

# 01 Interpolation Module - EOL in 2023

What	<i>nameofinstance.xml</i>
Description	Configuration for interpolation module
schema location	<a href="https://fewsdocs.deltares.nl/schemas/version1.0/interpolationSets.xsd">https://fewsdocs.deltares.nl/schemas/version1.0/interpolationSets.xsd</a>
Entry in ModuleDescriptors	<pre>&lt;moduleDescriptor id="Interpolation"&gt;   &lt;description&gt;General Interpolation Component&lt;/description&gt;   &lt;className&gt;nl.wldelft.fews.system.plugin.interpolation.InterpolationController&lt; /className&gt; &lt;/moduleDescriptor&gt;</pre>



This module has reached its end-of-life (EOL) status. This means that under normal circumstances, there will be no active development of this module. Configurators are recommended to use the [new Transformation Module \(Improved schema\)](#).

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## Interpolation Module Configuration

The Interpolation module generates data at desired locations or at desired points in time by means of either a serial or spatial interpolation technique. It is applied for the filling in of data gaps in measured on-line data, as well as to derive spatially distributed data for meteorological time series, such as precipitation and temperature, based on information available at neighbouring locations.

Two methods of interpolation are available;

### Serial interpolation

In serial interpolation mode, interpolation is done to fill any gaps in a time series. The interpolation module will only consider the time series itself in filling these gaps. Interpolation methods that can be used are;

- Filling of gaps with a default value
- Filling of gaps by linear interpolation
- Filling of gaps by block interpolation

- Extrapolation of gaps at start or end of a time series

All these methods can be configured to only fill gaps that are not more than of a given duration. Essential to the understanding of the Interpolation module is that the module does not have the capability to identify gaps due to potentially unreliable data in a time series. It will only provide an alternative value for those data points of which the quality flag is set to Unreliable. The validation module can be configured to identify unreliable data and set quality flags as appropriate.

## Spatial Interpolation

In spatial interpolation mode, the interpolation can be either applied to fill gaps in time series, or to create a new time series for a location using data from other (spatially distributed) locations. Spatial interpolation can also be applied for sampling scalar time series from grid time series, for re-sampling grids, or for creating grids from time series data. Different methods of spatial interpolation are available;

- spatial interpolation using Kriging
- spatial interpolation using Inverse Distance Weighting
- spatial interpolation using bi-linear interpolation
- Averaging of grid cells within a sub-basin boundary
- Averaging of grid cells within a sub-basin boundary using XML data
- spatial interpolation using closest distance
- input average times output Area
- Renka-Cline Triangulation
- Sum of grid cells within a sub-basin boundary.

## Note on spatial interpolation to polygons

Note that the spatial interpolation is written to aggregate grids to polygons, but not polygons to polygons or from point data to polygon averages. For example, performing Kriging with gauge inputs to a locationSet that are polygons will interpolate values for the centroids of the polygons only, and not calculate actual area averages. Aggregating data from smaller polygons to bigger polygons will not take into account the respective areas of the smaller polygons as weights.

## File system

When available as configuration on the file system, the name of the XML file for configuring an instance of the interpolation module called for example InterpolateHBV\_Forecast may be:

InterpolateHBV\_Forecast 1.00 default.xml

InterpolateHBV\_Forecast File name for the InterpolateHBV\_ForecastData configuration.

1.00 Version number

default Flag to indicate the version is the default configuration (otherwise omitted).

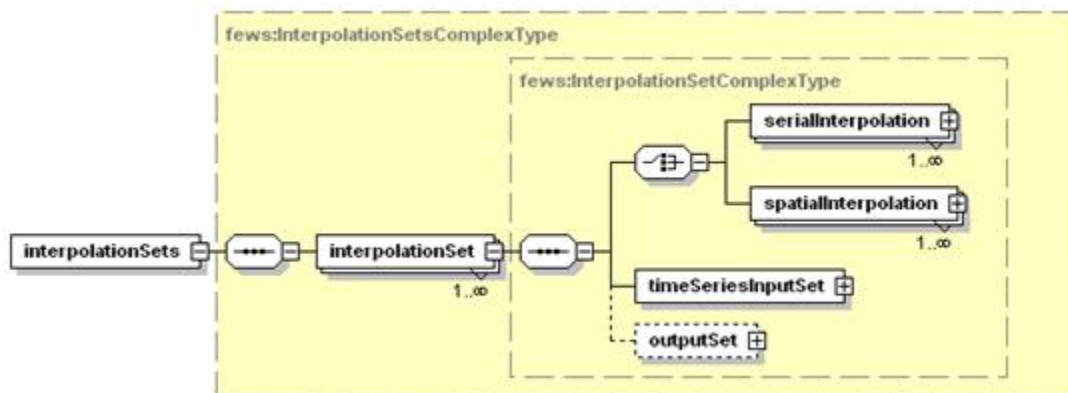


Figure 54 Root element of the interpolation module configuration

## interpolationSet

Root element for the definition of an interpolation step. Multiple entries may exist.

