REBEKA Update 2.4
New possibilities and improvements

Reading of rainfall data in text format TXT

Until now, only rainfall data in KMD format could be read in REBEKA. From version 2.4 it is possible to read in data in a line-based text format. This format (hereafter referred to as TXT) is already used in WaterElements and looks as follows:

- Optional comment lines, which must start with a # character.

- Data lines with the following structure:

  - 1st column: date/time in the format DD.MM.YYY hh:mm
    Example: 03/14/2003 13:10

  - Tab as separator

  - 2nd column: precipitation depth per time step (10 min) in mm (e.g. 1.2)

Lines with precipitation depth 0 mm do not have to be present. It is assumed that the time step is 10 min. At the moment no other time steps can be used. Reading in the data is done via the menu item "File / Read Rainfall Data (TXT)". After selecting the rainfall file, the minimum dry period between rainfall events must be entered. The default value is 60 min. This value determines the division of the rainfall data into rainfall events. If there is no rainfall for more than 60 min, a new rainfall event is defined. This value determines the number of rainfall events in the whole rainfall series and therefore the total initial losses (if the defined initial loss per event is not adjusted) as well as the net rainfall, the emission and the emission parameters. It has mostly a small influence on the immissions i. If continuous data with precipitation depths 0 mm are read in, it is recommended to save them in TXT format (menu item "File / Save Rainfall Data as TXT). Then the lines with zero values are not saved and the rainfall data file becomes much more smaller. Nevertheless, it is recommended not to overwrite the original rainfall data file, but to choose another name when saving. The new and smaller file can then be used for working. It will be loaded faster.

Since there is currently no update of REBEKA DIM with this functionality, the loaded rainfall data can also be saved in KMD format (menu item "File / Save Rainfall Data as KMD). This allows a conversion of rainfall data from TXT to KMD format in REBEKA 2.4.

At the moment no other line-based text formats are supported. This is planned in the next (then free) update. A conversion to the above TXT format may be possible in Excel, but it is rather tedious and time-consuming due to the amount of data (if zero values are present). WaterElements allows conversion from many formats to TXT. There is also a manual for this.

Data conversion is also relatively easy with Python and the Pandas module. Below is an example for the conversion of Meteo Switzerland rainfall data (date/time in UTC):

```python
import pandas as pd

filename = r'C:\Data\aRebeka\Regendaten\order_3456_data.txt'
df = pd.read_csv(filename, sep = '\s+', header=0, skiprows=2, encoding='ANSI',
na_values='-')
print(df.head()) # displays the first few lines of the dataframe df (just for control)
df.time = pd.to_datetime(df.time, format="%Y%m%d%H%M")
df = df[df.rre150z0 > 0] # only lines with rainfall depth > 0
print(df.groupby(df.time.dt.year)['rre150z0'].sum())  # output of annual sums for control
outfilename = r'C:\Data\aRebeka\Regendaten\order_3456_pyWE.txt'
df[['time', 'rre150z0']].to_csv(outfilename, header=None, index=None, sep='\t',
date_format='%d.%m.%Y %H:%M', float_format='%.1f')
```

If the above Python code (after adjusting the two paths (red)) is saved in a file sma2txt.py and executed in a console (python sma2txt.py), then the conversion should work (Python and Pandas must be installed, of course). If it does not work, please ask!

Possibly this conversion is also offered as online data conversion.

Simulation improvements

The following new option has been introduced in the simulation:

Offline overflow tanks are no longer emptied during the simulation period (i.e. during rainfall). Before a new rainfall event, water volume and pollutant loads in the tank are calculated under the assumption that emptying with a certain pump capacity took place during dry weather. The pump capacity can be specified in the combined and separated sewer system.

Combined sewer system: offline tank   Combined sewer system: online tank
Pump capacity activated   Pump capacity deactivated

This calculation is only active if the option "New Calc. of Tank Emptying" is activated in "Settings / Simulation".

It is automatically deactivated in continuous simulation, since pumping out with a defined pumping capacity is not yet implemented in this mode.

This new calculation in offline mode is more realistic than the previous one. In all cases, it is also no longer assumed that the tank is empty at the beginning of a new rainfall event. This makes simulations with large tanks and slow emptying more accurate.

## Additions to the Results of the Deterministic Simulation

The following additional information is displayed for the results of the deterministic simulation:

- **In 'Project':**
  Total Duration *[a]:* e.g. 10.000 (Decimal places are displayed for exact additional calculations, e.g. in Excel)
  Outflow to File   none/filename
  Continuous Sim.   Yes/No
  TSS Calculation   First Flush/Mischrechnung
  each run with same random numbers   Yes/No
  Calc. Time after Rainfall [min]   e.g. 300
  New Calc. of Tank Emptying   Yes/No

- **In 'Combined Sewer System (CSS)':** *Q Pump [l/s]*

- **In 'Separate Sewer System (SSS)':** *Q Pump [l/s]*

- **In 'Rainfall/Receiving Water':**
  Shortest Dry Weather Period [min]   e.g. 60
  Calc. Bedload Begin with d90   Yes/No
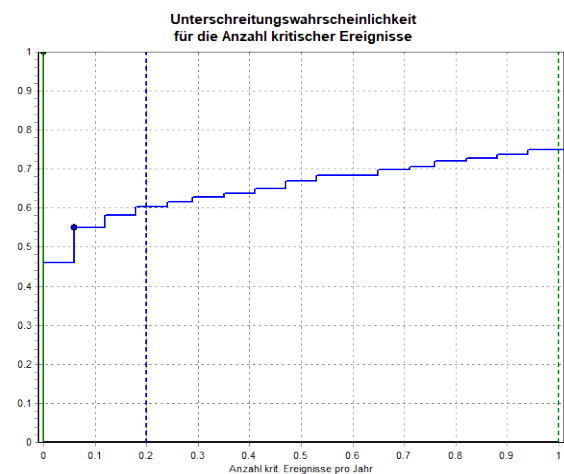 *Calc. of pH Mixing (default = simple = 0)*   0/1/2

With this, all settings and results of a project should now be visible in one column with "clipboard" and 'Paste' in Excel.

Results of the Stochastic Simulation

The results of critical events (bed load, NH3, turbidity) per year (file *_st.csv) are now stored with 2 decimal places, so that the representation of the probability curves is more exact. This only has an influence for rainfall series not equal to 10 years, because at 10 years the number per year is exact to 1 decimal place. In the following an example of a rain series over 17 years is shown:
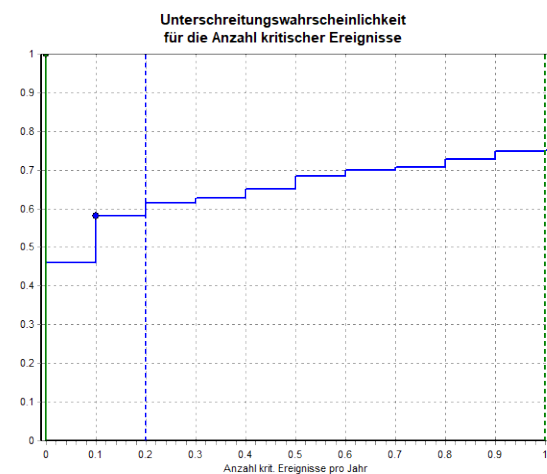
Old representation of NH3 toxicity at 17 years of rainfall

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