

# LOSS CALCULATION & RISK ANALYSIS

## OVERVIEW

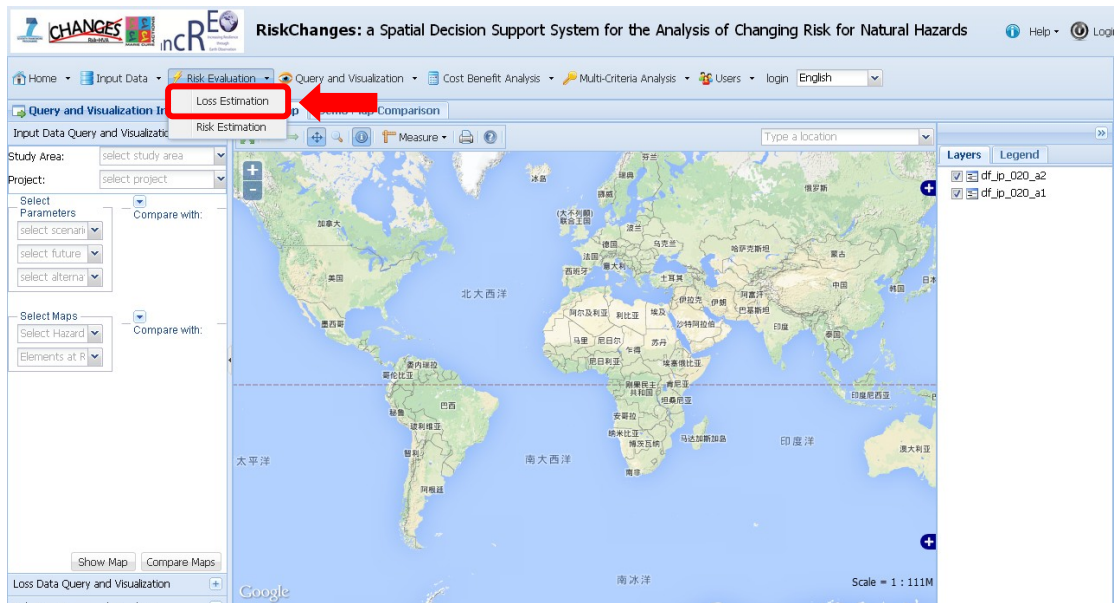
The overall Risk calculation is done in two major steps. In the first step, the loss is calculated from all the loss map parameter set records as they were prepared eventually by the Data Input module (see previous chapter). The result of this calculation is the (potential) loss expressed for every individual element at risk. These loss maps form the basis for further risk analysis. The losses are aggregated per administrative unit and expressed into either exposure or risk curves. The first section of this chapter deals with the calculation of the loss maps. The second section explains how to manage the risk analysis and to visualize the results.

## LOSS ESTIMATION

Users are able to compute loss and produce a number of loss maps based on the combinations of hazard maps and EaR maps made in the Data Input module, e.g. the population loss of building footprints under flooding hazard with 20 years return period. Users should follow the seven steps listed below.

### **1. Click the menu 'Risk Evaluation' and sub menu 'Loss Estimation'**

As shown in the [Figure 1](#) below, the menu 'Risk Evaluation' in the main toolbar is the starting point to conduct loss estimation. Under this main menu there are two sub menus 'Loss Estimation' and 'Risk Estimation' representing the loss and risk computation individually. After the users click the menu 'Loss Estimation', a new window named 'Loss Estimation' pops up. This can be seen in [Figure 2](#).



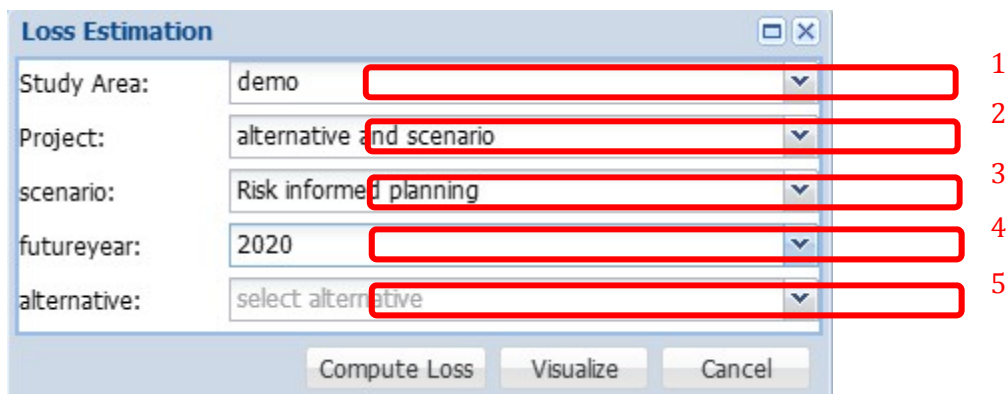
**Figure 1:** The menu to conduct loss estimation

