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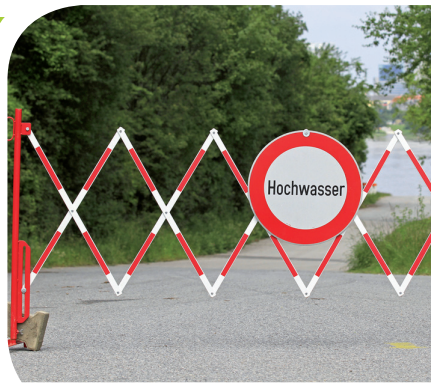

Climate Change

Impact on Environment and Society

Disaster Management

The Impact of Climate Change on Riverine Flood Risk in Austria

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Applying various economic evaluation approaches, the COIN project evaluates the impact of climate change on fluvial flood risk in Austria.

Main findings

- Taking into account the results of three evaluation approaches (a national approach based on HORA[1] and two approaches based on the European ClimateCost[2] and ADAM[3] projects, respectively), flood damages in Austria will increase in the future.
- Depending on the underlying evaluation approaches, the results regarding the scope of damage increase vary significantly, though; hence the extent of costs arising from flood damages for the 2016–2045 (2036–2065) period is estimated at an annual average of € 288 to € 940 million (mn) (€ 430 mn to € 1,787 mn).
- Climate change-related flood damages alone are projected to reduce welfare[4] by up to € 613 mn (€ 1 billion) p.a. for the 2016–2045 (2036–2045) period; all numbers refer to current buying power.
- The evaluation approaches apply different socioeconomic developments as well as a range of climate scenarios. Both factors considerably determine the forecast variations between the respective approaches.
- The public service and health sectors will be most strongly impacted by future flood damages (inter alia, due to redistribution of public expenditure toward covering increased damages). The manufacturing, trade, and retail sectors, on the other hand, would benefit the most, due to replacement expenditures and investments.

Climate change will impact on both the frequency and intensity of natural disasters (IPCC, 2014). In Austria, flood events, which already cause considerable economic damages, will be particularly significant. The damages resulting from the 2002 flood event amounted to more than € 3 billion (Habersack et al. 2004), and the flood of 2013 also had a drastic impact, causing estimated costs of € 0.9 billion (according to BMI, 2014).

To at least partly cover the expenditures for natural disasters, Austria has established a disaster fund, whose current volume is, however, not based on projections for future damages.

Project info box

The interdisciplinary COIN (Cost of Inaction – Assessing Costs of Climate Change for Austria) project evaluates economic impacts of climate change in Austria. For this purpose, a scenario-based analysis of and across twelve key sectors is conducted, which assesses the possible impact of climatic change in combination with socioeconomic developments. The main scenario assumes a temperature rise within the two degrees Celsius margin for the period up to 2050. This assumption presupposes stronger climate policies than the ones currently in place. The analyses presented here only show that part of all potential impacts which has already been quantified and takes into consideration individual adjustments made.

What has been analysed?

The current study investigates the possible impacts of climate change on future flood damage from fluvial floods. For this purpose, different evaluation approaches were chosen: the nationally-oriented HORA-based approach and the approaches of the large-scale European ClimateCost and ADAM evaluations. The HORA-based findings are currently the most detailed model results for Austria; they were obtained under the assumption of a moderate climate change scenario[5] and moderate socio-economic developments[6] as defined by COIN. However, the drawback of the HORA-based calculations is that they leave essential factors unconsidered (they, for instance, only reflect damages to residential buildings). Both ClimateCost and ADAM, on the other hand, include a wider range of climate scenarios and damage categories (inter alia, also damages to other infrastructures and to agriculture and forestry). However, compared to the HORA-based method, they demonstrate a lower level of spatial detail and do not use respective empirical data from Austria.

1 The method based on the Austrian flood risk zoning system (»HORA«) considers the distribution of building stock in Austria according to the different flood risk zones. The results are validated with data of damages occurred over a 50-year period.
2 ClimateCost (The Full Costs of Climate Change): Here the hydrological LISFLOOD model and a range of climate projections based on the A1B emissions scenario were used (see Rojas et al. 2013).
3 ADAM (ADaptation And Mitigation Strategies: supporting European climate policy): Here damage assessment maps were developed, taking into consideration flood levels and future developments (based on variations of a 100-year event) (see Lugeri et al. 2010 and Kundzewicz et al. 2010).
4 The COIN project assesses social costs of climate change in terms of welfare effects, which represent changes in the amount of goods and services consumed, including the utilization possibilities of stocks and assets. Other welfare-generating effects, such as changes in environmental quality, have not been quantified.

