A remote sensing based approach to quantify the impact of fluvial and pluvial flooding

WP6 : Flood mapping, data assimilation and evacuation route modelling

IISc-Bangalore, Bangalore, India
17th September 2019

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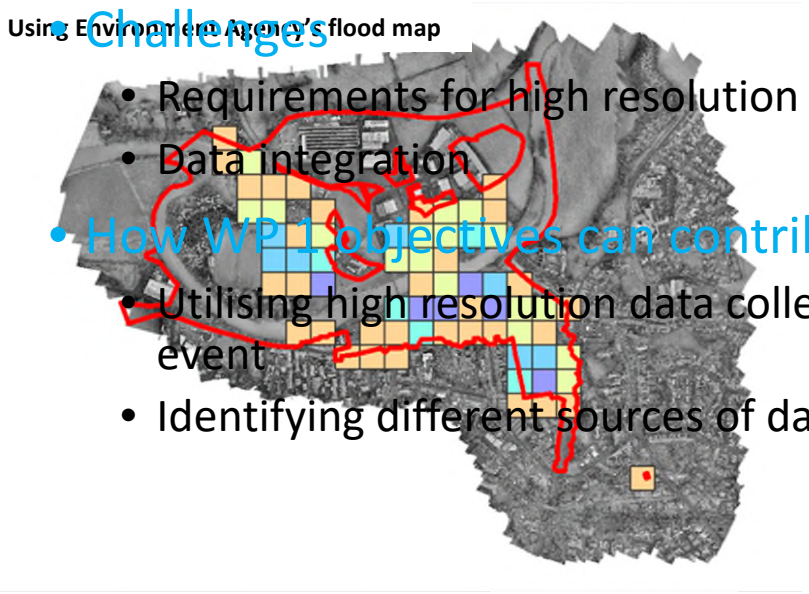
Background

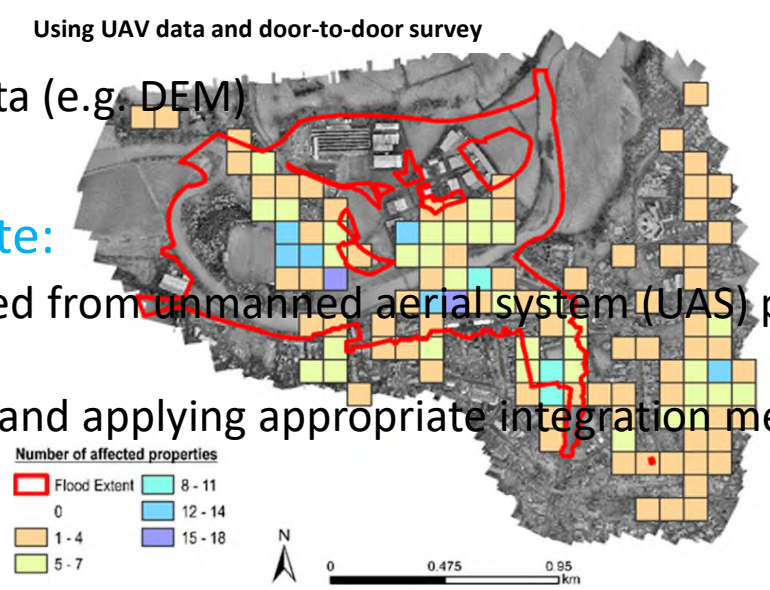
- Problem

  Currently, there is a lack of knowledge about the modelling and estimation of pluvial flood and its effective management and mitigation.
  - Unaccounted in estimation of flood risk and damages
  - Implication in emergency flood planning

- Challenges
  - Requirements for high resolution data (e.g. DEM)
  - Data integration

- How WP 1 objectives can contribute:
  - Utilising high resolution data collected from unmanned aerial system (UAS) pre-, during- , and post-flood event
  - Identifying different sources of data and applying appropriate integration methods





Ref : Rivas Casado, M.; Irvine, T.; Johnson, S.; Palma, M.; Leinster, P. The Use of Unmanned Aerial Vehicles to Estimate Direct Tangible Losses to Residential Properties from Flood Events: A Case Study of Cockermouth Following the Desmond Storm. Remote Sens. 2018, 10.