## 2. Select study area

As shown in the **Figure 2**, the first combobox is to select the study area. Users can choose one among all the possible study areas they have.

## 3. Select project name

After the study area is chosen, all the project names under that study area appear in the project combobox. Users can select the desired project name.



**Figure 2:** Loss Estimation User Interface

## 4. Select scenario name, alternative name and future year

After users choose the project, the scenario, alternative, and future year under that particular project are shown in the corresponding comboboxes. Users should select the required scenario and alternative.

## **5. Loss combination grid**

After all the study area, project, scenario, future year and alternative comboboxes are filled, all the loss combinations between hazard maps and EaR maps under the selected study area, project, scenario, future year and alternative appear in a list. See the example in [Figure 3](#). These loss combinations are exactly the ones that users made before in data input component (see previous chapter).

Take the first record in the grid for an example, it can be seen that the hazard type is 'flooding' with the intensity layer 'fl\_de\_020\_a0' which has been imported in our database through data input component, the spatial probability layer/value '1.0' and return period '20' years, and the EaR layer name is 'building\_footprints' with a column name 'type' containing building class info and a column name 'people' containing the number of people in each building. Actually each record in the list corresponds to a loss map that will be calculated in the next step.

## **6. Compute Loss**

A button 'Compute Loss' is for users to compute loss maps for all the records as a batch. This will calculate all the loss maps for the selected combinations.

## **7. Visualize**

The produced loss maps can be visualized by clicking the button 'Visualize' which is connected with another component 'Visualize' within the system (see next chapter).

