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Combining the Weights of Evidence model, the Strahler/Shreve hydrographic model, and the HEC-RAS analysis for the assessment of flood susceptibility in Essaouira Province, Morocco

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The most frequent disasters indiced by natural hazards in Morocco's northern and central regions are floods, namely flashfloods. Determining the areas covered by the maximum extent of floodwaters from estimated flood flows is how flood-prone areas are often defined. The primary goal of the current study was to develop a map of flood susceptibility using a weights-of-evidence (WofE) model. To confirm it, compare it to a simplified hydrographic model that was constructed based on the hierarchy of drainage system characteristics, adhering to the Strahler stream order criteria and the magnitude of the drainage networks based on Shreve's magnitude, considering both approaches are widely used in the literature review. The most susceptible area defined by the two approaches was thoroughly analysed through hydraulic modelling using HEC-RAS, providing the most accurate results. Digital elevation models (DEMs) created from 12.5 m high-resolution orthophoto images, were used for the investigation in this study.The Essaouira provincial Watersheds in Morocco mapped around 95 flood locations in a GIS system, during the last 20 years. From the flood locations inventory, 70% were randomly chosen for training the flood susceptibility model and the remaining 30% were deployed for independent validation goals. 18 flood-conditioning factors were considered: elevation, aspect, slope angle, curvature plan, curvature profile, Stream Power Index (SPI), Topographic Wetness Index (TWI), Normalized Difference Vegetation Index (NDVI), distance to rivers, lithology, rainfall, land use and land cover (LULC), drainage density, valley depth, Topographic Position Index (TPI), Terrain Ruggedness Index (TRI), Geomorphons and permeability. The final flood susceptibility map was produced by using the weights-of-evidence (WofE) model, for which the receiver operating characteristic curve and the area under the curve (AUC) were generated. The validation findings demonstrated the WofE model's robustness and effectiveness. Additionally, the results of both approaches revealed a

linkage in terms of susceptible locations, with the most susceptible area being nearer to the city of Essaouira on Ksob oued. HEC-RAS analysis was performed on the cited location, helped to determine the local susceptible area with higher specificity, comparing to the two previous approaches. Managers, academics, and planners can use the study's findings to manage flood-prone areas and decrease damage. Acknowledgements: The work has been financed by national funds through FCT (Foundation for Science and Technology, I. P.), in the framework of the project “HighWaters – Assessing sea level rise exposure and social vulnerability scenarios for sustainable land use planning” (EXPL/GES-AMB/1246/2021).