

Introduction

- The calculations of the predicted environmental concentrations (PEC) of active substances in surface water are based on a "single year" approach with an initial 6 year warm-up phase followed by 16 months of the year selected by the FOCUS group
- Unlike in groundwater with a 20 years assessment period, surface water exposure calculations based on a "single year" approach can be strongly affected by individual rainfall events (EFSA, 2013) which was discussed repeatedly by authorities, industry and academia (Klein, 2013, Goerlitz, 2015, Bach, 2016, Poulsen, 2016)
- In order to address the "single year" problem a preliminary approach for multi-year calculations is presented similar to the groundwater procedure
- Weather data for selected scenarios and crops, including rainfall and irrigation, were extended to 20 years using the original FOCUS weather data. The aim is to contribute to the development of an improved and generally accepted approach for surface water calculations representing a realistic worst case based on a robust evaluation

Aim of this work

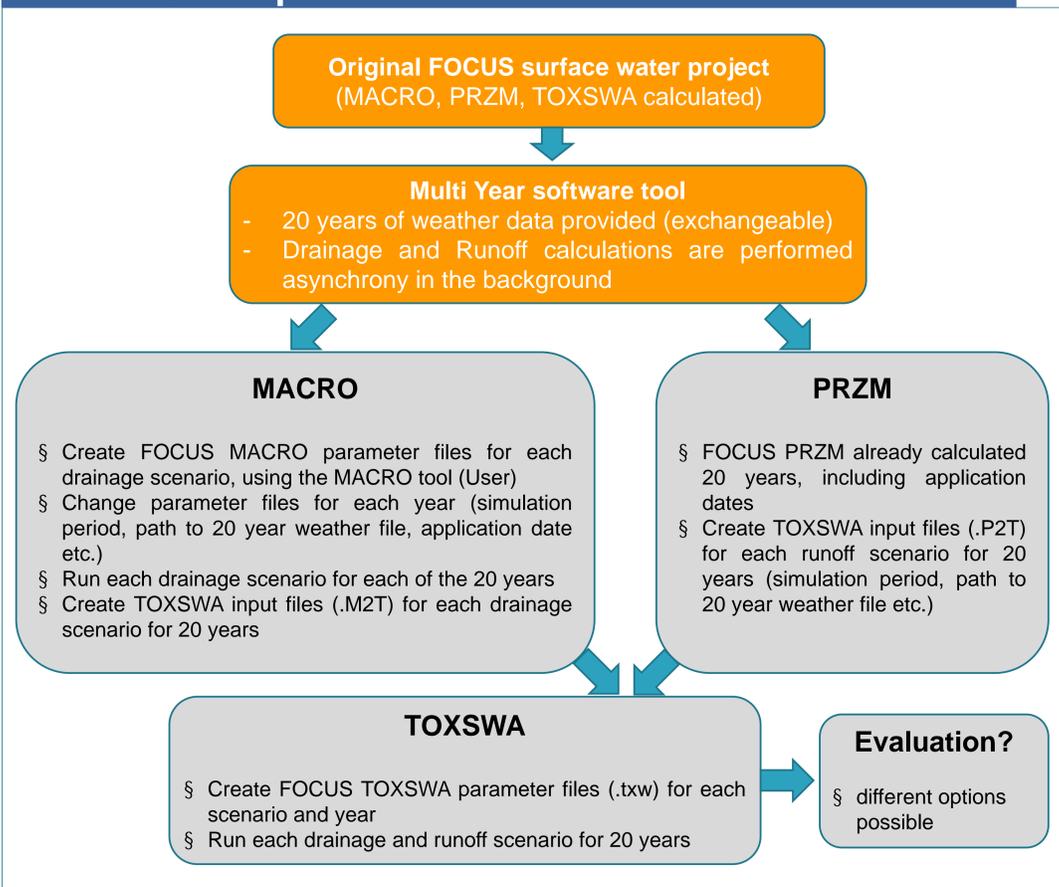
In order to provide an interim solution for FOCUS Multi-Year calculations a software tool should be developed which enables the user to:

- Do FOCUS Multi-Year calculations with only a few clicks
- Evaluate the results by selecting a method appropriate for the user (e.g. 80th or 90th or worst-case PEC_{SW})

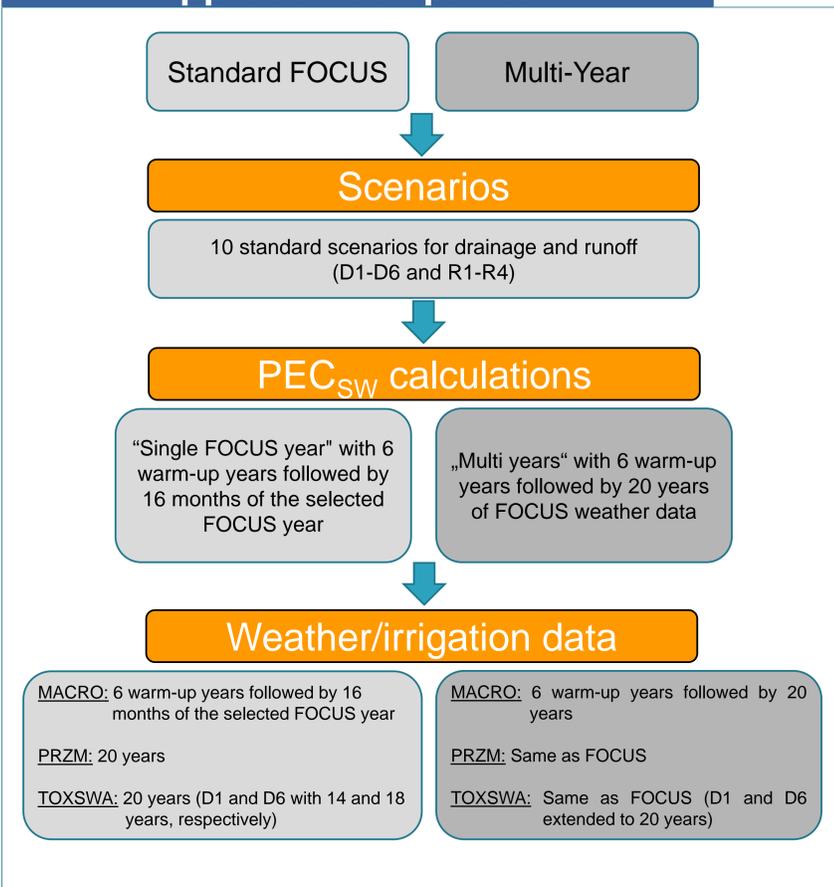
The tool should:

- Use the original 20 year FOCUS data
- Automatically generate all necessary input files
- Evaluate the results to specific needs
- Be easy to use and modular built for further extensions
- Programmed in a way that allows easy changes according to official technical recommendations

Conceptual model of the software tool



Approach comparison



Technical approach

The technical approach is based on the standard FOCUS Surface Water modelling using SWASH, with the exception of an extended simulation period. No changes to scenario parametrization were undertaken.

- In case of **FOCUS PRZM**, 20 years weather files already implemented in the model.
- For the multi-year drainage calculations, the complete original FOCUS weather files were used to extend the **FOCUS MACRO** weather data. Scenarios D1 and D6 (included only 14 and 18 years, respectively) were extended to the same length as the rest of the files, using the given weather data. Additionally, six years of the "warm-up" period were added similarly to the standard FOCUS MACRO calculation procedure.
- For the **MACRO** irrigation files, in scenarios D3, D4, D6, it was not possible to reproduce the irrigation dates as defined in the available 7 year period files, due to insufficient information on the parametrization of the ISAREG model performed during the FOCUS SW development. Therefore, a reasonable approximation of the extended irrigation schedule was performed.
- FOCUS TOXSWA** weather files also contain the whole 20 year period. Scenarios D1 and D6 (only 14 and 18 years, respectively) the weather files were amended in the same manner as for the MACRO model.
- A software tool with graphical user interface was developed to generate and change all MACRO, PRZM and TOXSWA files automatically, using a standard SWASH project as template. This includes parameters like e.g. application dates (PAT) and interception of irrigation (ZFINT) for each application day, using standard FOCUS approaches and models.

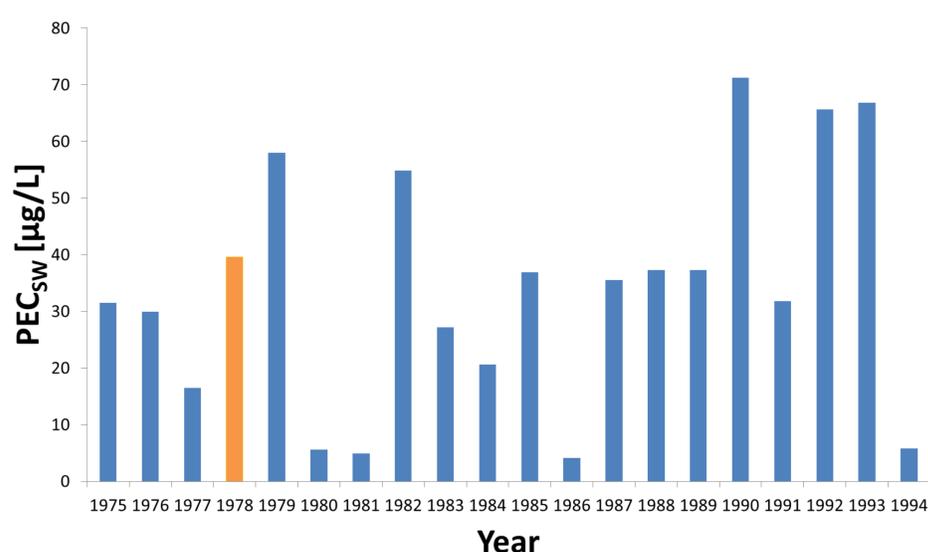


Figure 1: Example calculation for R1 stream. Maximum PEC_{SW} values from 20 years (selected FOCUS year in orange).

Results

- The software tool was developed and alpha-tested
- Extended weather data, for all standard FOCUS models, covering a period of 20 years (1975-1994) were created using FOCUS original weather data
- The approximation of the extended irrigation files in MACRO, resulted in reasonable and comparable values
- The extended data was used to calculate different test compounds and scenarios (the selected FOCUS year could be reproduced)
- All scenarios have different PEC_{SW} values over the 20 years (Figure 1), with larger differences between years for larger application rates
- Sometimes, the TOXSWA tool failed to calculate one year, due to high rainfall events. A change of the simulated time steps (implemented in the tool) often solved the problem (with slight differences in PEC values)

Conclusion and Discussion

- A software tool was developed that allows to perform FOCUS Multi-Year calculations in a easy way
- The underlying approach using FOCUS standard models and scenarios was successfully established and automated
- The different PEC values between the years gave a good overview of the general problem of the "single year" approach by FOCUS
- A statistically robust and reasonable approach for the evaluation of the multi-year results is still not officially available. However the tool provides different options for evaluation methods (e.g. 80th, 90th percentile or worst-case PEC_{SW})

The software tool is available for beta-testing to a limited number of persons upon request. The final version will be available for free via common sources for a broad community.

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