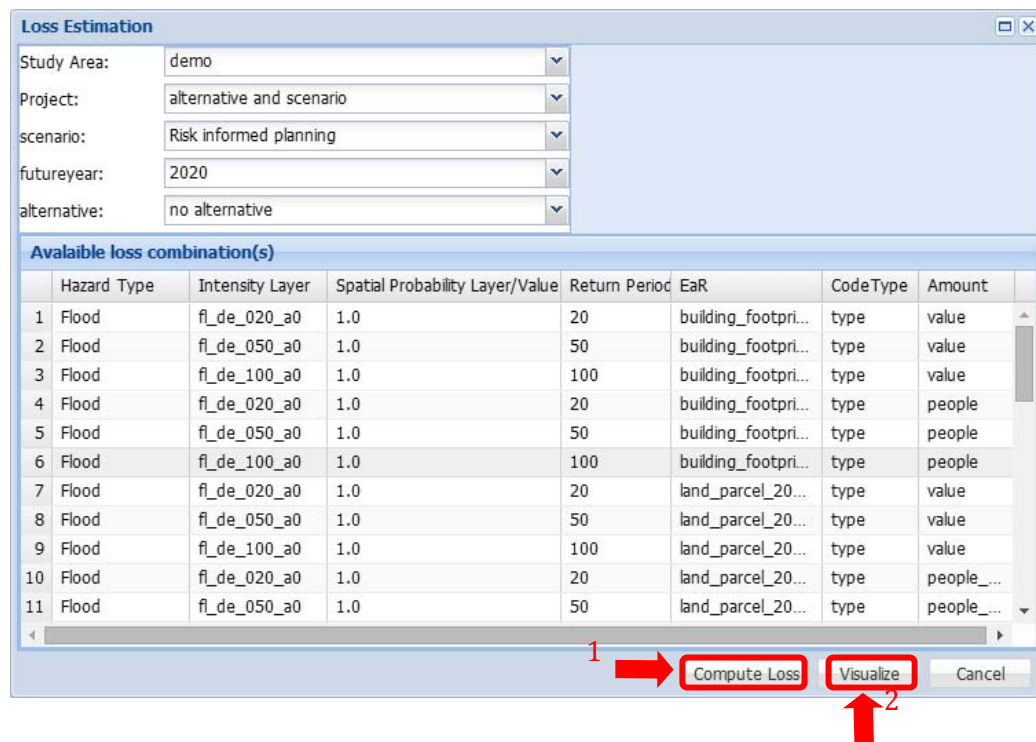


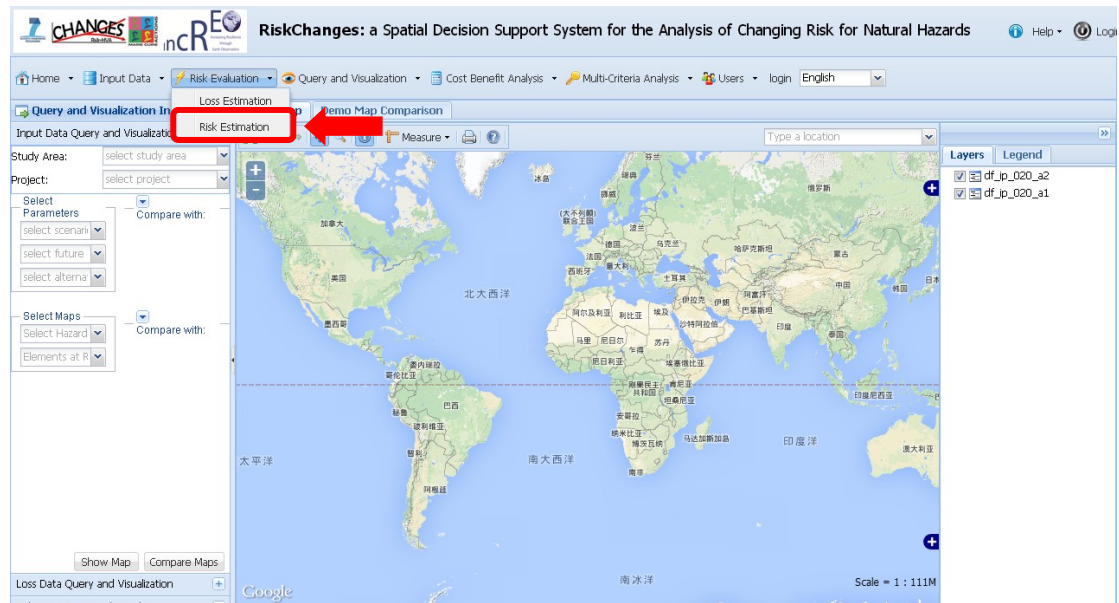
Figure 3: Loss combinations

## RISK ESTIMATION

After the loss computation is finished, users can perform a risk calculation. The risk estimation allows users to compute risk with flexibility to some extent. Users have the option to create their risk analysis for a certain purpose. The following eleven **steps** have to be conducted one by one.

### 1. Click menu 'Risk Evaluation' and sub menu 'Risk Estimation'

As shown in the **Figure 4** below, the menu 'Risk Evaluation' in the main toolbar is the starting point to conduct the risk estimation. Under this main menu there are two sub menus 'Loss Estimation' and 'Risk Estimation' representing the loss and risk computation individually. After users click the menu 'Risk Estimation', a new window named 'Risk Analysis Management' pops up, which can be seen in **Figure 5**.



**Figure 4:** The menu to conduct risk estimation

## 2. Select study area

In the new window as shown in **Figure 5**, the first combobox is to select the study area. Users can choose one from all the study areas they have.

## 3. Select project

After the study area is chosen, all the project names under that study area appear in the project combobox. Users can select the desired project name.

## 4. Risk analysis management

After those operations, the conducted risk analyses are displayed in the grid. Users not only have the options to edit, or delete or visualize those existed risk analysis, but also can add new risk analysis as they want.

If users click the button 'Delete' of an existed risk analysis, the particular risk analysis is deleted. If users click the button 'Visualize' of an existed risk analysis, the risk values and curves of the selected risk analysis can be visualized (go to **step 11**). If users click the button 'Edit' of an existed risk analysis, the specified

risk analysis can be edited, such as changing risk analysis name, or to compute other risks (go to step 5).