Aim and objective

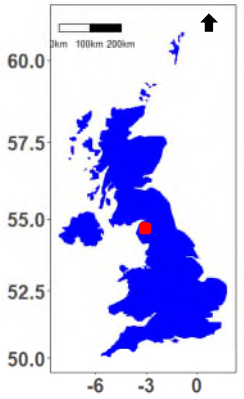
- Aim

  To develop a remote sensing based integrated methodology to quantify and compare the impacts of fluvial and pluvial flooding.

- Objectives

  - Identify different sources of data and apply appropriate integration methods to prepare data for a high-resolution DEM based 2D model for the study site.
  - Develop and calibrate the flood model which can simulate both pluvial and fluvial flooding.
  - Compare the flood extent and depth for different land use types between pluvial and fluvial flooding.
  - Estimate the number of residential properties affected by pluvial and fluvial flooding separately using a combination of model results and UAS data.

Study site and selected event



- Population ~ 8800 Households ~ 4000 (2011)
- Multiple floods in recent times
  e.g. Three storms in Dec, 2015
- Storm Desmond
  - 5-6/12/2015
  - 341 mm of rain in 24 hrs (UK record)
  - 5200 homes were flooded

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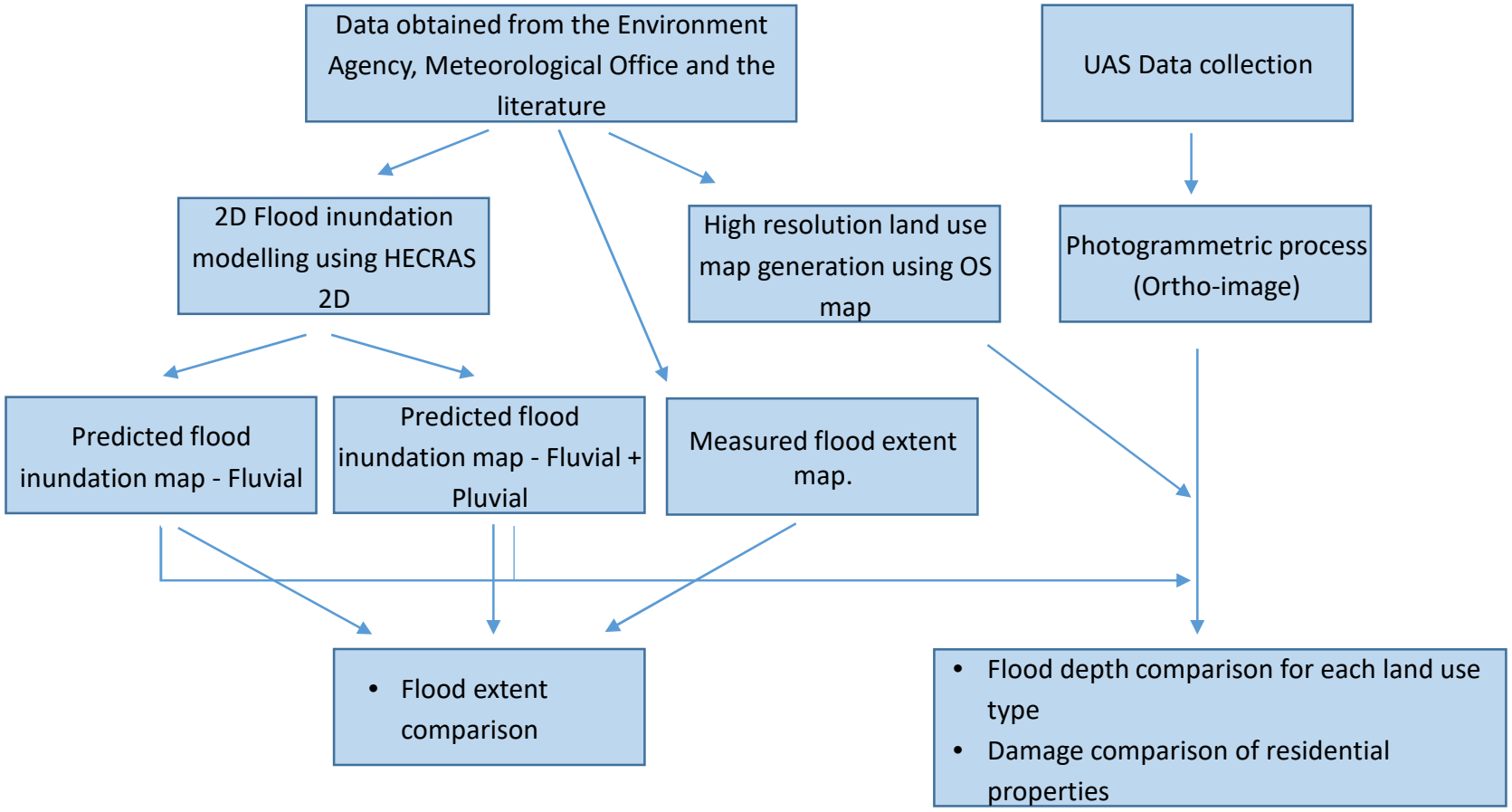
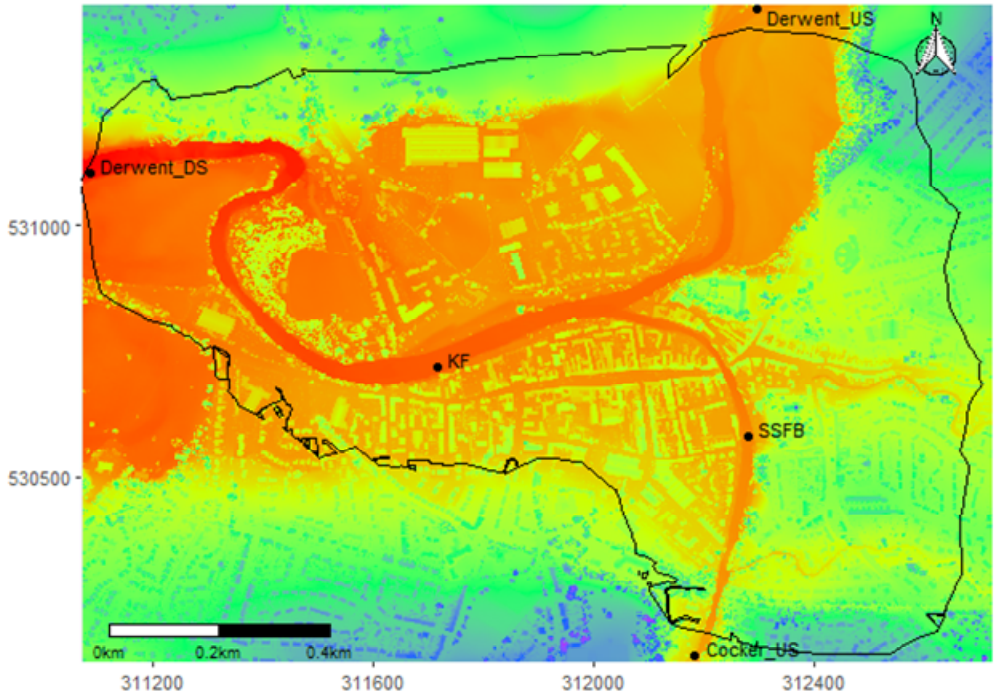
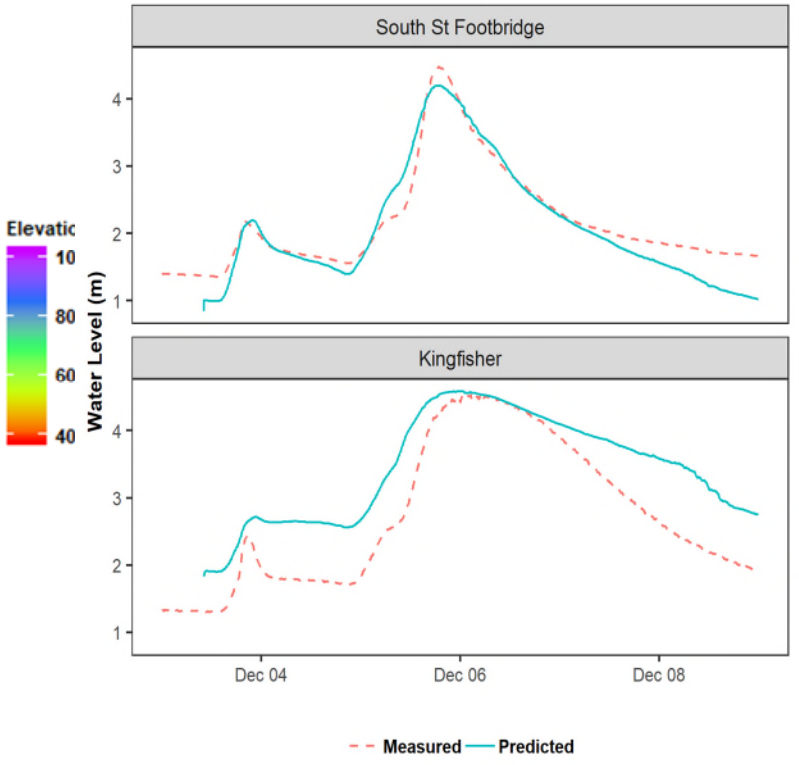
Methodology



