



Cloudburst catastrophe modelling: Case study – Jönköping municipality, Sweden

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Background

In Europe, flash floods are one of the most significant natural hazards, causing serious risk to life and destruction of buildings and infrastructure. While these events play an important role in the ongoing flood risk management discussion, they are under-represented among flood models.

Catastrophe models is a recent methodology to do this, but its development is limited both by a lacking balance between hazard and vulnerability information and by protective commercial interest seldom allowing the methodology to be openly published in the scientific literature.

The main aim of this study is to demonstrate an approach by showing how methods and techniques can be integrated together to construct a catastrophe model for flash flooding of Jönköping municipality in Sweden.

Data

Precipitation data from 20 municipal tipping-bucket gauges. These data were analysed for cloudburst events on July 2013, August 2014, and June 2017.

Exposure data, the locations and extents of 57,408 buildings in the modelled area were obtained from Lantmäteriet.

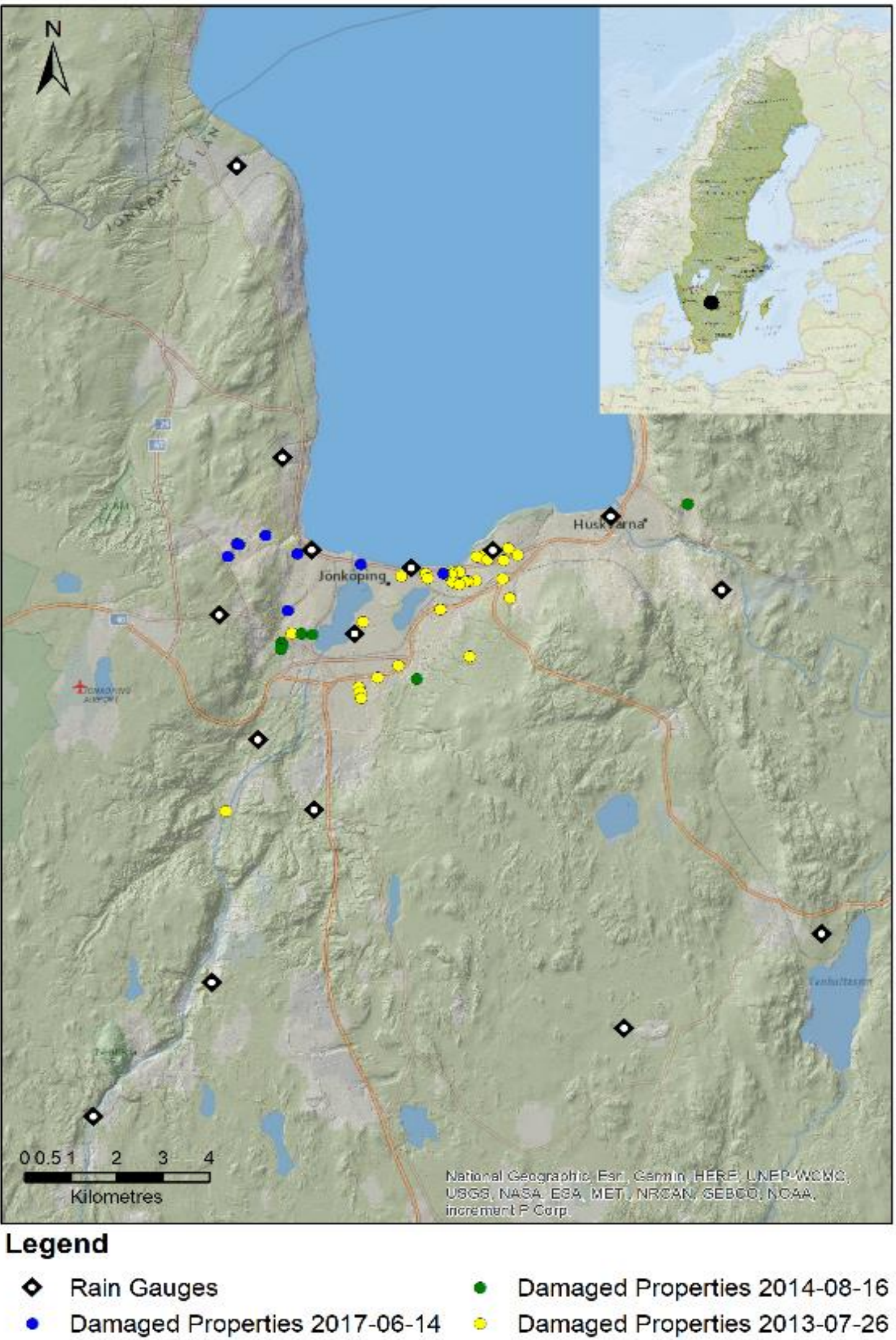
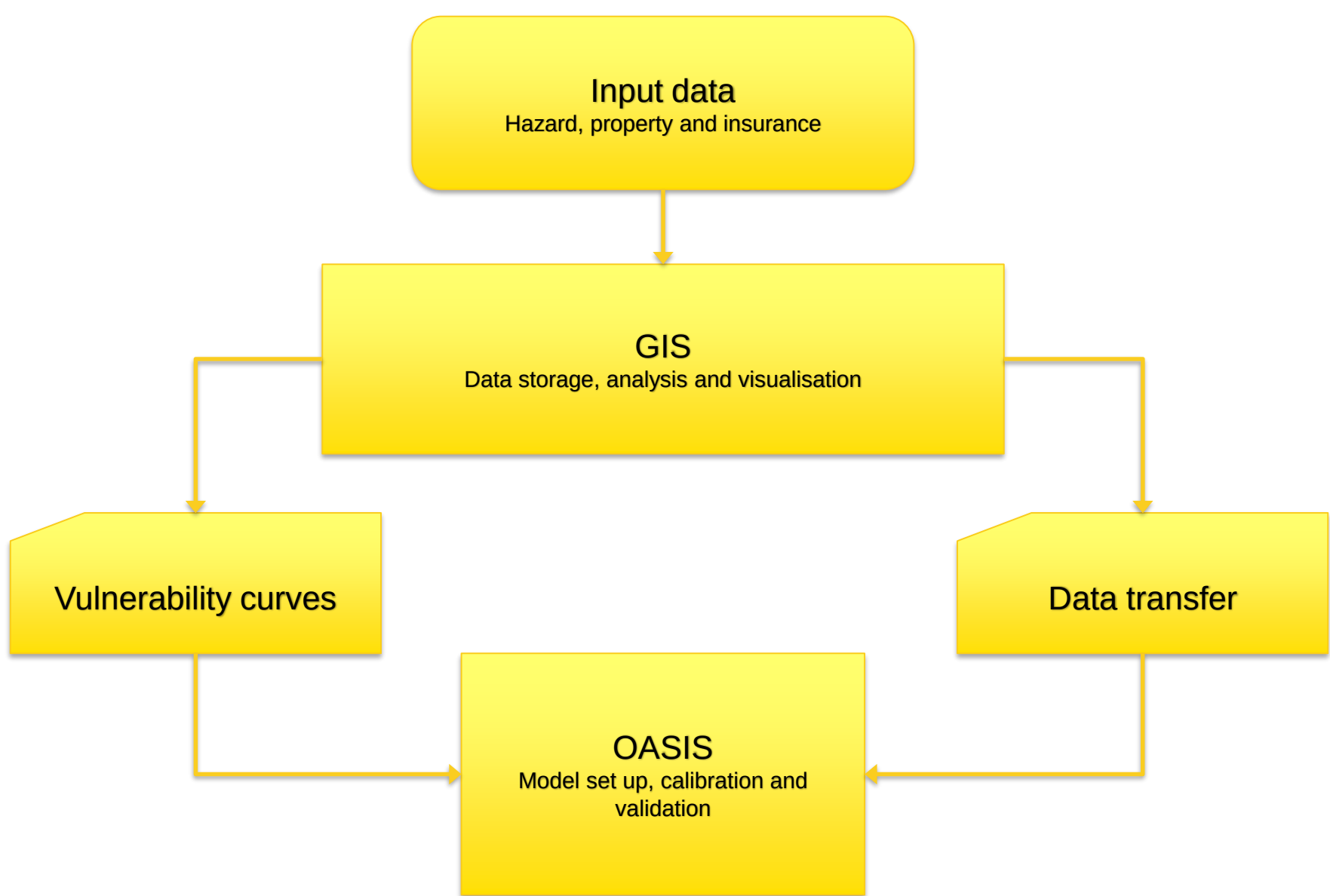
Flood-insurance data from Länsförsäkringar Jönköping as a proxy for flood damage to establish flood-damage vulnerability curves.

