Update of FROGS and adaptation to PEARL 4.4.4 and FOCUS groundwater II guidance

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FROGS (French Refinement of Groundwater Scenarios) is a PEARL-based simulation tool considered as a higher-tier option within the authorization process for plant protection products in France. The current FROGS 2.2.2.2 (FROGS 2011) is based on PEARL 3.3.3 and was published in July 2011. Meanwhile, the new FOCUS-PEARL 4.4.4 has been released, which incorporates various updates and amendments recommended by the FOCUS groundwater group (FOCUS 2009). Consequently, the FROGS development group decided to update the tool to (i) adapt it to PEARL 4.4.4, (ii) integrate the adaptations from FOCUS (2009) that were considered to be appropriate and meaningful to the specific FROGS assumptions and (iii) improve the method for allocating crop surfaces.

Inclusion of PEARL 4.4.4 and its new hydrologic model version of SWAP 3.2.34

Technically, the main change in FROGS to adapt it to PEARL 4.4.4 is the adaptation of the input template file. This update eliminates crashing of PEARL runs (9 out of 1481 scenarios aborted in the previous FROGS version due to a problem with the former SWAP version) so splitting of rainfall events over several consecutive days in selected scenarios is no longer required and allowed the inclusion of 4-year crop rotations.

Adaptations to the FOCUSgw II guidance implemented in FROGS 3.3.3.3

- The most appropriate method for calculating reference evapotranspiration for Southern European scenarios and conditions according to FOCUS, 2009 is considered to be the FAO method. As France belongs to the Southern regulatory zone, this method was implemented.

- In accordance with FOCUS (2009) harmonisation of the implementation of crop factors, which are needed for the calculation of actual evapotranspiration, was adopted.

- 80th percentile $\text{PEC}_{gw}$ is calculated according to FOCUS (2009) based on the annual average of the 16th & 17th highest $\text{PEC}_{gw}$ values.

Some points that changed in FOCUS (2009) compared to the former guidance have not been adopted. Thus, the extensive method in which realistic irrigation amounts were identified for the previous FROGS version was kept and the adaptation of rooting depth up to the target depth was not considered relevant since rooting depth was already limited to the target depth in the previous version of FROGS.

Additional updates implemented in FROGS 3.3.3.3

- New mitigation template to enable mitigation based on soil pH.

- Finally, the approach to allocate crop surfaces within the agronomic units (AU) was improved: the surface of each combination of soil, crop and AU is now estimated using the cultivated area of each crop within each AU (based on the 2000 agricultural census), the distribution of soils in the cropping region and the area of each soil
within each AU. This results in ca. 25% fewer scenarios (1097 in total in FROGS 3.3.3.3) and in a more accurate total area modelled for each crop.

Results

Test runs were conducted with FOCUS dummy substances D, C and Met-C to evaluate the overall effect of the changes. Example results are provided in Figure 1.

![Graphs showing cumulative areal distribution of PECgw for different combinations of crops and compounds.](Figure 1. Cumulative areal distribution of PECgw for some selected combinations of crops (MG: grain maize, SB: sugar beet) and Compounds (FOCUS Dummy substances C and D, Metabolite of C).)

Conclusions

FROGS was updated to reflect a more appropriate allocation of crop surfaces, current European guidance for groundwater modelling (FOCUS 2009) and PEARL model enhancements to meet the current status implemented in the regulatory groundwater modelling framework for pesticide authorisation at EU level. Test simulations show that the cumulative areal distribution of the 80th temporal percentile PECgw is slightly impacted by the modification included in FROGS 3.3.3.3. The main impact is introduced by the modification of the crop surface allocation (see right graphs in Figure 1).

The new FROGS 3.3.3.3 and the corresponding updated version of the FROGS report (FROGS 2013) outlining all the amendments in detail will be made available soon on the FROGS webpage (http://frogs.eclosion-share.net).

References