Attributes;

- **interpolationId** : Id of the interpolation defined. Used for reference purposes only. This Id will be included in log messages generated.

## serialInterpolation

Root element for the definition of serial interpolation options.

## spatialInterpolation

Root element for the definition of spatial interpolation options.

## timeSeriesInputSet

Input time series set. Note that when the interpolation module is used to fill gaps in time series the input time series set is the same as the output time series set. The time series sets may include either a single location or a locationSet. Note that the latter may not always be possible when using the "default" interpolation option, as the default may be location specific.

- `outputSet`

Output time series set. Note that when the interpolation module is used to fill gaps in time series the input time series set is the same as the output time series set. Identification is only required when the series generation option is used in spatial interpolation. The locations defined in this timeSeriesSet, and their geographical attributes, determine the locations of the series generated.

## Serial interpolation

The serial interpolation option is used to define interpolation options for filling gaps in the time series identified. Multiple methods of interpolation may be identified. These will be executed in order of definition for the same time series (e.g., first linear interpolation, then an extrapolation and finally filling remaining gaps with default values).

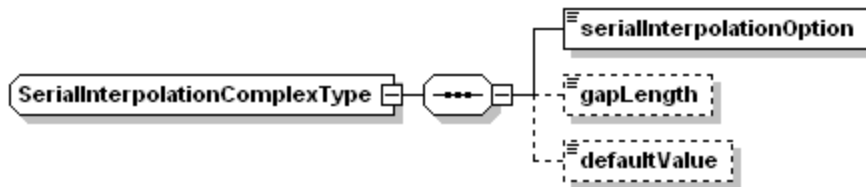


Figure 55 Elements for defining serial interpolation options in the Interpolation module configuration.

### `serialInterpolationOption`

Selection of type of serial interpolation. Enumeration of available options is;

- *linear* ; for linear interpolation between available values
- *block* ; for block interpolation (note: the last available value is then used until a new value available).
- *extrapolate* ; for extrapolation at start or end of series. Extrapolation uses the last or first value to fill the gaps at the end or start of the series.
- *default* ; for replacing unreliable values with a default.

### `gapLength`

Maximum gap length of unreliable data in seconds which will be filled using the interpolation option defined. If the gap is longer, then none of the values will be replaced.

### `defaultValue`

Default value to use to replace interpolation values.

## Spatial interpolation

The serial interpolation option is used to define interpolation options for filling gaps in the time series identified using available data from other (spatially distributed) locations. This method can be used to either fill gaps, or to create a new time series.