Type	Issued by
Insurance-loss data	Länsförsäkringar
Rain-gauge data	Jönköping municipality
Building extents	Lantmäteriet
Property taxation values	Metria AB

Methods

The study was based on three methodological pillars:

- a multi-source data-collection strategy,
- Spatial analyses and reformatting within a Geographical Information System (GIS),
- and a cat-modelling environment (Oasis).



Results

The hazard input to the Splash model was the cloudburst intensity over the modelled area. On the 2013 event, two cloudburst-intensity maxima could be seen. The first over a relatively flat valley bottom where about half of the damaged buildings were located, whereas the second and largest maximum was located along the shore of the lake at the bottom of the steep north-to-west-facing hillslopes. The 2014 cloudburst was located to the west and to the east of the central city with its maxima on the mountain ridges. The damaged buildings on this occasion were located similarly to the 2013 event, accumulating water from the hillslopes to the west and to the east. On the 2017 event, the largest cloudburst intensity occurred on the western ridge and along the western part of the lake shore at the bottom of east-facing hillslopes. The calibration to the 26 July 2013 event was successful and allowed the modelled gross loss to match the actual gross average loss.

Conclusions

It is possible to get acceptable results from a catastrophe model for cloudburst flooding using only rainfall.

Loss data are increasingly difficult to access at property level.

Our vulnerability function, based on real property-level data, could possibly be a benchmark for theoretically derived functions.

