Modelling flood risk in Paratrexos/Peritsi stream, Naxos island (Cyclades, Greece)

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***Abstract*—This research deals with the flood risk in the island of Naxos (Cyclades, Greece). In the stream called Peritsi or Paratrexos, the geomorphology, geology, the land uses and the relief of its drainage basin were studied in detail. These results allowed the estimation of flood risk in the area of Naxos, as well as the security measures that need to be applied.**

The main aim is the investigation between the relation of rainfall and the outflow with the use of hydrographs. Thus an evaluation of the flood risk of this basin has been studied. In order to produce results of high accuracy the basin was divided into 13 smaller sub-basins which were interpreted separately. For the optimum application of method Clark, there were two tools used: a) water level recorder, b) Meteorological station.

Based on the processes mentioned above, individual hydrographs were produced for each of the 13 sub-basins. Once again, the main goal of this project is to compare the rain and outflow parameters in order to identify the areas of the highest risk. Additionally, a flood map has been developed which visualizes the risk scale in a color coded image.

Keywords—flood risk; Naxos Island; Unitary Hydrographs; Clark method

I. INTRODUCTION

Our study area is located in Naxos Island, Central Cyclades, Greece. The island of Naxos belongs to the Attic Cycladic unit. It could be described as a dome of an elliptical shape with a N15°E orientation. Regarding its geology, there are mostly metamorphic shale rocks, gneiss and marbles. Sedimentary rocks from Neogene and Quaternary deposits are also present in the area. In the core of the dome there's the migmatite penetration.

The basin of Paratrexos/Peritsi using GIS (Geographical Information System).This basin is about 54km long, characterized by variable relief in high and low altitudes. The average height reaches 245m and its average inclination is around 21%. The basin is drained from a hydrographical network of medium or higher density. In some parts it takes a significant meandered shape.

It has been noted that significant problems may derive from Peritsi or Paratrexos due to rainfalls, landslides and inundations on the road network. Occasionally it has been threatening for the broader areas of Naxos by causing floods. The most recent flooding issues occurred in March 1998, January 1999 and the 18th of February 2003.

For the integration of this mission, fieldwork for the data collection over different periods was required. Having to face the natural disasters that occur nowadays, it is an essential issue for the environment and the humanity. Thus it's a challenge for young researchersto investigate the causes of such phenomena. The will of research and discovery does not serve only selfish purposes, but also a survival need.

Therefore, through this research a location of high risk has been assessed. It's been proven that especially during the winter season, due to precipitations, Paratrexos/Peritsi stream has serious impacts on the island inhabitants. The basin drainage has been sub-divided in order to provide results of high accuracy.

II. METHODOLOGY

The study area was investigated though the Clark Method and field work. All the data concerning the study area were analyzed in order to produce the hydrographs and maps, necessary for the purposes of this study.

A. Clark Method

Primary and secondary data were used for the implementation of the Clark Method in order to produce the Instantaneous Unitary Hydrographs. Through this method, the maximum flow at the mouth of each sub-basin and the concentration time were calculated. Maps of flood risk were developed, with the use of ArcGis software, presenting the characteristics of the flood risk locations in the study area. The identification of these areas and the application of the method were accomplished through the study of the relief, land use, hydrographic network, soil characteristics, and flood picks. The Clark Method includes specific steps in order to obtain the following data, for each hydrologic basin: a) concentration time, b) maximum discharge, c) Instantaneous Unitary Hydrographs

B. Field Work

Fieldwork was carried out in order to confirm the results of the method, by installing a water-level meter in a specified location of the riverbed. The aim was to record the level of the water and the time, and calculate the discharge.

III. PRELIMINARY RESULTS

The three main parameters that were studied were the climate, the topography and the geology. The climate did not have a serious impact on the flood risk, given that its variability is not significant. The topography and the geology, however, were the key factors. Through the analysis of the I.U.H, developed by the Clark method, it can be concluded that there are three main zones whose characteristics constitute the cause of hazard in the mouth of the hydrologic basin. The first zone is the mountainous areas in eastern part of the basin, with very high risk, while the second and third zones are areas in the central part of the basin.

A series of safety measures are suggested in this paper, including the construction of a pre-planned dam and the raise of human awareness for the restriction of activities around this area, vegetation cover on the slopes, reduction of the slope's inclination or/and height, cleaning and restoring of the existing ditches from the dense vegetation, pumping of water, removal of small dams. With regard to the high risk areas, an early warning system is necessary.