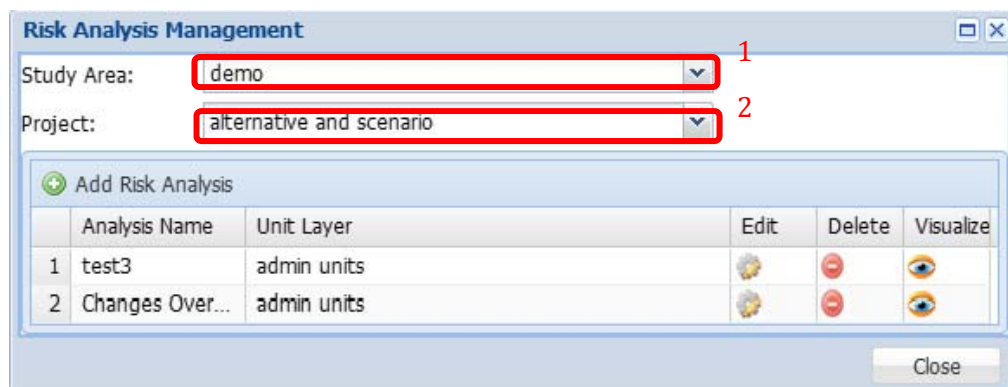


Figure 5: risk analysis management user interface

## 5. Add new Risk Analysis

Click the button 'Add Risk Analysis' in Figure 5, then a new window pops up, in which users can define the name and objective of the new risk analysis. A unit map for which the risk is going to be calculated should also be indicated, which can be administrative units (e.g. sections of the municipality), homogenous units (user defined polygons) or for the entire municipality.

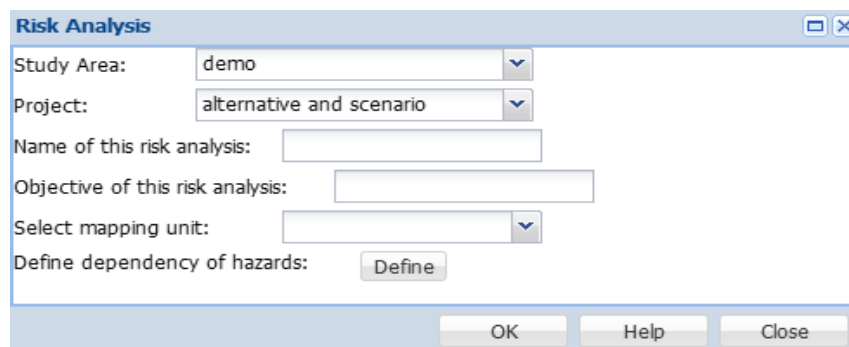
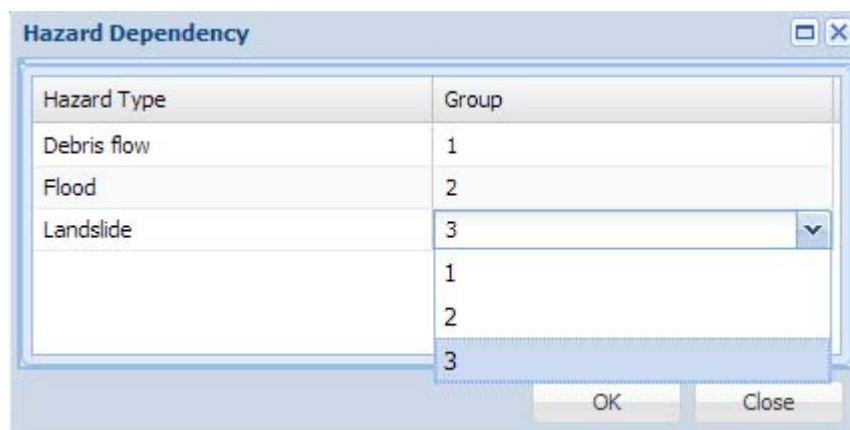


Figure 6: Create new risk analysis user interface

## 6. Define hazard dependency

Hazard dependency is used for multiple hazards risk assessment. As shown in Figure 7, all the hazard types involved in this project have a unique group ID as default. Users are able to change the group ID of each hazard type.

