5 - Assess Risk and Impact

User
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field_eu_gl_methodology

This module provides a structured method of analysing climate hazards and their impacts to provide the fundamental information for decision-making.

In line with the updated approach as outlined in the IPCC-AR5, this evaluation is derived by the general relation R=H x E x V.

The risk and impact assessment[1] process work through taking into account the magnitudes and likelihoods of the impacts associated with the hazards identified in Module 2 - Evaluate exposure to climate hazards and assessing the significance of the assessed risks to the success of the project. Risk and impact assessment may well identify issues which have not been picked up in the vulnerability analyses.

- **Risk assessments**: aim at defining a synthetic index/coefficient, representing the convolution of the probabilities of different hazard intensities (H), in relation to the exposure (E) and vulnerability (V) conditions in a given area. Such a risk index is useful to allow high-level comparisons between alternative project options but does not allow detailed quantification of impacts on considered elements at risk.

To produce reliable results that can be a sound basis for decision making in the field of infrastructure development, risk assessment should be always based on numerical modelling procedures. Probabilistic quantitative risk assessments can be undertaken in the early phases of the asset lifecycle, with different levels of detail (including the spatial resolution of the models' output) depending on the availability of exposure and vulnerability. This requires running various scenarios and comparing the results with respect to the frequency of event occurrence and event magnitude by means of a probability distribution.

- **Impact scenario analysis**: as a complement to the risk assessment, by choosing in a "deterministic" way one or more reference events (among actually occurred past events or as a result of numerical hazard simulation models) the corresponding "impact scenario analyses" can be performed using numerical impact models, providing detailed damage evaluation on selected elements at risk following specific event(s) (Here again one has to consider the uncertainty delivered by the risk-modelling, and vulnerability modelling and the exposure modelling with respect to future distribution of the elements at risk..

Unlike the risk assessment, the impact scenario analysis represents a simulation of the expected impacts of a specific hazard (in terms of intensity, location, etc.), derived from the application of an impact model able to correlate hazard (H), exposure (E) and vulnerability (V) characteristics to produce a detailed quantification of damage on elements at risk considered (e.g. population, buildings). An analysis based on the output of the impact models can be used to support decision-making, e.g. by applying multi-criteria and/or cost-benefit analyses on a number of relevant impact scenarios.

Probabilistic assessment and uncertainty evaluation are provided also in relation to impact scenario analyses, mainly related to the probability of occurrence of the hazard type and intensity at the location of the analysis.

The detailed risk assessment and/or scenario analysis is divided into 3 steps: (1) It involves an analysis (e.g. refinement of hazard properties, exposure distribution, and algorithms to model the relations between H, E, V) by specialists to quantitatively evaluate risks while taking into account climate (and socio-economic) change. (2) Aspects and characteristics of the most relevant climate hazards need to be defined (e.g. magnitude and direction of change, statistical basis, averaging period and joint probability events). In addition, it is also essential to determine the aspects and characteristics related to exposure and vulnerability parameters relevant for the elements at risk considered in the area of interest. (3) The ability of the project to cope with existing climate variability and with future climate hazards should be assessed. This typically involves the use of numerical models (e.g. climate impact models), that describe some element of the project, namely the relevant exposure and vulnerability parameters likely to be affected by the hazard(s) considered (e.g. spatial and technical characteristics of ground and underground floors of a building in a flood-prone area). The assessment should involve a number of climate models (e.g. hydrological, flood risk, heat wave models, etc.) as well as specific vulnerability functions in relation to the hazard(s) and element(s) at risk considered. A range of future climate scenarios should be investigated based on a number of climate models and a range of greenhouse gas emissions scenarios, such as RCP4.5 and/or RCP8.5.

1 Risk is a probabilistic measure that relates to a cumulative effect of all (likely) hazard occurrences, whereas the impact merely indicates the effects of specific reference events.

Maps

Tables

Scenario Analysis

Indicators	Heat wave 28°, 6 days	Heat wave 30°, 6 days	Heat wave 32°, 6 days	Haet wave 34°, 6 days
people				
Fatigue, discomfort	489,601.53 number of people	401,640.19 number of people	314,091.79 number of people	228,395.99 number of people
Heat cramps, heat exhaustion	225,174.22 number of people	184,835.16 number of people	144,142.23 number of people	104,729.69 number of people
Heat cramps, heatstroke	47,634.46 number of people	39,142.03 number of people	30,375.27 number of people	22,033.63 number of people
Heatstroke, sunstroke	5,948.64 number of people	4,894.55 number of people	3,774.24 number of people	2,731.45 number of people
Death	446.92 number of people	368.20 number of people	282.13 number of people	203.69 number of people

Indicator Table

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