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Comparison of drainage morphometry and hydraulic modelling results in the view of flooding on the Havran River (Western Turkey)

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Catastrophic floods occurred on the Havran River in the years of 1528, 1904, 1958, 1964, 1968, 1979 and 1981. Flooding has not occurred since 1981 on the river due to decreased of rainfall intensity. Moreover, some prevention measures have been taken on the river channel such as canalization and construction of weirs and a dam. The main purpose of the dam construction is to obstruct probable floods on the main channel and provide water for regional agriculture.

This study has three main goals; i) delineation of drainage networks of the Havran River basin and analysing of their morphometries at sub-basin level, ii) mapping of floodplain based on new channel form and dam construction using hydraulic modelling, iii) comparison of drainage morphometries of sub-basins and floodplain modelling results with focus to flooding of the main channel.

For these purposes, topographic maps scaled 1:25000, a 10m Digital Elevation Model (DEM), Quickbird satellite images dated 2004, discharge data of the tributaries in last 30 years and GPS measurements in the main channel were used. The drainage networks of the basin were extracted from DEM using Geographic Information System (GIS). Morphometric parameters such as bifurcation ratio, drainage density, stream frequency, texture ratio, ruggedness number and time of concentration were calculated for the drainage networks at sub-basin level. The results of morphometric parameters of the sub-basins were evaluated to measure the effectiveness on the main channel. Using GPS measurements and contours derived from topographic maps, a digital terrain model was created with respect to the new channel form of the main river. Using Hec-

GeoRas and Hec-Ras hydraulic modelling software, all geometric data such as rivers, bank lines, flow path centrelines, bridges, ineffective flow areas, blocked obstructions, levees, and land use were created and completed. Based on last 30 years discharge data of the tributaries, flood frequency analysis were applied using Log Pearson Type III distribution and then 5, 10, 25, 50, 100 years flood were calculated. In hydraulic modelling, the discharge of the sub-basin 4 where the dam was constructed on its outlet was undervalued. Finally, both analysis results were compared and evaluated.

This study reveals that evaluating the drainage morphometries is of a great helps in analysing sub-basins effect on the main channel from the flooding point of view. Morphometic analysis results indicated that the sub-basin 4 has the fourth order influence on the main channel. This means that the sub-basins 1, 3, and 5, which join the main channel after the dam, have more influence on the main channel than the sub-basin 4. Hydraulic modelling results show that even if there is no discharge from the sub-basin 4, flooding will still occur on the main channel in spite of the canalization and the dam.