GREAT-ER: the model and its use

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Abstract

This poster illustrates technical developments and practical applications of GREAT-ER (Geo-referenced Regional Exposure Assessment Tool for European Rivers), a software system for predicting chemical exposure in river basins. The first version of the software, GREAT-ER 1.0, was delivered in 1999 by ERASM, and has been updated several times since. At the end of 2003, a new Open Source software architecture for GREAT-ER was released via the CEFIC-LRI programme with two versions: GREAT-ER *desktop* and GREAT-ER *web*. Both software generations rely on the same underlying exposure models, which have been shown to produce good predictions of measured concentrations in several field validation exercises. The web version -for light use- aims to reach a wide group of users through easy access and elimination of installation costs.

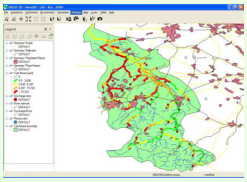
From its conception as a risk assessment tool for chemicals emitted by point sources into surface waters (e.g. from down-the–drain household products), the model has been successfully applied to a wider range of chemicals and applications. Studies have shown the added value in terms of accuracy of exposure predictions in the freshwater environment between a generic-multimedia approach (e.g. EUSES) and a spatially referenced (GIS) approach like GREAT-ER. As such, GREAT-ER is an environmental tool which can be used for water quality assessments at higher tiers under the new EU Chemicals legislation (REACH) and the Water Framework Directive. Equivalents of both the site-specific "PEClocal" and the average "PECregional" values can be calculated by GREAT-ER in a probabilistic way.

Recent improvements in PC performance and the increasing availability of Geo-Referenced (GIS) data at the level of governments and basin agencies have considerably facilitated the development of more, and larger catchment areas. Regulatory bodies in Germany and UK have provided data and financial support for GREAT-ER catchment development and validation projects on a large spatial scale.

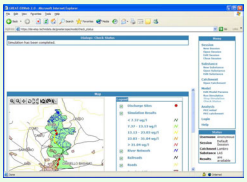
Software developments: from GREAT-ER 1.0x (1999) to the new GREAT-ER *desktop* and GREAT-ER *web* (2003)

In order to keep the GREAT-ER software compatible with the latest ICT developments, a CEFIC-LRI project was undertaken to redesign the software architecture of the original GREAT-ER 1.0 software, released in 1999 by AISE/CESIO. Two state-of-the art software interfaces were delivered in 2003, containing the same underlying exposure models as GREAT-ER 1.0: GREAT-ER *desktop* (for the heavy user), and GREAT-ER *web* (for the light user). Contractors for the CEFIC-LRI project were Technidata AG and Intevation GmbH.

Due to the new software architecture and web based approach it was possible to drastically reduce installation costs, whilst increasing the accessibility to potential users. The new GREAT-ER is available as free software, and is released under the GNU General Public Licence. GREAT-ER desktop requires an Oracle™ Database to be installed in conjunction.



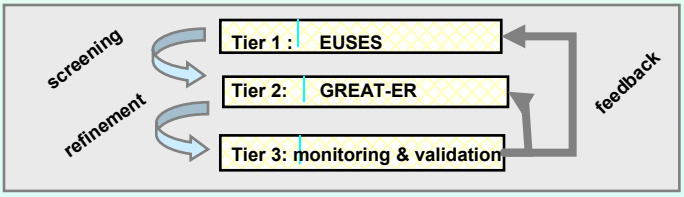
GREAT-ER desktop interface



GREAT-ER web interface

Use of the model in risk assessment: highly accurate Predicted Environmental Concentrations (PECs)

GREAT-ER was conceived to improve the accuracy of PECs in the freshwater compartment versus generic, multimedia–type models. Some interesting papers have recently appeared which clearly demonstrate, via comparison of field monitoring results with modelling in appropriate catchments, that concentrations are indeed better-predicted by GREAT-ER than with EUSES. The improvement occurs for both the PEClocal and the PECregional values (e.g. Wind, T. *Chemosphere* **54**, 1145 - 1153 (2004)). GREAT-ER is, therefore, suitable for use in (EU) risk assessment as a second tier, in order to refine -where/when needed- a preliminary exposure assessment using EUSES (see scheme below).

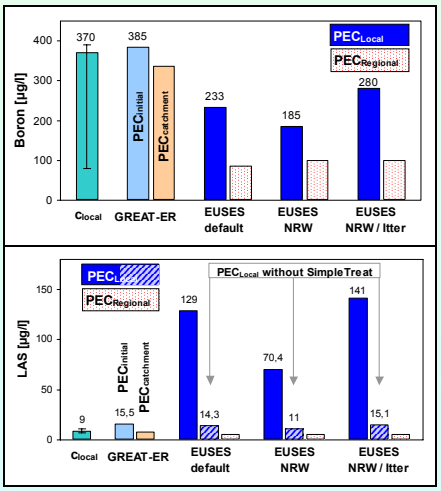


In addition, the use of GREAT-ER could also be advantageous to verify PECs produced in generic risk assessments for HPV chemicals, such as those performed under HERA and OECD SIDS, in real representative catchments. This will help to dimension the uncertainty and variability around the mean results caused by factors such as emission size, seasonality, specific sewage treatment infrastructure, dilution, etc.

Finally, GREAT-ER has the potential to be used within the context of the EU Water Framework Directive (WFD) as a tool for identifying point-source pressures (e.g. pollution "hot spots") on water quality and for helping to explain deviations from 'good ecological status', at the catchment scale.

Figure: Comparison of measured (c_{local}) and predicted environmental concentrations of boron and LAS as calculated by GREAT-ER and EUSES in the Itter river (D).

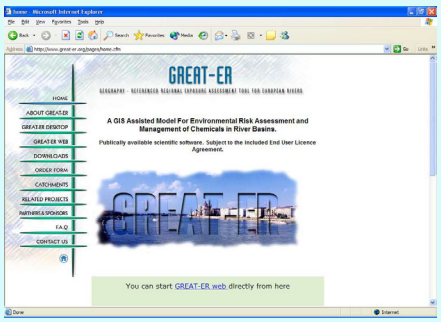
Two PECLocal calculations were performed for LAS; dark blue: with SimpleTreat, shaded: without SimpleTreat but with imposed 99% elimination.



Communication to the GREAT-ER user community

The GREAT-ER website is used as an efficient means of communication with the GREAT-ER user community, and for the management of software, manuals and data. All relevant publications and posters about GREAT-ER since 1996 can be traced via the website.

Access to the GREAT-ER *web* software application can also be made via the project's website (www.great-er.org).



Next steps for GREAT-ER

The next major improvement will be the addition of a module to predict PEC-sediments (available at the end of 2004).

New catchments are continuously being added to the data set. Some of those areas are large (e.g. Elbe catchment) and can be used for risk assessments on a similar spatial scale as the "regions" defined in EUSES.

www.great-er.org