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Analysis of Severe Flash Floods in Europe

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Brief Report

Due to its high ranking among natural disasters in terms of both the number of persons impacted globally and the proportion of individual deaths, flash flooding is a source of concern in hydrologic and natural hazards science. In many areas, the risk of flash flood deaths and property damage is growing as a result of social and economic growth that puts pressure on land usage. Furthermore, evidence of rising heavy precipitation at both the continental and global scales supports the hypothesis that the global hydrological cycle is becoming more intense as the globe warms. As a result of the effects of global change on climate, storm–weather systems, and river discharge conditions, flash floods are anticipated to become more frequent and severe in many locations.

Flash floods are caused by localised, short-duration, high-intensity rainfalls, mostly of convective origin. As a result, flash floods often affect basins with a surface area of less than 1000 km^2 with reaction periods of a few hours or less. The flash flood response's temporal dimension is determined by the extent of the affected catchments on the one hand, and the activation of surface runoff on the other, which becomes the dominant transfer mechanism. Due to the combination of strong rainfall, soil moisture, and soil hydraulic qualities, surface runoff may be caused by a variety of producing mechanisms. It may also be aided by land use changes, urbanisation, and fire-induced changes.

When travelling from Continental to Mediterranean areas, the space and temporal scales of flash floods change consistently, while seasonality varies proportionally from summer to fall months, according to a study of flash flood regimes across Europe. This has various hydrological ramifications, which must be considered when looking at the impact of land use and climate change on the incidence of flash floods. For example, Forecasting, warning, and emergency management for flash floods are all designed to deal with the unique characteristics of flash flood danger. The short lead periods and the requirement to offer local and spread forecasts make flash flood forecasting particularly problematic. In this context, attempts to characterise the flood response to brief and strong storm events are crucial. However, due to a lack of systematic observational data on flash floods, including data on flood-generating rainfall at the appropriate spatial and temporal complexity, as well as discharge data, researching these features is challenging.

Flash floods are challenging to detect because they occur at spatial and temporal scales that traditional rain and river discharge measuring networks are unable to sample efficiently. Furthermore, because flash floods are an uncommon occurrence on a local level, they are difficult to monitor in experimental catchments. This research aims to better characterise flash floods in Europe at multiple temporal and geographical scales as a key element of climate and hydrologic science in general, as well as to improve flood risk management in particular. The three-fold goal of this study is to summarise data from an archive of selected extreme flash flood events that occurred in Europe between 1994 and 2007, as well as background climatic and hydrological information, to characterise these events in terms of basin morphology, flood-generating rainfall, peak discharges, runoff coefficient, and response time, and to use the insights gained from this analysis to identify implications for flash flood risk management.

The repository contains data from 25 significant flash flood incidents that happened between 1994 and 2000, with 20 of them occurring since then. Data has been collected in numerous European areas, however not in a systematic manner at a continental size. High-resolution rainfall patterns and flood hydrographs or peak discharges are among the hydro meteorological data. The database includes contains climatic data as well as data on morphology, land use, and geology. Hydrologic and hydraulic models are utilised to ensure that the data is consistent and to recreate specific occurrences for which only partial data is available.

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