Geophysical Research Abstracts,
Vol. 11, EGU2009-10456, 2009
EGU General Assembly 2009

Regional estimation of torrent hazards by analysing weather radar data and catchment characteristics

G. Pistotnik (1), K. Klebinder (2), P. Chifflard (3), R. Kirnbauer (3), and T. Haiden (1)

(1) Central Institute for Meteorology and Geodynamics, A-1190 Vienna, Austria (georg.pistotnik@zamg.ac.at), (2) Department of Natural Hazards and Alpine Timberline, Federal Research and Training Centre for Forests, Natural Hazards and Landscape, A-6020 Innsbruck, Austria (klaus.klebinder@uibk.ac.at) , (3) Institute for Hydraulic and Water Resources Engineering, Vienna University of Technology, A-1040 Vienna (chifflard@hydro.tuwien.ac.at)

Torrent hazards in mountain areas in the eastern part of Lower Austria are mostly triggered by convective rainfall events during thunderstorms. The Austrian Avalanche and Torrent Control Service commissioned a project for a regional analysis of torrent hazard potential in the region Bucklige Welt / Wechselland as the basis for detailed investigations and torrent control measures which will be planned later, taking into account the hazard potential of individual streams, the most dangerous first, the less dangerous later.

Thus, the following problems had to be analysed: Are there any typical points of origin of convective storms in or near the project region? Are there any typical tracks of these storms endangering the region, and what is their extent and lifetime? Which catchments generate more and which less runoff caused by the same precipitation amount?

For approaching the meteorological part of the integrated problem the precipitation is estimated from radar data on a 15 minutes basis with a spatial resolution of 1 km, because no sufficient precipitation measurements are available. Within the nowcasting system INCA (Integrated Nowcasting through Comprehensive Analysis) of the Central Institute for Meteorology and Geodynamics (ZAMG) these radar data are combined with satellite data, ground data, model data from the meteorological local area model “ALADIN Vienna” and with a digital terrain model of 1 km grid space. Thus, a continuous set of precipitation fields were calculated for the years 2003 to 2007 with a temporal resolution of 15 minutes and a local resolution of 1 km. Based on this data set convective cells were identified and their tracks analysed. If a precipitation intensity of 3,8 mm/15 min was exceeded, in accordance with experiences of the meteorological remote sensing group of the ZAMG, it was a-priori assumed that this was a convective storm. According to this threshold nearly 350 convective events were automatically extracted. After discarding approximately about one third of these events as spurious the tracks of the remaining 245 cells were identified. The locations of the origin of these cells were in accordance with the experience of synoptic meteorologists, and the tracks, as to their motion direction averaged over the whole observation period of five years, followed the main wind direction in the region. Within the day of the event and from one to the next time step of 15 minutes, however, the motion of the cells was rather erratic, and their motion vectors could be described by normal distributions for speed and angle. As to their shape, the cells can be approximated by circles of changing radius: first small, then growing to a maximum size and then shrinking. The maximum diameter can be approximated by a two parameter log normal distribution, and such is the lifetime of the cells and the rainfall intensity. Due to the short observation period the intensities cannot be directly used for design purposes but have to be extrapolated to the design intensities supplied by the Hydrological Service.

Intensive field studies were performed for assessing the runoff behaviour of the catchments. On nine locations irrigation experiments took place by use of a transportable spray irrigation installation with rain intensities of approximately 100mm/h on plots of 80m^2 and they were accompanied by soil moisture measurements with TDR probes. They were situated in two profiles of the irrigation plots and in 5, 15, 25 and 40 cm depth respectively. Six undisturbed soil cores were taken with cylindrical samplers (200 cm^3 volume each) in four depths down to 50 cm. The samples were analysed with respect to their soil type, soil texture, bulk density, porosity and saturated

conductivity. Thus, the results of the irrigation experiments could be thoroughly interpreted with the additional information on soil moisture dynamics and physical characteristics. For the irrigation plots and for additional 350 locations standardized investigations referring to vegetation, surface roughness, upper soil layers, deep soil and geology were performed and regionalized all over the project region Bucklige Welt.

In summary, regional information on the runoff behaviour could be combined with regional design storm information for estimating torrent hazard in the project region as a basis for detailed planning of torrent control measures.