Results - Calibration





	SSFB	KF
RMSE (m)	0.28	0.69
Percentage error - peak flow	6%	1%

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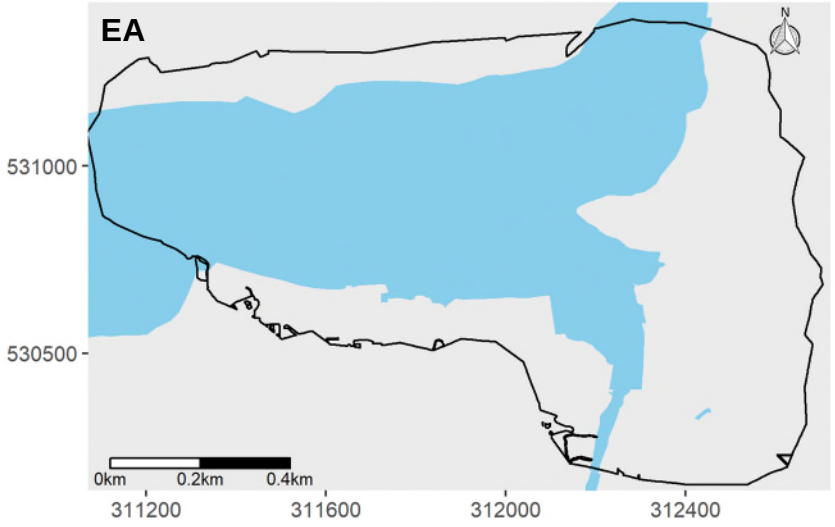
