IDENTIFICATION AND ESTIMATION OF TORRENTIAL HAZARDS AT THE REGIONAL AND LOCAL PLANNING LEVEL

A CONTRIBUTION TO THE MANAGEMENT OF NATURAL HAZARDS

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From 1998 to 2006 at the Bavarian Environment Agency methods were developed to identify and to estimate torrential hazards at the regional and local planning level within two EU-projects. Data evaluated in the course of the projects should provide a valuable basis for a broad range of area-planning activities and protective measures.

EGAR – A PREVENTIVE METHOD AT THE REGIONAL PLANNING LEVEL

One aim of the EU-project EGAR (1998 – 2001) – **E**inzugs**g**ebiete **A**lpiner **R**egionen (catchment areas in alpine regions) was to find a method for estimating the preparedness to torrential processes at the regional planning level (scale 1:25 000). By means of a GIS the produced and evaluated data should be used as a decision factor for transparent ranking of priorities.

For estimating debris potential it is necessary to determine basic and large scale geomorphological processes and their evaluation with regard to their type, activity and significance for torrential processes.

For estimating runoff the mapped soil-/vegetation units are evaluated by using "A Simple Code of Practice for Assessment of Surface Runoff Coefficients for Alpine Soil-/Vegetation Units in Torrential Rain" (MARKART et al., 2004) and extended with geological and geomorphological criteria. In order that and by means of the roughness of surfaces, the surface slopes, the surface-runoff coefficients and the runoff concentration, the surface flow-velocities can be calculated (map of "flow velocities"). With regard to this and the channel slopes the flood discharges can be estimated.

By the developed method and additional parameter-analysis the identification of the origin of the hazardous processes (slope and channel processes) and the ranking of priorities are possible.

Since autumn 2002 the hazard areas in the torrential catchments of the Bavarian Alps are identified by this method on 22 maps (ca. 2000 km²) in a scale of 1:25 000 and by order of the Bavarian State Ministry for Environment, Health and Consumer Protection.

NAB – A PREVENTIVE METHOD AT THE LOCAL PLANNING LEVEL

Within the EU-project :nab (2003 – 2006) – **N**aturpotenziale **A**lpiner **B**erggebiete (Natural Space Analysis For Alpine Mountain Areas) the aims were to develop a process-oriented

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analysing and planning instrument to assess natural hazard processes in torrential catchments at a local scale, to generate indications to derivate process oriented measures (e.g. optimized land use), to illustrate the impact and development areas and to evaluate and apply practically the proceeding with potential users.
In three catchment areas of the Bavarian Alps a process oriented mass balance was constructed.
The method EGAR and the instructions for the assessment of surface-runoff coefficients were the basis for the assessment of discharge and erosion processes.
In the selected catchment areas the mapped slope and channel processes were adapted and verified at the local planning level (scale 1:5000 – 1:2000). Afterwards the processes were evaluated and the surface-runoff coefficients could be determined. Additional all parameters of the channel geometry and channel shape were collected.
The instrument PROMAB^{GIS} was used to design process-oriented mass balances in detail:
To design precipitation events volumetric reduced data of heavy rainfalls (block rainfalls) of different durations and intensities are used.
The runoff is calculated with regard to surface-runoff coefficients and the initial abstraction and by hydrological surface- and channel routing.
Based on the determined runoff volume the volume of bed load is calculated. Thereby erosion, transit and temporary or permanent bed load deposit can be described.
Calculating the bed load transport capacity the empiric transport equation by RICKENMANN (1990) is used, which was developed for steep channels.
As a result for several tested catchment areas the endangered zones by torrential processes on the alluvial fans could be identified on the one hand. Thereby it is possible to separate the useable areas with or without protective measures.
To get indications for measures (e.g. silvicultural measures) “hot spot” interpretations by parameter-analysis were made on the other hand. In doing so it is possible to filter out these areas, which are the significant sediment sources and are mainly responsible for intensive and rapid runoff formation. E.g. on these areas it is possible to improve the forestal structure and texture for better infiltration-capacity and reduced run-off velocities. Therefore this affects a smaller peak discharge at the same precipitation event and a decreased unit bed load discharge.
At present these relationships are tested at changing conditions with regard to runoff and vegetation due to climatic change (EU-project ClimChalp).

CONCLUSION

The described methods are a tool which allows the estimation of runoff and geomorphological processes in torrential catchment areas in a high degree. The results are used as a basis for planning protections like at the Bavarian Restoration of Protection Forests at the present. The methods are also used in practice at the Bavarian Water Management Agencies. Special attention is called to the “Integrated Torrent Protection Project Oberallgäu” (ca. 1500 km^2), were the tools are used for planning real protective measures.

Keywords: Watershed management, runoff, geomorphological processes, mass balances.