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Road Infrastructure Resilience to Climate Change: A Hydrological-based Model for Flood Risk Assessment and Preventive Asset Management.

Paulo J. Ramísio[1], Clara Vieira[2], Fernando Sousa[2]
[1] School of Engineering, University of Minho, Portugal
[2] ASCENDI S.A., Oporto, Portugal

ABSTRACT
Climate change is increasing the incidence and severity of extreme weather events around the world, and flooding is a growing risk factor for road infrastructure drainage systems. Extreme events are becoming more frequent, more intense and of longer duration, and heavy precipitation is no exception, so flooding is also becoming more frequent and of greater magnitude. Hydrodynamic modelling of the hydrological phenomena and processes associated with the generation of surface runoff is of paramount importance in improving the resilience of road infrastructure to extreme precipitation and flood events.
In this paper, a hydrological-based model is proposed, tested, and validated for a selected case study and then will be extended to several case studies.
The PH29 culvert of the A41 highway of the Ascendi network in northern Portugal is the starting point for the development of a simple hydrological-based model for the estimation of flood hydrographs, taking into account the temporal variability of precipitation and the spatial and temporal variation of the runoff coefficient in the catchment area.
To this end, robust precipitation data recorded in recent years and higher resolution satellite data for land use mapping will be considered in the development of the hydrological-based model to better represent the space-time variability of precipitation events and the variation of land use over time.
It should be noted that the PH29 culvert is an interesting case study as it has already undergone two major interventions and there have been hydraulic and land use changes in the catchment area.
The ultimate aim is to establish a relationship between changing precipitation patterns (and land use) and flood hydrographs for the catchment area, and thereby identify risk mitigation measures to increase the resilience of drainage systems to extreme events and prevent potential damage to road infrastructure. This will also increase the resilience of road infrastructure to natural hazards and improve design criteria, while reducing operating costs and contributing to more effective asset management policy.

Keywords: climate change; culverts; dynamic hydrological modelling; floods; hydrological-based model; precipitation; rainfall-runoff-routing; road infrastructure drainage systems; surface runoff.