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Real disaster scenario of Cannes 2015 flash flood event with climate change projection for 2050

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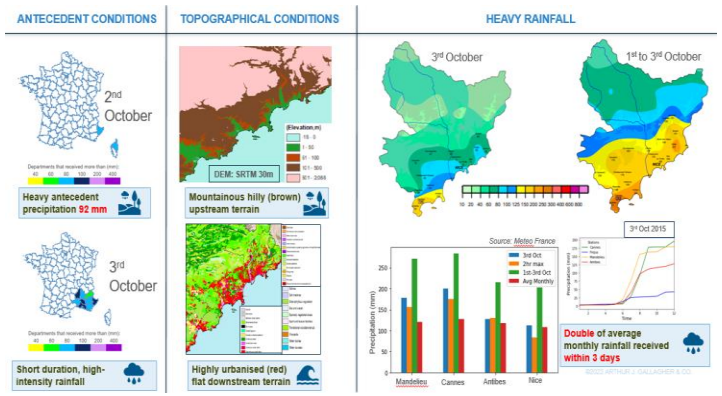
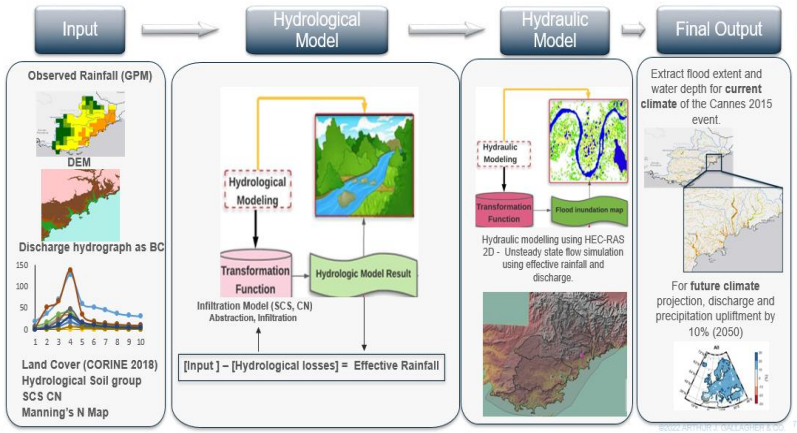
Abstract

The French Riviera in the Alpes Cote d'Azur province of France has been experiencing severe flash floods in the last decade. These recurring flash floods are usually a combination of meteorological factors such as cloudbursts and orographic shifts resulting from the proximity to the sea. In addition, studies also indicate that climate change plays an important role in the recurrence of such flash floods. The current study focuses on the reconstruction of the October 2015 event footprint and on the reprojection of the event in the 2050 future climate scenario. The event has been driven by heavy rainfall which mostly affected the cities of Cannes, Antibes, and Nice. In most of the regions more than 100 mm of rain fell in less than 2 days, with Cannes reaching 200 mm in 24 hours. According to *Merad et al. 2021* the precipitation and discharge return period relative to this event exceeds 100 years. The SCS Curve method was used to reproduce the hydrological response of the system during the event, with observed GPM precipitation data, CORINE 2018 Land use/Land cover, and observed discharge hydrograph implemented as input forcings, parameters and boundary conditions of the model. The final inundation for the 2015 scenario was obtained by means of hydraulic modelling in HEC-RAS 2D and the resulting footprint has been successfully validated both in terms of extent and flood depth against JBA footprint and available satellite imageries. For the reprojection of the event in the 2050 future climate scenario, we referred to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) and implemented an upliftment of 10% to both the precipitation and discharge. HEC-RAS 2D unsteady state flow was run under the new forcings to generate the reprojected event footprint, which revealed a significant increase in both flood depth and extent. Given the detailed inundation map relative to the future climate scenario, this study is particularly useful for designing flood mitigation measures in the French Riviera to protect life and property from the risk arising from similar catastrophic flash flood events. In addition, climate change associated risks represent a big concern for many industries including the insurance and re-insurance and this study can be used to estimate the risk and future losses associated to this and similar events.