What impacts are to be expected?

In the context of the HORA analysis alone, the chosen climate scenario featuring reduced precipitation extremes results in a slightly diminished flood risk for the 2016–2045 period. However, combined with the assumed socio-economic developments (e.g., more living space per capita; additional building stock in risk areas) the climate-related impacts result in estimated annual flood damages of approx. € 288 mn. This corresponds to a 50 % increase compared to the current (average annual) costs. For the 2036–2065 period, the total estimated damages increase to more than € 400 mn per year, i.e., to double the current damages. For the same period, directly climate changerelated costs amount to € 25 mn p.a.

To make viable predictions, additional climate scenarios were included, and an extended range of impact areas was analysed based on the alterative evaluation methods of ClimateCost and ADAM. These spatially less detailed methods show distinctly higher results. The ADAM method predicts average annual climate-related damages of just over € 1 billion for the 2036–2065 period (the method does not consider socio-economic developments). The ClimateCost approach already forecasts annual flood damages of almost € 1 billion for the 2016–2045 period. For the second period of analysis (2046–2065), the results of the ClimateCost approach show damages in an approx. annual range of € 1.8 billion.

Table 1 compares the results of the individual evaluation approaches, displays the respective damage sums (from changing socio-economic situations and from climate change; the numbers given above refer only to the latter), and states which respective factors were considered. The findings forecast damage extents to increase (from ADAM to ClimateCost) in accordance with both the spheres of influence (from the HORA approach to ClimateCost and ADAM, respectively) and with an adequate consideration of socio-economic developments (e.g., the increase in building stock).

Table 1: Findings of the different calculation approaches (in million €).

Future economic impact*		Socio-economic development	Economic impact of floods	
Ø 2016-2045	Calculation method	Hora-based**	yes	-288
		ClimateCost***	yes	-940
		ADAM***	no	n/a
Ø 2036-2065		Hora-based**	yes	-430
		ClimateCost***	yes	-1787
		ADAM***	no	-1146

* Future economic impact: negative number indicate net losses, positive numbers indicate net gains. ** Impact chains investigated: residential building stock. *** Impact chains investigated: damage to buildings; damage to infrastructure, agriculture, and forestry as well as cost arising from higher workloads for disaster response units. n/a: data not available.

What impacts on the Austrian national economy can be expected?

The respective national economic costs can be assessed based on the range of climate scenarios and on the extent of the impact chains under consideration. The results obtained when referencing the HORA-approach and calculating the directly climate change-related impact on welfare even show a slight increase[7] in welfare (at an average of € 117 mn p.a.). This is due to the decrease in flood damage predicted by this rather arid[8] climate scenario. However, due to increasing climate changerelated flood damage in the 2036–2065 period, also the HORA approach shows an average annual decrease in welfare of € 14 mn for that period. Considering a wider range of climate scenarios and damage areas (ClimateCost approach) results in a significant decrease in welfare (by an annual average of € 613 mn) already for the first period of analysis (2016–2045). For the 2036–2065 period, the ClimateCost approach even shows a welfare decline by € 1 billion per annum. Moreover, it is certain that the manufacturing and trade as well as the retail sector would benefit the most from future flood damages, whereas the public service and health sectors would suffer the biggest losses. While the gains in the manufacturing and trade as well as the retail sector would primarily be owed to replacement of damaged properties, the losses would mainly be an indirect consequence of redistributing higher public expenditures toward covering the damages.

Fact Sheet as well as literature citations based on

Prettenthaler F, Kortschak D, Hochrainer-Stigler S, Mechler R, Urban H, Steininger KW. 2015. Catastrophe Management, Chapter 18 in: Steininger KW, et al. (eds.), Economic Evaluation of Climate Change Impacts: Development of a Cross-Sectoral Framework and Results for Austria. Vienna, Springer.

5 According to the climate change scenarios modelled in COIN, moderate climate change leads to shifts in precipitation maxima for three consecutive days of -2.2 % (+1.3 %) (averaged over all NUTS3 regions in Austria) during the 2016–2045 (2036–2065) period. This shows that the climate scenario chosen by COIN will be a »moderate« one at the end of the 21st century, but that it will be relatively arid up to 2030.

6 The socio-economic assumptions consider future changes in value and numbers of real estate.

7 The results are based on comparing the respective climate change scenarios to a baseline scenario (which interprets socio-economic developments at a medium sensitivity level of the sector, disregarding climate change).

8 »Arid« is to be seen relative to other available climate change scenarios.

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