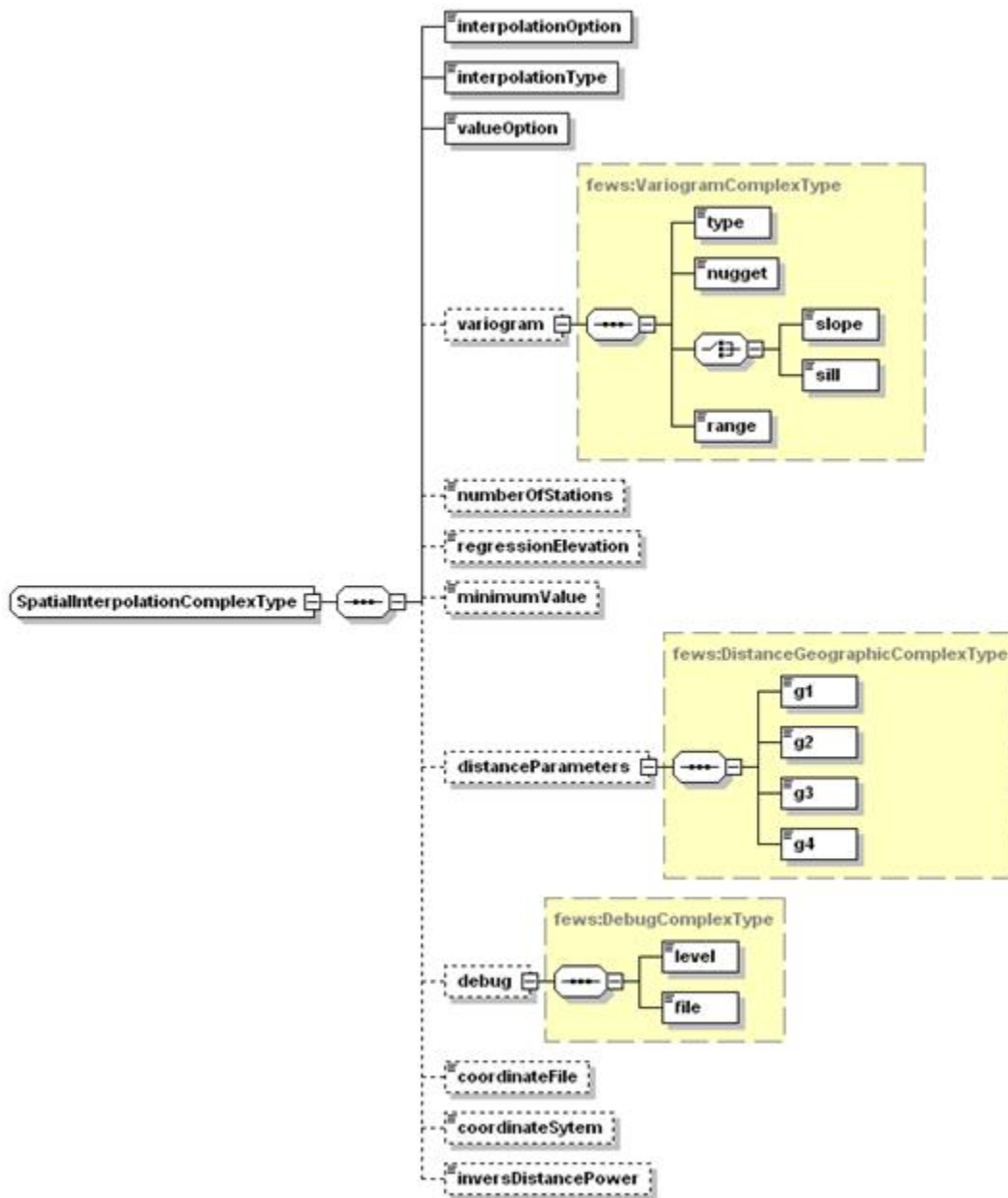


Figure 56 Elements for defining spatial interpolation options in the Interpolation module configuration.

### interpolationOption

Selection of type of spatial interpolation. Enumeration of available options is;

- *inversedistance* ; for inverse distance weighted interpolation between available values at spatially distributed locations.
- *bilinear* ; for bilinear interpolation between available values at spatially distributed locations.
- *kriging* ; for interpolation using Kriging between available values at spatially distributed locations.
- *gridcellaveraging*; for interpolation of time series based on averaging grid cells (used for example for establishing catchment averages where the catchment size is much larger than the grid cell size).
- *Closest distance*; for interpolation of time series based on the closest distance between available values at spatially distributed locations. An extra option is to interpolate from a grid to a longitudinal profile.

### interpolationType

Specify if spatial interpolation is used for filling gaps in series or for generating a new series. Note in the latter case the output variable will need to be defined. This also defines if the output variable is a grid time series or a scalar time series. The available options are:

- *seriesfilling*: for filling gaps in time series (scalar timeseries only).
- *seriesgeneration*: for creating a new time series.

### valueOption

Option to determine how input values are used. Enumeration of available options is;

- *normal* ; for using values as is.
- *residual*: for applying linear regression first and applying spatial interpolation on residuals of values only.
- *splitwithelevation*; for applying different linear regression parameters above and below an elevation split (required only when elevation is considered).

### variogram

Root element for the semi-variogram to be used when Kriging is applied.

#### variogram:type

Type of variogram to be used. Enumeration of available options is;

- *Gaussian* ;
- *Exponential* ;
- *Linear* ;
- *Spherical* ;
- *Power* ;

is the correlation coefficient, and the distance between parameter pairs.

#### variogram:nugget

Nugget of the variogram (parameter b in linear type)

#### variogram:slope

Slope of the variogram. Used for linear variogram types (parameter a) and for interpolation points that coincide with a sample point.

#### variogram:sill

Sill of the variogram (for all types except the linear type).

#### variogram:range

Range of the variogram (for spherical, Gaussian and exponential types only).

#### numberOfStations

Number of stations to consider in spatial interpolation. Used in Inverse distance when taking a limited number of stations into account. The nearest stations will be used in preference.

#### regressionElevation

Elevation level at which the regression split is applied.

#### minimumValue

Minimum value of the output data. For interpolation of rainfall data this should be set to zero. Numerically the interpolation may produce invalid (negative) data.

### distanceParameters

Distance parameters for computing actual distances between locations when projection is geographical (WGS1984). Four parameters are required.

### debug

Optional debug level. Spatial interpolation is implemented through a DLL. This can produce a log file, depending on level specified. A setting of 1 is the lowest level, a setting of 4 is highest (can produce very extensive log files).

### coordinateFile

Coordinate file allocating grid cells to be considered per location. This coordinate file follows a specific format. Locations to be interpolated to are indicated through their spatial location. After each location a list of grid cells (m,n coordinates) to be considered is included.

### coordinateSystem

Indicates if coordinate system is longitude-latitude this is defined as 1. If not 0 is used and distances are calculated in metres.

### inverseDistancePower

Power applied to the inverse distance interpolation.