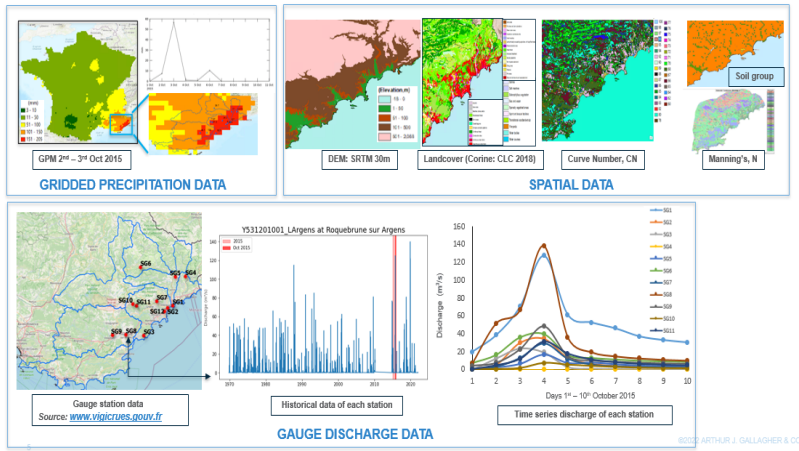
2015 Flood event overview



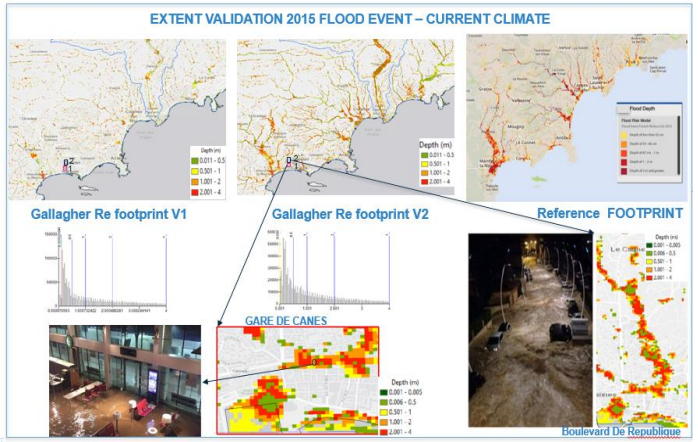
Methodology



Datasets used in RDS

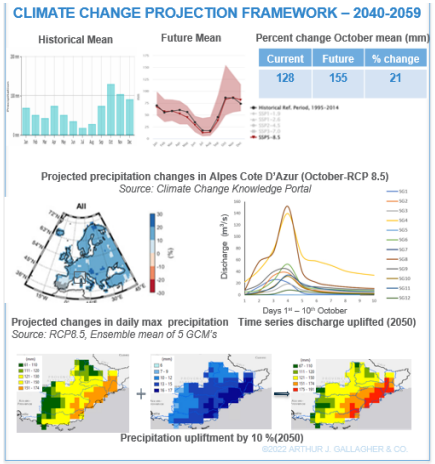


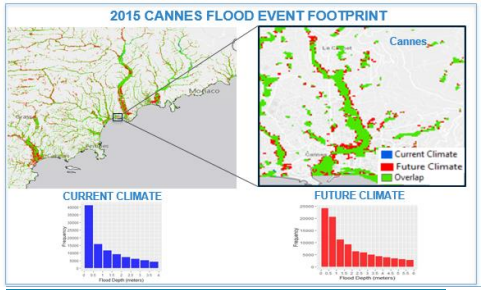
Results



- Two versions of flood footprint have been simulated.
  - V1 – 6 hours simulation period (03rd Oct 2015- 6 PM to 2 am)
  - V2 – 48 hours simulation period (02nd and 03rc Oct 2015)

- V1 captures only peak rainfall duration, antecedent conditions are not captured hence flood extent is lesser.
- V2 captures both antecedent and peak rainfall duration hence flood extent is wider
- Flood extent and depth of Gallagher Re V2 footprint is comparable with reference footprint.
- Depth validation at two locations (1 & 2).





Conclusion

- 20-year historical data shows October as the wettest month of the year with highest mean precipitation of 128 mm.
- Data obtained from Climate Change Knowledge Portal shows the mean projected precipitation of 155 mm for the Alpes Cote d'Azur Province.
- The daily maximum precipitation is set to increase by 10-20% according to RCP 8.5 scenario.
- For 2015 event reconstruction, considering daily maximum precipitation upliftment.
- Hence, 10% upliftment for precipitation and discharge is considered for 2050 year projection.

There is significant increase in hazard extent in the future climate projection.

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