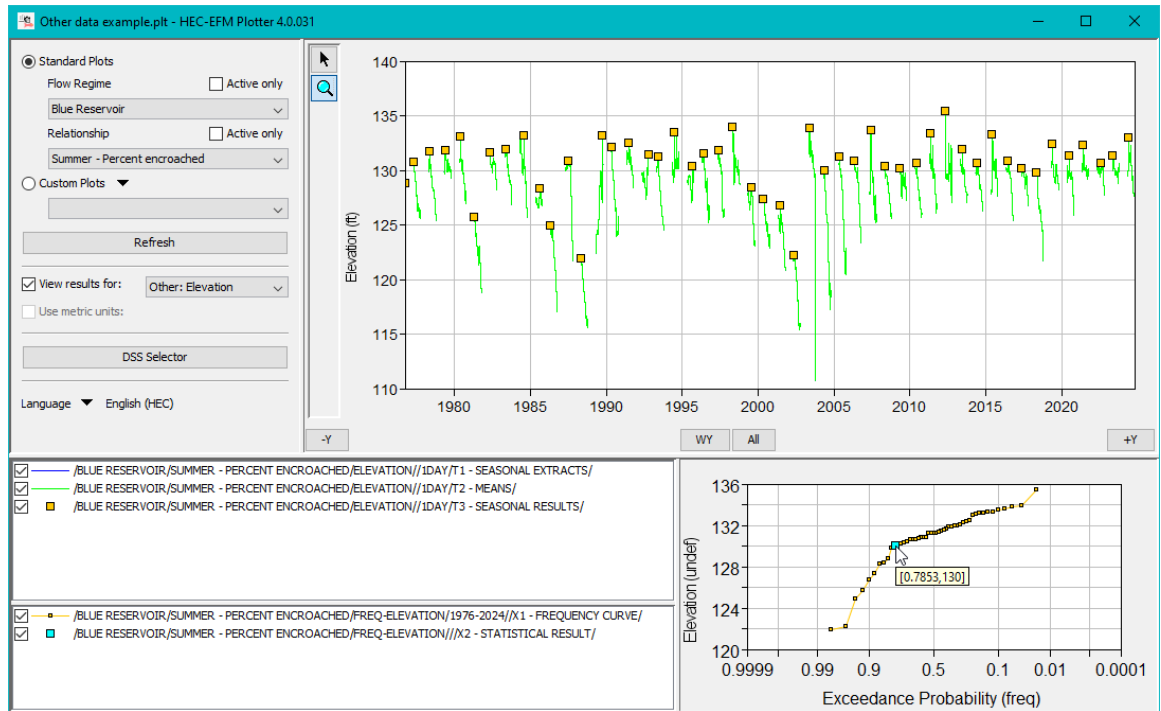


Figure 8. Example of “Other” data type (here, “Elevation”) displayed in EFM Plotter.

Options to add or remove “Other” data types are provided in the View Results for: dropdown list (Figure 9).

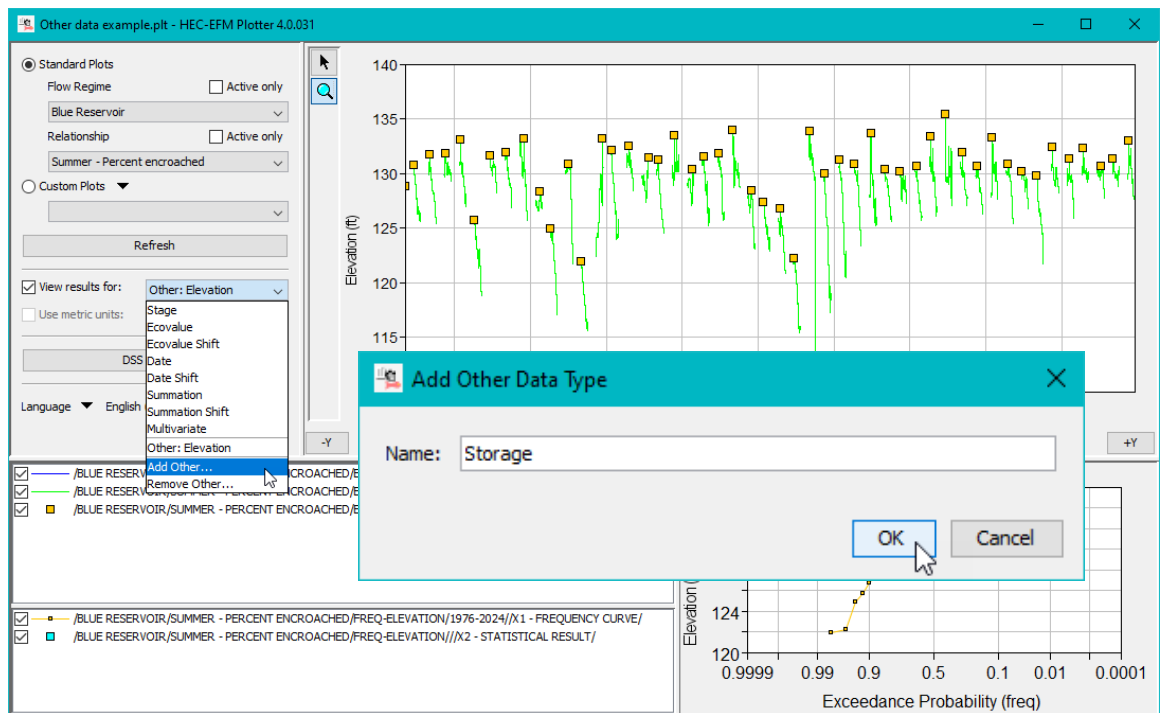


Figure 9. Option and interface for adding an “Other” data type in EFM Plotter.