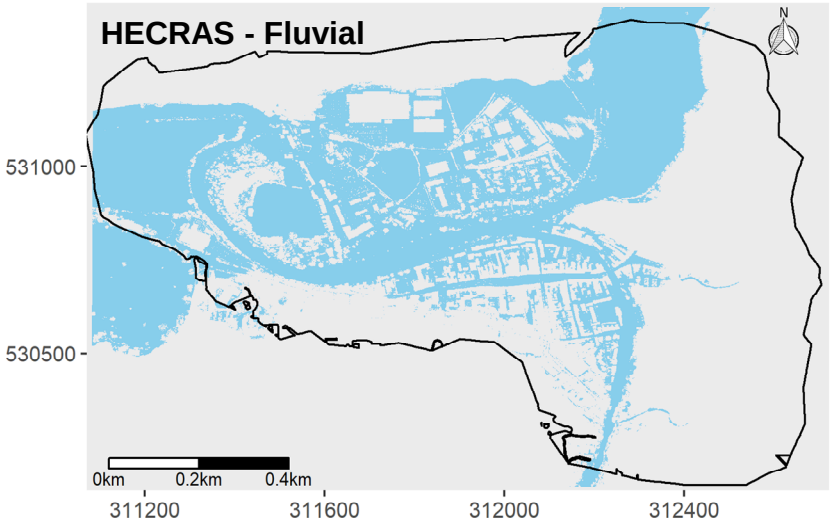
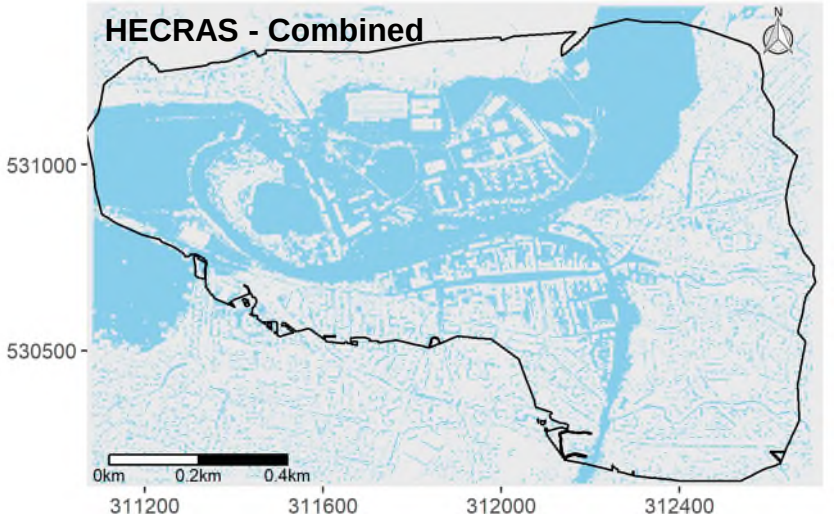
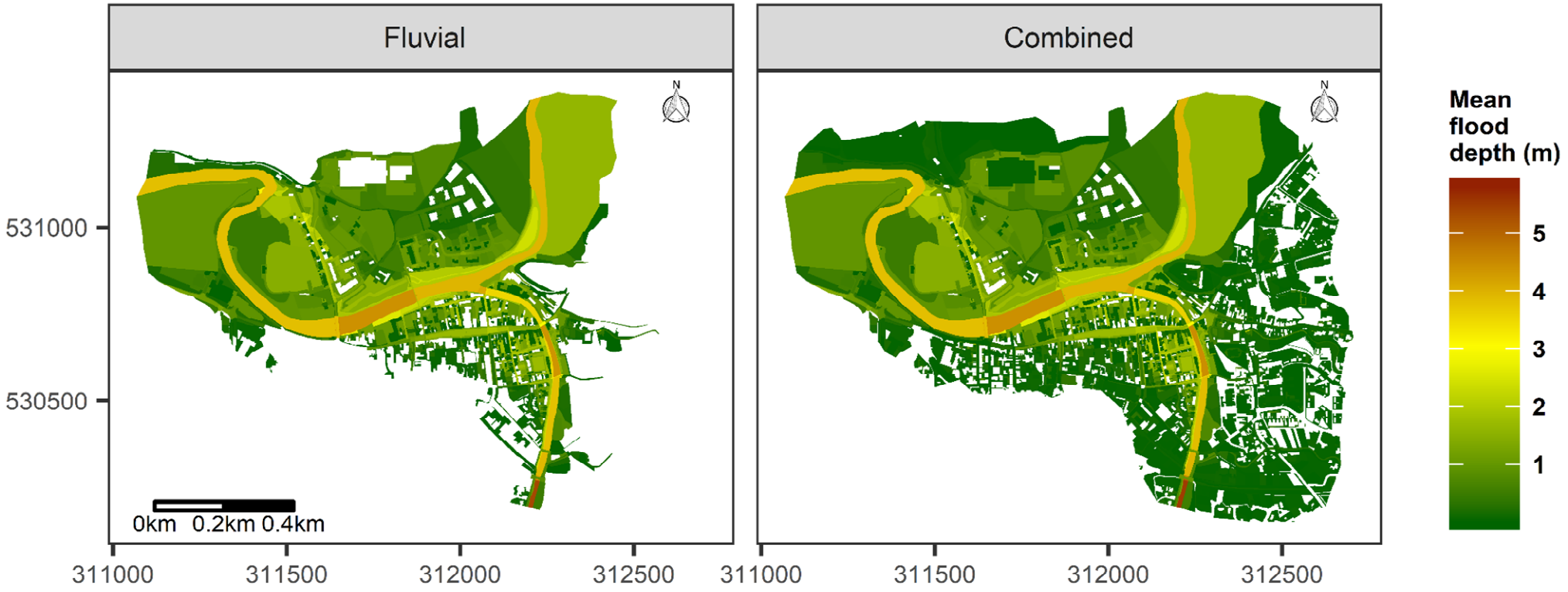
Results – Flood extent



