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A HYDROLOGICAL-BASED MODEL FOR THE ESTIMATION OF ROAD DRAINAGE INFRASTRUCTURES RESILIENCE TO CLIMATE CHANGE.

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Abstract

Flood events are one of the greatest risk factors associated with road drainage infrastructures and climate change has been increasing the uncertainty around hydrological phenomena. Also, the large increase in population, and its concentration in dense urban centers, has promoted a significant increase in soil imperviousness, leading to a scenario where, for the same hyetograph, the resulting hydrograph shows a higher peak flow and a shorter period of time.

Furthermore, due to the uncertainty of precipitation patterns, and the complexity of the phenomena that lead to the formation of surface runoff, simplified methods for estimating flood flows are still used in the design of road hydraulic structures, not considering the rainfall and runoff coefficient space-time variations.

This deficiency motivates the study of innovative solutions to predict flood hydrograms, estimate their potential consequences, and provide solutions to mitigate associated negative impacts.

The present research seeks the development of a hydrological-based model that includes Rainfall-Runoff-Routing, considering changes throughout the hydrological basin and the time variability of precipitation patterns.

The proposed methodology includes the use of special satellite data with higher resolution and recent precipitation records for the last years in order to propose a hydrological-based model that better represents rainfall space-time variability and the uncertainty of hydrological phenomena.

The studies are being developed based on a theoretical framework and the application of a case study – the PH29 culvert of the A41 highway of Ascendi Network in Northern Portugal. This culvert is an interesting case study for the development of a dynamic-based model since it has already been subject to two major interventions, and there have been hydraulic and land use changes in the catchment area.

The results will allow to test the proposed methodology and develop a simple hydrological-based model, that can then be extended to other case studies.

Keywords: Climate change; Culverts; Dynamic hydrological model; Hydrological-based model; Rainfall-Runoff-Routing space-time variability; Road drainage infrastructures resilience.