Transferring expertise on Global Sensitivity Analysis to (re)insurance practitioners using workflows

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To quantify risk from natural hazards and achieve a robust decision-making process in the (re)insurance industry, uncertainties in the mathematical models that underpin decisions need to be efficiently captured. Although methods to capture these uncertainties are widespread in the (re)insurance industry, the complexity and sheer scale of the mathematical modelling, particularly since the advent of computer-based catastrophe modelling, often makes a comprehensive, transparent and easily communicable understanding of the uncertainties very difficult. Global Sensitivity Analysis (GSA) may provide techniques to help overcome these issues. GSA has been implemented successfully in tools such as the Sensitivity Analysis For Everybody (SAFE) toolbox, which is currently used by more than 1800 researchers worldwide. However, tailored tools, workflows and case studies are needed to demonstrate GSA benefits to practitioners and accelerate its uptake by industry. To overcome the so-called "valley of death", i.e. the gap between research development and uptake by industry, it is important, among other things, to identify how practitioners learn about new research and methods, and how they adopt them; and to understand their workflows for model development and use, and make them explicit. We found the use of workflows very effective when demonstrating the benefits of GSA and the SAFE toolbox, and in bridging the gap between academia and industry. With workflows in a R Markdown document, the user is guided through the choices that need to be made to set up the GSA application, such as selecting the appropriate GSA method for the intended purpose and the definition of inputs to be tested and their variability. Moreover, guidance is provided on how to interpret the analysis results and their robustness. Here we introduce the SAFE toolbox and show the benefits of using workflows to apply GSA and interpret the results with examples from natural hazards and insurance pricing models. It is hoped that the work will increase the transparency of an insurer's risk profile, and ultimately facilitate the management of an insurer's financial risk.