For example, if flooding and landslide are triggered by the same event such as rainfall, users can make these two hazard types have a same group ID. In this case, only the maximum damage caused by these two hazard types will be counted in risk computation. Instead, if two hazard types hold different group IDs, the damage caused by those hazard types are added up as a total for multiple hazards risk. If hazard dependencies are well defined, users are able to click the 'OK' button in [Figure 7](#)



[Figure 7](#): Define hazard dependency user interface

## 7. Risk analysis dashboard

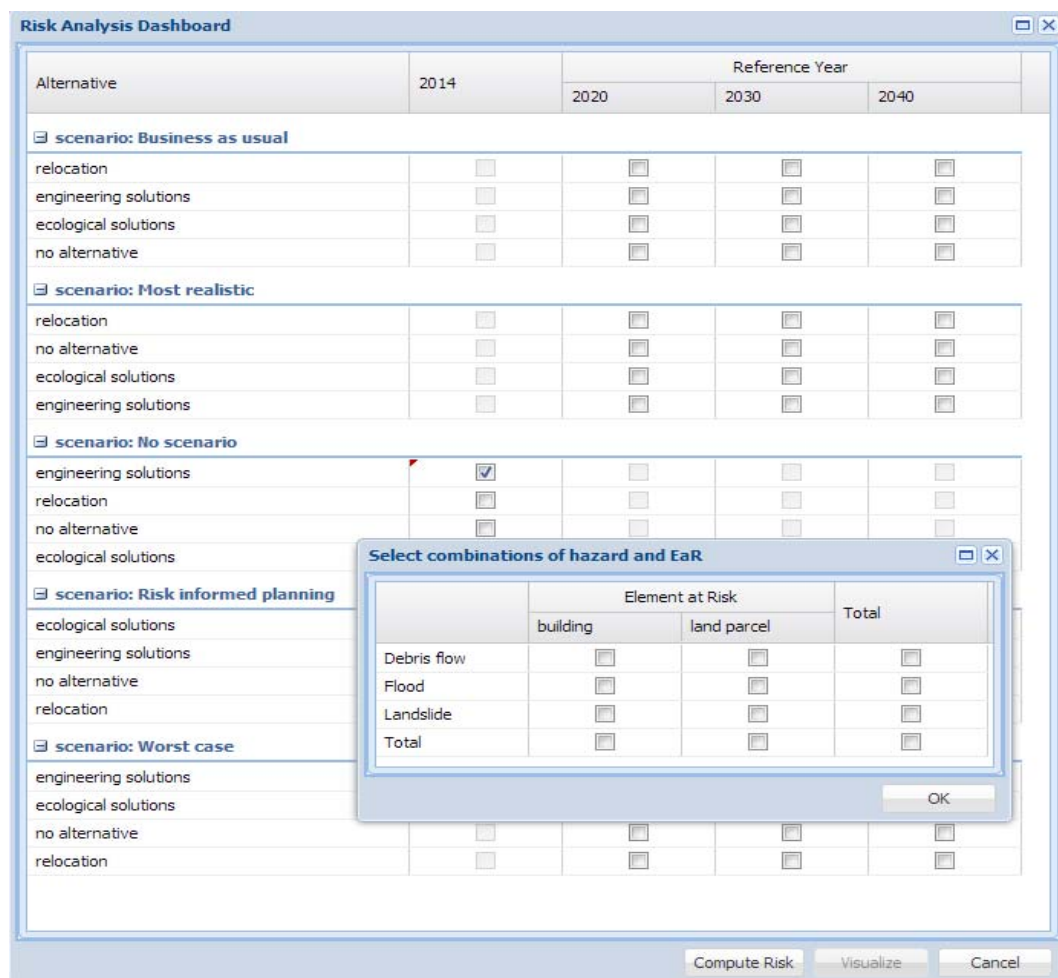
Click the 'OK' button in [Figure 6](#), the window "risk analysis dashboard" appears. Each combination of scenario, alternative and future year is shown as a checkbox in the window. The disabled checkbox indicates that no input data, or no enough return periods available to conduct risk analysis under this combination of scenario, alternative and future year. Users can click the enabled checkbox to select the available risk computations in the particular checkbox.

