Flood assessment under climate change scenarios

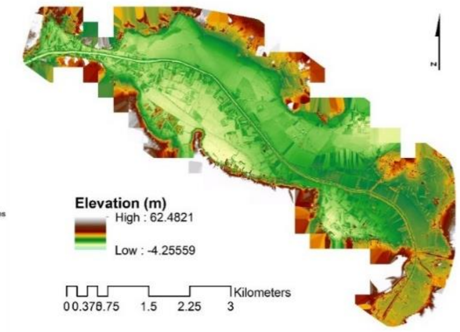
CLIM Risk floods

Background

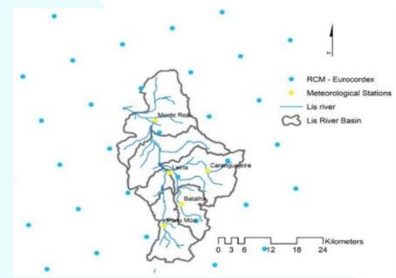
This poster presents the flood hazard projections under climate change scenarios, for the period between 2021 and 2070, in the Lis river alluvial plain located at the Centre of Portugal. It is also aimed to evaluate the hydrological processes in the study area by using an hydrological and an hydrodynamic model. The Lis river basin is favourable to the production of high water flows due to the increase of impervious areas and deforestation which have reduced the time concentration of the river basin, increasing flood risk with serious consequences for the facilities (pumping stations, centre pivots) and infrastructures (irrigation networks and roads) in the alluvial plain.

Study area and data

The Lis River Basin has a total area of 944 km^2. Upstream the study section the Lis River basin as an area of 619 km^2. The hydrodynamic modelling was carried out on an 8.5 km extent of the Lis River in the alluvial plain near the river mouth. Daily precipitation data were obtained from 5 meteorological stations from the National water service (snirh.pt), for calibration and validation period and from the E-OBS grid dataset for the period between 1979 and 2008.



Outputs from the high-resolution regional climate change ensemble EURO-CORDEX were used for generating the future climatic dataset. These data comprise datasets simulations with a horizontal resolution of 12.5 km for the Representative Concentration Pathway RCP4.5 and RCP 8.5 from Aladin53; HIRHAM5; RACMO22E; REMO2009 and WRF331F models. The control period is 1979-2008 and the scenario periods considered were 2021-2050; 2031-2060; 2041-2070.



Hydrologic and hydrodynamic modelling

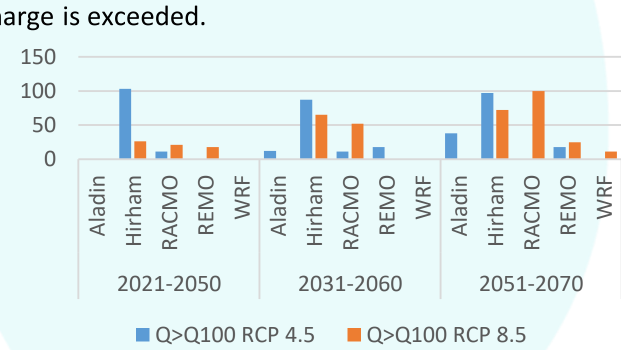
The HEC – HMS is designed to simulate the precipitation–runoff processes of dendritic watershed systems. The model was calibrated against records of two hydrometric stations, based on R^2 statistical values ranging from 59% to 81% it can be seen that the model estimates the runoff in good agreement with the observed runoff. Simulations with the calibrated HEC-HMS model were done for the periods 1979-2008 and 2021-2070 and the resulting hydrograph is used as the upstream boundary condition to the HEC-RAS model.

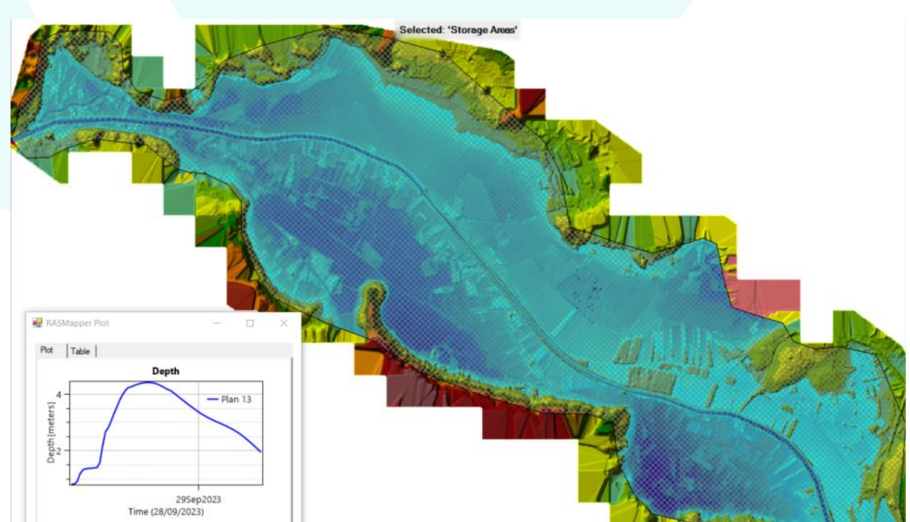
Hydraulic computations were made with the HEC-RAS Data requirements include topographic information, roughness coefficients and flow data including flow rates, water depth and boundary conditions. In order to calibrate and validate the hydraulic model, the water depth was measured at three hydrometric stations. Two recorded stage hydrographs were used as boundary conditions (*Monte Real e Ponte da Bajanca*) and a third recorded stage hydrograph (Ponte da Carreira) was used for the model validation.

Results

The following figures show the number of days with specific discharges, for the different periods, scenarios and climate models.

The number of days in which the 100 years return period discharge is exceeded.





Conclusions

The climate models outputs result in different flood impacts, but they all agree in that the number of days with higher flows will increase, mainly in HIRHAM and RACMO models, and the number of days with discharges that exceed the 100 years return period flood will increase by the end of the century. As a result, the flood risk will be more intensive in terms of its frequencies and magnitudes of damage and could be more extreme in the future. The outcomes of this study can be used as a guideline for adaptation measures under climate change impacts.

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