Flood Risk Reduction and Adaptation Support through Object Protection Measures – Benefit Analysis on Catchment Scale from Upper Austria

Research question
What are the potential pathways of future settlement development and how do they interact with the positive effects of Local Flood Protection Measures?

Study area and legal framework
Study area Ottanger Redl in Upper Austria
• Several times affected by severe flood events
• Pre-alpine catchment between 400 and 700m a.s.l.
• Catchment area of 60km² (inflow to the river Ager)
• Eight communities with approx. 18,500 inhabitants
• Intensive settlement pressure

The Provincial Act for Construction Engineering and Materials (LBGl- Nr. 35/2013) covers the rules for flood safe design of buildings.

The construction of buildings within flood planes (recurrence interval of 100 years) is permitted if:
• The building is sealed against the ground or has an elevated design
• Openings require sealing and protective measures against water ingress
• The top edge of the ground floor is located 20cm above the water level (since 2015, 50cm)

Methodology
The study follows a risk-based approach. Beside the current settlement situation (2012) reconstructions of the past (1999) and future settlement scenarios (2030) are considered. The potential benefits of two different LFPM according to the Provincial Act are evaluated. Two different approaches to comparatively quantify damage reducing effects are applied:
1. Scenario-based evaluation (linking losses to return periods)
2. Stochastic damage evaluation

The modelling concept comprises five main methodological steps:
1. Hydrological Modelling and Design Flood Estimation
2. Hydro meteorological scenario building
3. Hydrological Model Calibration
4. Hydrological Scenario
5. Damage Modeling and Risk Evaluation

Results and Conclusion
Scenario approach:
• Most significant effects until the design event (HQ100 +20cm) is reached (no increased losses)
• Type of LFPM relevant for scenarios with magnitudes above the design event
• The more intensive scenario magnitudes the less effective is the type LFPM 1 whereas type LFPM 2 retain their effectivity

Stochastic approach:
• Due to the stochastic nature of flood events the results show a wide range
• Increasing flood losses without LFPM due to settlement dynamics
• Positive effect of LFPM but not as pronounced as shown within the scenario approach

Conclusion
• LFPM can be efficient measure to reduce flood risk until the events do not exceed the design event magnitudes
• For low frequency/ high impact events above design event criteria the type of flood protection measure is essential (LFPM 2 > LFPM 1)
• LFPM alone are not sufficient the reduce flood risk (concurrent with an increasing damage potential); however, flood risk can be reduced relatively to the settlement development
• Flood risk can only be reduced on a sustainable manner in the framework of an Integrated Flood Risk Management

References: