The impact of rainfall extremes for multi-year surface water pesticides exposure modelling

Science For A Better Life

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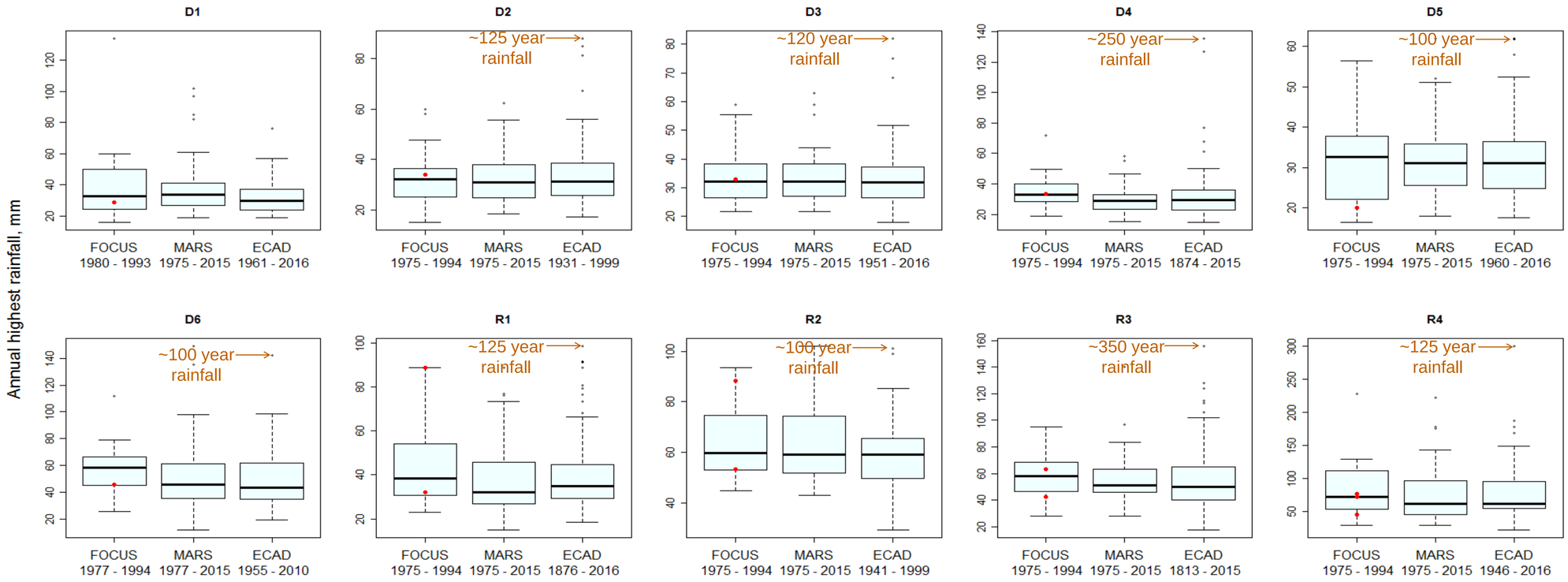
INTRODUCTION

Current approach to the surface water exposure assessments in Europe is based on simulation results for a one year evaluation period. Over the past years, this “single year” approach has come under scrutiny in the scientific and regulatory community. One of the main problems is that the exposure of surface water bodies due to drainage and especially runoff of pesticides is strongly driven by individual rainfall events, whereas the FOCUS year was chosen based on annual or seasonal rainfall. This work examines the individual high rainfall events of the FOCUS scenarios and their possible impact on pesticide exposure of aquatic environments in the context of multi-year SW exposure calculations.

