

In the face of the growing threat of extreme weather events, such as urban floods, researchers have initiated a research project aimed at assessing the vulnerability of transport systems to such events in large cities in Poland and Austria. This project focuses on analyzing the impact of floods on transport accessibility, road network load, and residents' mobility behavior, utilizing advanced computer models and data from mobile devices. This issue is gaining significance in the context of progressing climate change and the increasing frequency of extreme weather events, which have a profound effect on the functioning of urban spaces and their transport infrastructure.

The main goal of the project is to investigate how urban floods affect the functioning of transport systems in cities with populations exceeding 100,000, such as Warsaw, Kraków, and Vienna. The research aims to answer questions regarding the extent of road network inundation, travel times, infrastructure congestion, and access to key locations such as hospitals, transportation hubs, and public administration buildings during crisis conditions. The project examines various modes of transport, including private cars, public transportation, pedestrians, and cyclists, enabling a comprehensive understanding of the issue and a detailed assessment of the sensitivity of individual components of the transport system.

This research topic has been undertaken due to the fact that urban floods have become a significant challenge in the context of climate change and intensive urbanization, which increases the impervious surfaces in cities. Large areas such as streets, squares, and parking lots prevent the natural infiltration of rainwater, leading to rapid water accumulation on the surface and localized flooding. The consequences include disruptions in transportation, difficulties in the daily functioning of cities, and direct threats to residents' health and lives. In Poland, where transport infrastructure often requires modernization, the effects of flooding may be more severe than in Austria, which has more developed infrastructure and greater experience in managing crisis situations. Comparing these two countries allows for the identification of both vulnerabilities and best practices that can be adapted in Poland and other countries with similar climatic and urban conditions.

The project is based on multi-faceted scientific research utilizing a wide range of methods and tools. Key elements include hydrological analyses, traffic modeling under flood conditions, and mobility data collected from mobile devices. Computer simulations allow predictions about which road sections will be flooded, as well as indications of changes in travel times and road network load. Traffic modeling, both at the macro and micro-simulation levels, enables an analysis of mobility behavior under crisis conditions, accounting for slowdowns, detours, and changes in preferred travel routes.

One innovative aspect of the project is the use of advanced technologies, such as radar satellite data and GPS signals, which enable precise tracking of changes in residents' mobility. These data allow for the analysis of actual mobility behavior during floods and its comparison with typical mobility patterns during non-disruptive periods. This helps researchers better understand residents' responses to crisis situations and identify areas most at risk of losing access to transport infrastructure.

The project outcomes are expected to provide tangible benefits for city authorities and planners. One key result will be the development of a Flood Vulnerability Index, which will help identify the most damage-prone elements of transport infrastructure. Such a tool will be invaluable in decision-making processes related to infrastructure modernization, planning preventive measures, and developing crisis management strategies. Additionally, the project will provide insights to support the creation of effective evacuation plans, educate residents on appropriate mobility behavior during emergencies, and implement intelligent transport systems to support urban functionality in crisis conditions.

Thanks to the international scope of the project and case analyses from Poland and Austria, it will be possible to gain a better understanding of how diverse transport systems respond to urban floods, taking into account different climatic, urban, and social conditions. The research findings will contribute to the advancement of knowledge in crisis transportation management, while simultaneously supporting the development of sustainable urban mobility. They may be applied in both spatial policy and urban management practices, ultimately improving the safety and quality of life for city residents.