Cross-country transferability of flood damage models for residential buildings

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Background

The estimation of flood damage is an important component for risk-oriented flood design, risk mapping, financial appraisals and comparative risk analyses. However, existing damage models are hardly validated and inherent to substantial uncertainty. Many damage models are currently transferred in space and time, e.g. from region to region or from one flood event to another. Though, it is still unknown to what extent and under which conditions this transfer is possible and reliable. Model validations in different countries could provide valuable insights into the transferability of damage models.

Concept

The German flood damage model FLEMOps (Thieken et al. 2008) is applied and validated in Austria and an Austrian flood damage model is applied and validated in Germany. The Austrian municipality of Gleisdorf and the German city of Eilenburg are analysed as test cases. Flood damage data collected after the flood in 2005 in Tyrol, Austria and Bavaria, Germany are used for validation purposes.

Example: transferability-problem

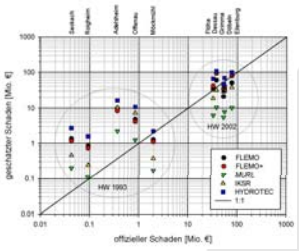

Figure 1: Official repair costs and estimated building losses in ten municipalities that were affected by flooding in 1993 or in 2002 (source: Thieken et al. 2008)

Losses for the 2002 flood event are very well estimated by FLEMOps and FLEMOps+. However, model performance is much lower in case of the 1993 flood event . While the mean relative error of the estimates for the 2002 event amount to 24% for FLEMOps+, it is more than 1000 % in case of the 1993 flood. Therefore, transferability of loss models to other regions seems to be limited and has to be investigated further (Thieken et al. 2008).

The German flood loss estimation model FLEMOps

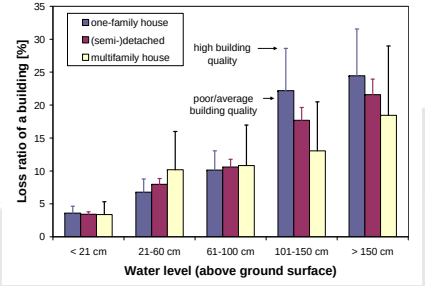

Figure 2: First stage of the micro-scale FLEMOps model: mean loss ratios of flood losses to buildings depending on water depth, building type and building quality.

Table 1: Scaling factors for the second stage of the micro-scale FLEMOps model (FLEMOps+): Scaling factors for residential building losses depending on contamination and precaution.

		Private precaution		
		none	good	very good
Conta-mination	none	0.92	0.64	0.41
	moderate	1.20	0.86	0.71
	severe	1.58	---	---

German case study area

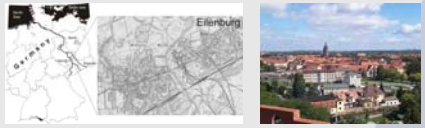

Figure 3: German case study area: City of Eilenburg in the federal state of Saxony (source: Apel et al. 2009)

The Austrian flood loss estimation model

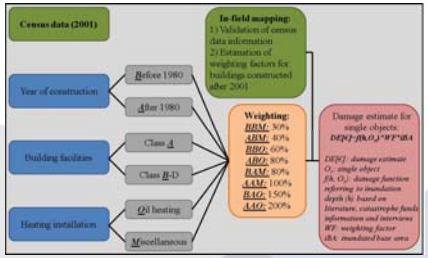

Figure 4: Overview of the Austrian method with weighting factors and the relation to in-field mapping results.

Austrian case study area

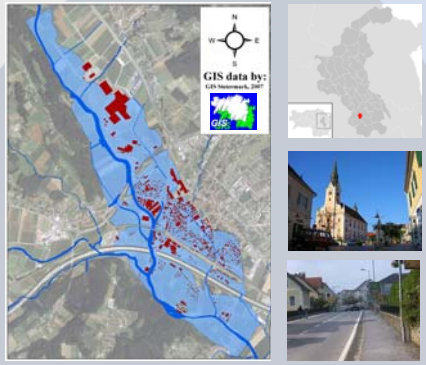

Figure 5: Austrian case study area: municipality of Gleisdorf

Preliminary results

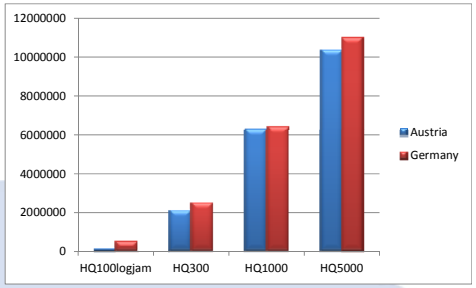

Figure 6: Comparison of Austrian and German flood damage model estimations for flood scenarios of the municipality of Gleisdorf in Austria.

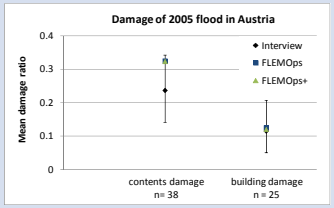

Figure 7: Evaluation of the German flood loss model FLEMOps applied to a data set of Austrian residential buildings affected during the flood in 2005. Shown are surveyed and estimated mean ratios of losses to contents and buildings as well as the 2.5–97.5% confidence intervals of the surveyed data, calculated by bootstrap.

Table 2: Error statistics for estimated loss ratios of the interviewed households (related to Figure 7; MBE: mean bias error; MAE: mean absolute error; RMSE: root mean squared error; MRE: mean relative error).

	Contents damage		Building damage	
	FLEMOps	FLEMOps+	FLEMOps	FLEMOps+
MBE	-0.0151	-0.0100	-0.0145	-0.0101
MAE	0.0502	0.0466	0.0201	0.0162
RMSE	0.1460	0.1408	0.0588	0.0521
MRE	2.7746	2.2426	8.0831	5.0434

Conclusions

First results show a relatively good agreement of the damage estimated by the German and the Austrian flood loss models applied in Austria. The damage estimates of FLEMOps for flood damage data from the 2005 flood in Austria are within the 95% confidence interval. Thus, transferability of flood damage models between Germany and Austria seems possible under certain conditions. Further investigations on the specific situations which enable a transferability of damage models are upcoming.

References:

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