

Tobias Sieg^{1,2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹





• Do more detailed data and models improve flood risk estimates?

Motivation Methods Results I Results II Results III Conclusion

• Exposure data sets and asset scaling factors strongly determine the estimates.



Tobias Sieg^{1,2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹



Motivation

- More and more different modeling approaches and data sets exist to describe flood hazard, exposure and vulnerability.
- The influence of these advancements on the estimated flood risk is rarely assessed.
- A quantification of the influence can identify which advancements are most profitable for the whole risk assessment.





University

Methods

We estimate economic flood impacts to private households and companies for a flood event in 2013 in Germany using two different approaches to describe each of the three risk components.

Hazard

• A flood map specifically derived for the flood 2013 (jbarisk) and a map formed by serveral local flood maps provided by the European Joint Research Center (JRC).

Exposure

• Using an object-based approach with OpenStreetMap (OSM) data and with the landuse based Basic European Asset Map (BEAM).

Asset Estimation

• Based on asset values per sqm and an alternative approach for companies based on the number of employees (see Sieg et al. 2019).

Vulnerability

• Use tree-based models and Stage-Damage-Functions (Sieg et al. 2019).





Tobias Sieg^{1, 2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹

Methods

We measure the influence of input data with two approaches.

- First, we evaluate the performance of the damage estimations based on different input data sets with the continuous ranked probability score CRPS.
- Second, we calculate a relative difference RC between between damage estimates computed with different input data sets.



Tobias Sieg^{1,2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹

Continuous ranked probability score

The CRPS of a given distribution for a observation y_i is defined as

$$CRPS_i(F_i, y_i) = \int_{-\infty}^{\infty} (F_i(x) - \mathbf{1}\{y_i \le x\})^2 dx$$

where $F_i(x)$ is the cumulative distribution function (CDF) of the predictive distribution $f_i(x)$ and $\mathbf{1}\{\cdot\}$ is the indicator function. We compute the CRPS with an empirical CDF estimated from samples of $f_i(x)$.





Relative Contribution

The relative contribution RC of a risk component h, e, v for a spatial unit i is defined as

$$RC_{h}^{(i)} = \frac{\max_{e \in \{e_{1}, e_{2}\}, v \in \{v_{1}, v_{2}\}} |x_{h_{1}, e, v_{1}}^{(i)} - x_{h_{2}, e, v}^{(i)}|}{\max_{h \in \{h_{1}, h_{2}\}, e \in \{e_{1}, e_{2}\}, v \in \{v_{1}, v_{2}\}} x_{h, e, v}^{(i)} - \min_{h \in \{h_{1}, h_{2}\}, e \in \{e_{1}, e_{2}\}, v \in \{v_{1}, v_{2}\}} x_{h, e, v}^{(i)}}$$

where x is the median of the calculated distribution of the damage estimates.



Tobias Sieg^{1,2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹





- Median of distributions of estimated economic impacts per affected federal state.
- Computations based on OSM data and sqm asset estimation systematically overestimate the economic impacts.
- The systematic overestimation is not apparent if asset estimations for companies from OSM data are based on employees.



Abstract

Motivation

The Influence of Input Data on Flood Risk Estimates

Tobias Sieg^{1,2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹

Results III

Conclusion





Results I

Methods

- CRPS of distributions of estimated economic impacts for all federal states.
- Biggest difference in performance due to different exposure data sets OSM and BEAM.
- OSM shows weaker performance with sqm asset estimation, but higher performance for employee-based asset estimation



Tobias Sieg^{1, 2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹





- The spatial scale is defined as a share of all flood-affected objects identified.
- The choice of exposure data sets has the highest influence on the impact estimation followed by influences from the hazard.
- c shows OSM only; spatial scale equals to the number of companies, extents of flood maps have no influence.
- The asset scaling contributes most to the impact estimation.





Tobias Sieg^{1,2} (tobias.sieg@uni-potsdam.de) Annegret Thieken¹

Conclusion

- Exposure data sets and asset estimation methods strongly influence the impact estimates.
- Their influence exceeds the ones from hazard and vulnerability.
- High potential for future research in exposure and asset data sets.