# Launch a sensitivity analysis

## Launch sensitivity interface

Click on the MEXICO logo in the application tabs.

## Sensitivity interface

## Parameters tabs

This tab is the same than the normal simulation launch one. You can chose here the simulation parameters (initial population parameters, number of years, strategies and rules used). This is also from this tab that you will chose or launch simulations.

## ‘Sensitivity analysis tab (factors selection)

This is from this tab that you will chose all the factors to take into account in the sensitivity analysis. Factorisable parameters are shown with a little icon that change shape when moused over. To take this parameter into account, you have to double click ont hat parameter. A pop-up will be shown, depending on the parameter type.

### Equation

An equation can be continuous or discrete

#### *Continuous*

For a continuous equation, you have to choose the parameter by clicking on Add. Then we have to enter the parameter name, its initial value (by default), the coefficient (in percentage, so a 0.05 coefficient stands for a 5 % variation), and the operand.
Then you have to click on validate so that this parameter values  are taken into account. Once all the equation parameters entered, you have to click on Save.

#### *Discrete*

For a discrete equation, you have to specify the number of different values for the factor. Then you have to modify the equations (one equation per value/tab).

## Matrix

A matrix can be continuous or discrete.

### *Continuous*

For a continuous matrix, you have to enter the base matrix (generally, it does not change from the usual one), the coefficient (in real value and not percentage as indicated) and the operator.

### *Discrete*

For a discrete matrix, as for the equation, you have to indicate the number of different values. Then you have to modify the matrixes (one matrix per value/tab).

## Numerical value

A numerical value can be continuous (only real values) or discrete (integer and real values).

### *Continuous*

For a continuous numerical value, you have to select the distribution and enter its parameters (the minimum and maximum value for uniform distribution).

### *Discrete*

For a discrete value, you have to indicate the number of different values. Then you have to modify the values.

## « Sensitivity method » tab

This tab allows you to chose the sensitivity method that will be used.

First, you have to chose the method and enter its parameters (mousing over the parameter name, a contextual help will show you parameter info and accepted values).

Then, depending on the chosen method, you have to specify the number of different values per factor (some methods adapt the number of values to optimise the definition interval scan).

To finish, you have to specify the values on which to perform the sensitivity analysis and the parameters needed to compute those values.

### *Model outputs :*

12 outputs could be considered :

- 6 to directly study the model properties :

    - **SensitivityCatchWeightY1 =** Catch summed over monthes, classes and zones of the simulation last year.
    - **SensitivitySpawningBiomassY2 =** Spawning biomass in the last time step (sum of the biomass for all mature classes and zones at the last time step).
    - **SensitivityBiomassY3 =** Total biomass in the last time step (sum over all the classes and zones).
    - **SensitivityCatchWeightRelativeY4 =** SensitivityCatchWeightY1/CatchWeight summed over monthes, classes and zones of the simulation first year.
    - **SensitivitySpawningBiomassRelativeY5 =** SensitivitySpawningBiomassY2/Spawning biomass in december of the simulation first year (sum of the biomass for all mature classes and zones at time step = 11).
    - **SensitivityBiomassRelativeY6 =** SensitivityBiomassY3/Total biomass in december of the simulation first year (sum of the biomass for all classes and zones at time step = 11).
- 6 others to diagnose the impact of rules relatively to a reference scenario (ref)
    - **SensitivityCatchWeightReferenceY7** = SensitivityCatchWeightY1/SensitivityCatchWeightY1(ref)
    - **SensitivitySpawningBiomassReferenceY8** = SensitivitySpawningBiomassY2/SensitivitySpawningBiomassY2(ref)
    - **SensitivityBiomassReferenceY9** = SensitivityBiomassY3/SensitivityBiomassY3(ref)
    - S**ensitivityCatchWeightRelativeReferenceY10** = SensitivityCatchWeightRelativeY4/ SensitivityCatchWeightRelativeY4(ref)
    - **SensitivitySpawningBiomassRelativeReferenceY11** = SensitivitySpawningBiomassRelativeY5/SensitivitySpawningBiomassRelativeY5(ref)
    - **SensitivityBiomassRelativeReferenceY12** = SensitivityBiomassRelativeY6/SensitivityBiomassRelativeY6(ref)

### « Results export » tab

This tab is the same than for a normal simulation, you specify here the exports to take into account.

### « Result choice » tab

This tab is the same than for a normal simulation, you specify here the results to save.

### « Advanced parameters » tab

This tab is the same than for a normal simulation. It allows you to specify the log level, the simulator to use or the tags to add.

### « Analyse results » tabs

This tab allows you to see the results of a sensitivity analysis (some results from R), to launch again a sensitivity analysis from the simulations results (once all the simulation ran without errors).

## Use results in R

## Find .Rdata file

Results are located in a .Rdata file located in isis-export directory written in your configuration file

## .Rdata file content

The R session contained in the .Rdata file contains numerous R objects obtained at each step of the anaysis in ISIS-Fish.

### *isis.factor*

`isis.factor` is a 5 column, single row data frame.

- column 1: `nomFacteur`
- column 2: `Nominal` (value in the database)
- column 3: `Continu` (TRUE/FALSE)
- column 4: `Binf` (minimum value)
- column 5: `Bsup` (maximum value if continuous, otherwise the number of values)

Attributes

- an attribute for each discrete factor: `nomFacteur`: list(values)
- an attribute `nomModel`: “isis-fish-externeR”

`isis.factor` is registered in R as `SensitivityAnalysisName_0.isis.factor` (all spaces are stripped by R).

### *isis.factor.distribution*

`isis.factor.distribution` is a 3 column data frame with one row per factor

- column 1: `NomFacteur`
- column 2: `NomDistribution`
- column 3: `ParametreDistribution`

`isis.factor.distribution` is registered in R as `SensitivityAnalysisName_0.isis.factor.distribution` (all spaces are stripped by R).

### *isis.methodExp*

`isis.methodExp` is a list with three objects

- object 1: `isis.factor`
- object 2: `isis.factor.distribution`
- object 3: `call`

Attributes

- an attribute `nomModel`: “isis-fish-externeR”

`isis.methodExp` is registered in R as `SensitivityAnalysisName_0.isis.methodExp` (all spaces are stripped by R).

### *isis.simule*

`isis.simule` is a data frame with one row per simulation and one column for each factor and each simulation result

- columns 1 to k: values of the k factors.
- columns k+1 to k+n: values of the n simulation results

Attributes

- an attribute `nomModel`: “isis-fish-externeR”
- an attribute `call`: the method that generating the simulations.

`isis.simule` is registered in R as `SensitivityAnalysisName_0.isis.simule` (all spaces are stripped by R).

### *isis.methodAnalyse*

`isis.methodAnalyse` is a list with 5 objects:

- object 1: `isis.factor`
- object 2: `isis.factor.distribution`
- object 3: `isis.simule`
- object 4: `call_method`
- object 5: `analysis_result` (R object with the analysis results. If the results were calculated by aov, the object is a list with the aov and the sensitivity indices.)

`isis.methodAnalyse` is registered in R as `SensitivityAnalysisName_0.ResultName.isis.methodAnalyse` (all spaces are stripped by R).

## List of all R session objects

You can always use the R function `ls()` to list all the objects in the R session.