## 8. Select risk combinations

When users tick the enabled checkbox, a pop-up window appears. Take the one shown in [Figure 8](#) for an example, in which the window contains all the combinations of hazard type and EaR, as well as the "total" options. If users tick the checkbox with 'hazard' type equaling to 'Total' and 'EaR' type 'Building', it



means that the risk of building under all the hazard types (flood, landslide and debris flow in this case) will be computed. The hazard dependency users defined before is used in this computation. If users tick the checkbox with 'hazard' type 'Flood' and 'EaR' type 'Total', it means that the risk of all the EaR (building and land parcel in this case) under the hazard flood will be computed. If users tick the checkbox with 'hazard' type 'Total' and 'EaR' type 'Total', it means that the risk of all the EaR (building and land parcel in this case) under all the hazard types (flood, landslide and debris flow in this case) will be calculated.



**Figure 8:** Risk analysis dashboard user interface

## 9. Compute risk

Once users have ticked all the desired checkboxes in the risk analysis dashboard and the desired combinations of hazard and EaR for each selected dashboard



checkbox, users can then click the button 'Compute Risk' in the risk analysis dashboard in [Figure 8](#).

### 10. Select combinations of Hazard and EaR for risk visualization

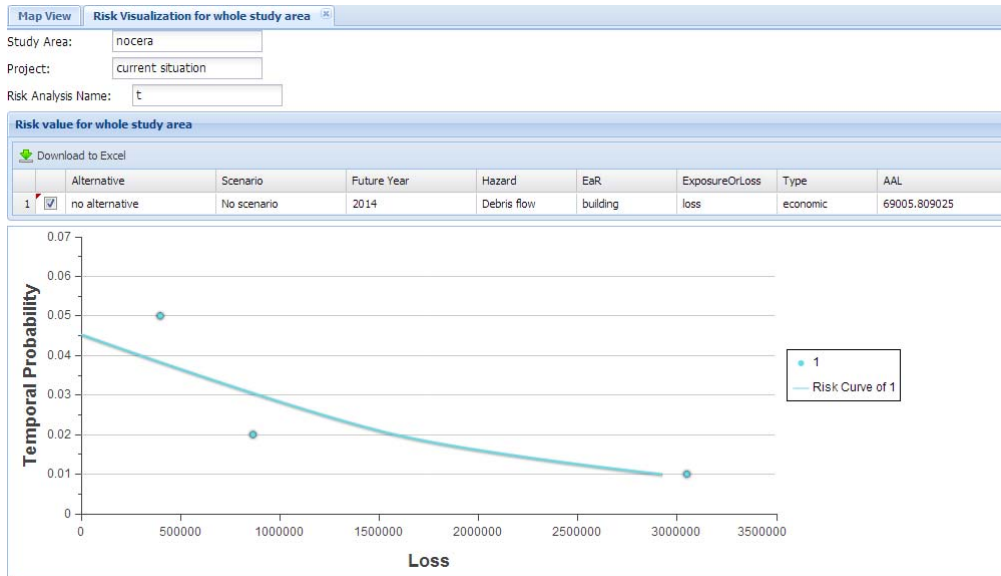
After the risk computation is completed, users can visualize risk values and curves in the whole study area by clicking the button 'Visualize' in the risk analysis dashboard user-interface. [Figure 9](#) shows the user interface to query what kinds of risk the users would like to visualize. They have the option to select loss or exposure, economic or population and tick the checkbox to include which combinations of hazard and EaR. The disabled checkbox means no risk has been computed for that combination of hazard and EaR types in [step 8](#).

The dialog box titled "Select combinations of hazard and EaR" contains the following elements:

- "Select Loss/Exposure:" dropdown menu with "loss" selected.
- "Select Type:" dropdown menu with "economic" and "population" options.
- "Available Hazard" section with a table for selecting hazard types and elements at risk.

	Element at Risk		Total
	building	land parcel	
Debris flow	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Total	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[Figure 9](#): Risk visualization user interface



**Figure 10:** Risk value and visualization

### 11. Visualize risk value and curve

After clicking on 'OK' button in **Figure 9**, a tab is added in the main view in the interface as shown in **Figure 10**. The tab lists the study area, project and the risk analysis name the users defined, as well as a grid containing the risk values. For example, the first record in **Figure 10** shows that the economic risk value of building under debris flow in current situation (no scenario, no alternative and current year 2014) in the whole study area is 69005.8€. If users tick the checkbox, the risk curve is depicted below the grid along with the loss values related to different return periods.