

A Guideline for Sensitivity Analysis of Repository Models

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Introduction

Numerical models for final repositories may exhibit a highly non-linear behaviour. Objectives of a guideline for SA are that the analyses produce unique and robust results as well as provide clear answers to the asked

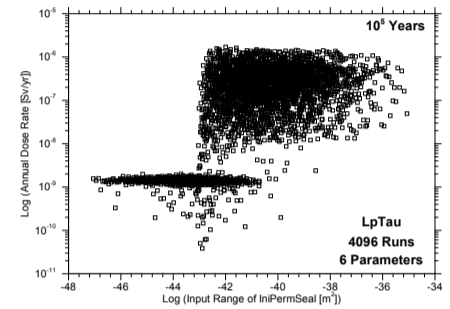
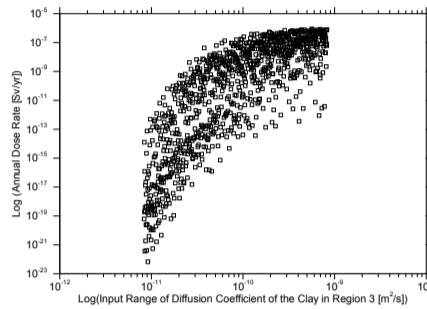
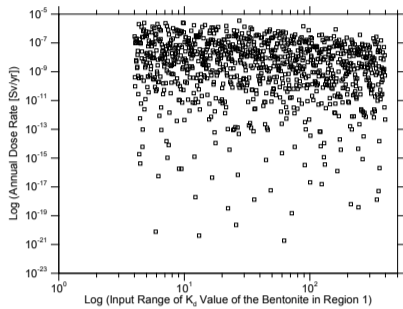
questions. The guideline presented in this poster is a recommendation based on the outcome of detailed experiments with different methods and sample sizes

Guideline

Small sample is sufficient

Scatterplot to identify characteristics of model
-> look at a few different time points

Quasi-Monte-Carlo sample, e.g. LpTau sampling generally provide more robust results than random sampling; sample can be increased



- Linear, smooth and monotonic system behaviour
- Peak dose
- Ranking list

- Non-linear or non-monotonic system behaviour
- Many zero runs
- Many parameters
- Time-dependent
- System understanding
- Identification of research need

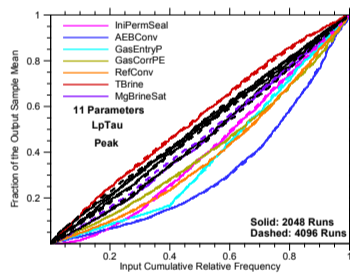
- Extremely non-linear and non-monotonic system behaviour
- Predominantly very low output, distributed over many orders of magnitude -> steep and asymmetric distribution
- Unknown system behaviour
- Parameter interactions
- Discontinuous model behaviour -> two-split output distribution
- Problematic parameters

Simple SA

Detailed SA

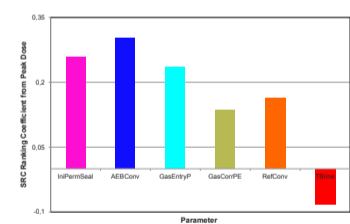
Expert SA

CSM plot



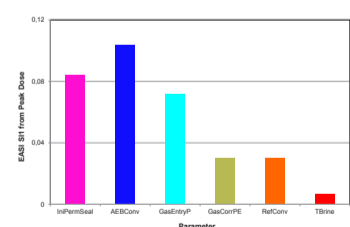
Graphical analysis:

SRC



Regression-correlation based analysis:
Check R²

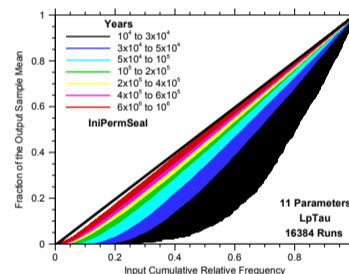
EASI-SI1



Variance-based analysis:
Check sum of SI1

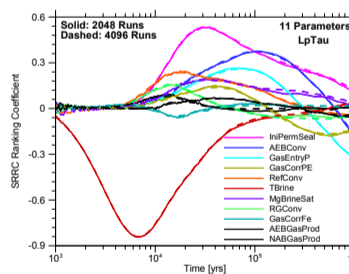
Graphical analysis:
=> Parameter screening
=> Reduce number of parameters

CSM plot



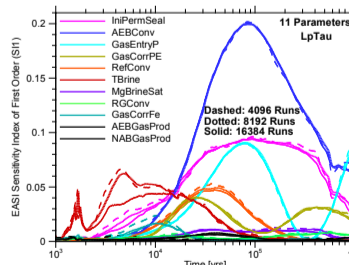
Regression-correlation based analysis:
Check R²

SRRC



Variance-based analysis:
Check sum of SI1

EASI-SI1

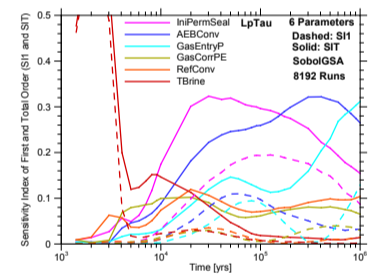


Performing different types of methods allows obtaining different insights into the problem and to find unforeseen characteristics and sensitivities.

If unsatisfying or suspicious results or specific behaviour

Expert SA

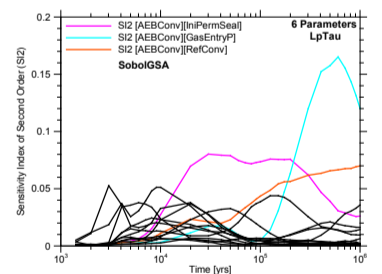
SobolGSA: RS-HDMR-SIT



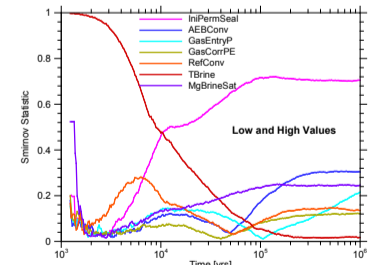
- Higher order SI
- Total order SI
- Output transformation
- 2-parameter test
- Others

Check robustness, convergence and reliability of results

SobolGSA: RS-HDMR-SI2



Smirnov test



Start with a small sample. A good size to begin with may be 512 points depending on simulation time and number of parameters. If convergence of the results is not reached, increase sample size by factor of 2. A good idea to check convergence of the results is to begin to use the variance based method EASI. In general, variance-based methods require more simulations than graphical and regression-based methods to achieve robustness of results.

Acknowledgements:

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