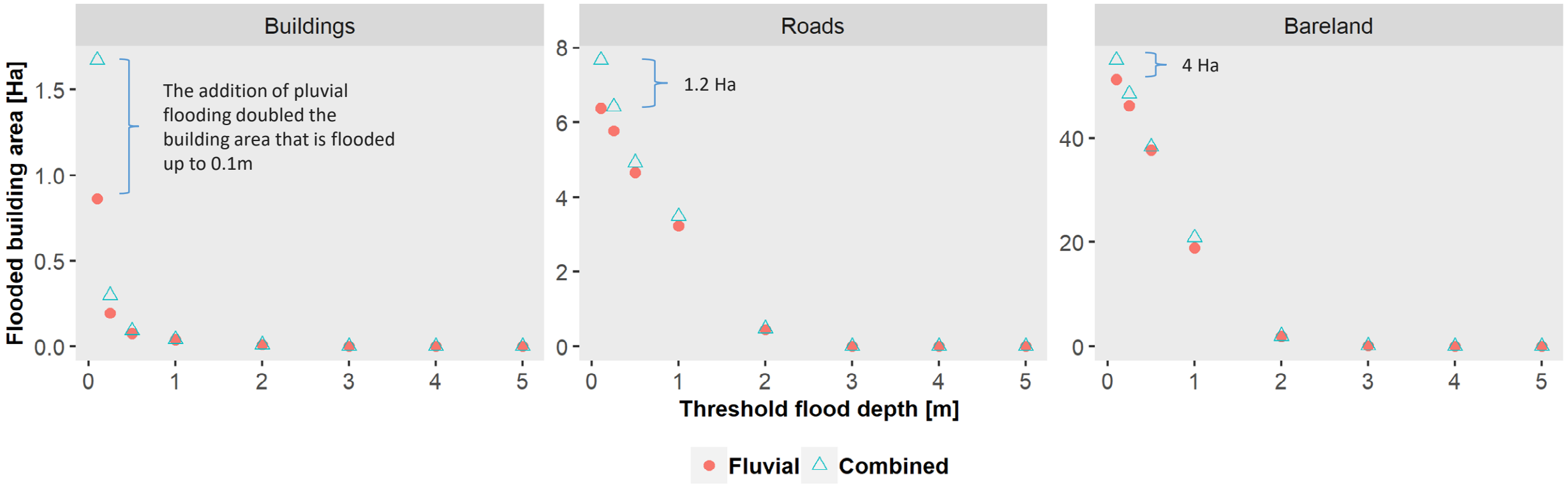




Results – Flood depth



Results – Land use level analysis



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Results – Property level analysis

Contribution of pluvial flooding in total flood depth	Number of properties
0 (Fluvial flooding only)	16
1% - 25%	84
26% - 50%	41
51% - 75%	11
76% - 99%	10
100% (Pluvial flooding only)	51
Total	**213**

Conclusions

- Pluvial flooding can have a significant effect even in a catchment where fluvial flooding is the major cause of the flood damages.
  - Shows that pluvial flooding needs to be taken into account for a comprehensive flood emergency planning.

- The presented study needs to be further improved by collecting more data for more comprehensive calibration of pluvial flood extend and depth.
  - A wider use of UAS in data collections could be the most effective way to do this.

- This will eventually help to develop a better informed emergency flood plan.

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Thank you!
Questions?