ANALYSIS OF EXTREMES

FOCUS 20 year weather datasets contain several extremely high rainfall event, which might have a very low return periods. Thus, these data were crosschecked with longer-term data obtained for nearby locations from MARS and ECA&D:



Comparison of annual daily rainfall extremes for 20 FOCUS years (red dots represent FOCUS assessment year), 41 years of MARS25 and > 50 years from the ECA&D rainfall data (for nearest locations)

SCENARIO	EXTREME EVENT, mm/day	RETURN PERIOD, year	No. of Years in the ECA&D dataset
D1	133.9*	> 100	56
R4	228	~79	71

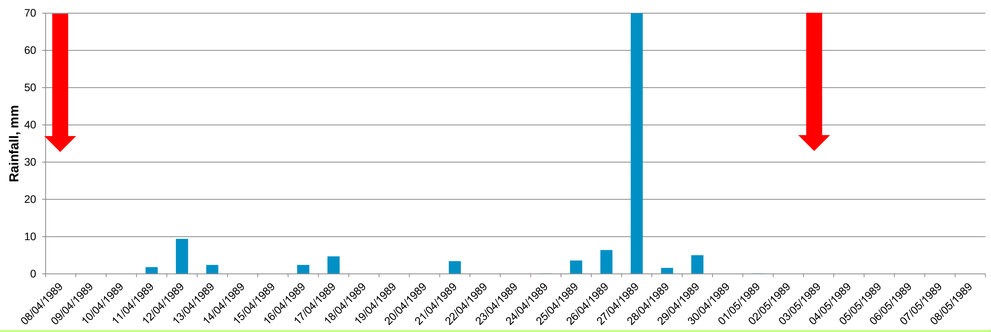
*might be an outlier (Grubbs-Beck test)

Rainfall events with low return periods (>50 years) identified in FOCUS scenarios based on ECA&D data

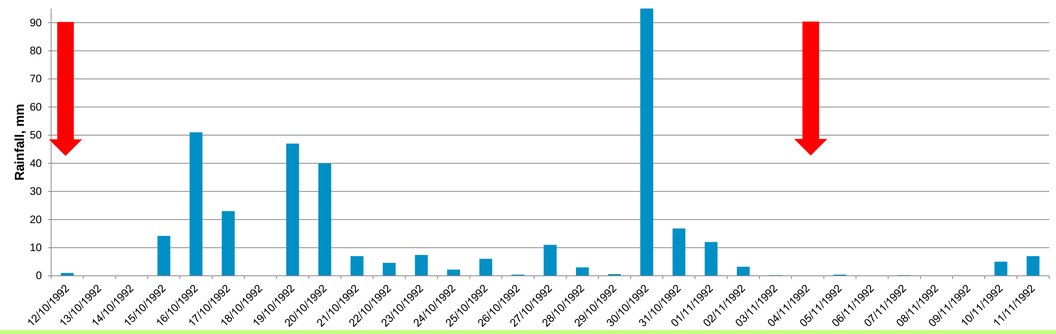
IMPACT ON AQUATIC PESTICIDE EXPOSURE: PAT

Pesticide Application Timing calculator (PAT) incorporated in FOCUS models, was developed with the goal to support the choice of realistic application dates with respect to weather conditions after application. It aims at a selection of 50th to 70th percentile wettest days, but also eliminates high rainfall (> 2 mm/day) in a five day period around the day of application. This is illustrated with the 2 examples below:

Example 1: 70 mm, 27-Apr-1989. The following 30 days intervals allowed for PAT selecting the closest actual application date: 8-Apr – 8-May with an actual application date on 8-Apr. Shifting the application window to later dates results in an application after the rainfall event of interest (3-May).



Example 2: 95 mm, 30-Oct-1992. The following 30 days intervals allowed for PAT selecting the closest actual application date: 12-Oct – 11-Nov with an actual application date on 12-Oct. Shifting the application window to later dates results in an application after the rainfall event of interest (4-Nov).



Possible application dates close to extreme rainfall events in scenario R3

CONCLUSION

- The switch to multi-year FOCUS surface water calculations requires an extended weather dataset.
- The comparison of existing FOCUS 20 year weather datasets with longer-term data from MARS and ECA&D with respect to extreme rainfall values in most cases did not detect severe contradictions.
- The analysis, however, revealed that the FOCUS datasets contain several rare extreme rainfall events.
- Such extreme worst case events are not the goal of regulatory risk assessment and their impact on exposure modelling should be minimised.
- This can be achieved by the use of a PAT calculator, as was shown in the example with the currently used PAT. Alternatively, such events could be eliminated from the regulatory modelling datasets.

References:

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Klein Tank, A.M.G. and Coauthors, 2002. Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment. Int. J. of Climatol.,22, 1441-1453. http://www.ecad.eu

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