InsuResilience
Solutions Fund

CLIMADA Climate Risk Analysis

Coastal Protection in Vietnam

Tropical Cyclone Risk

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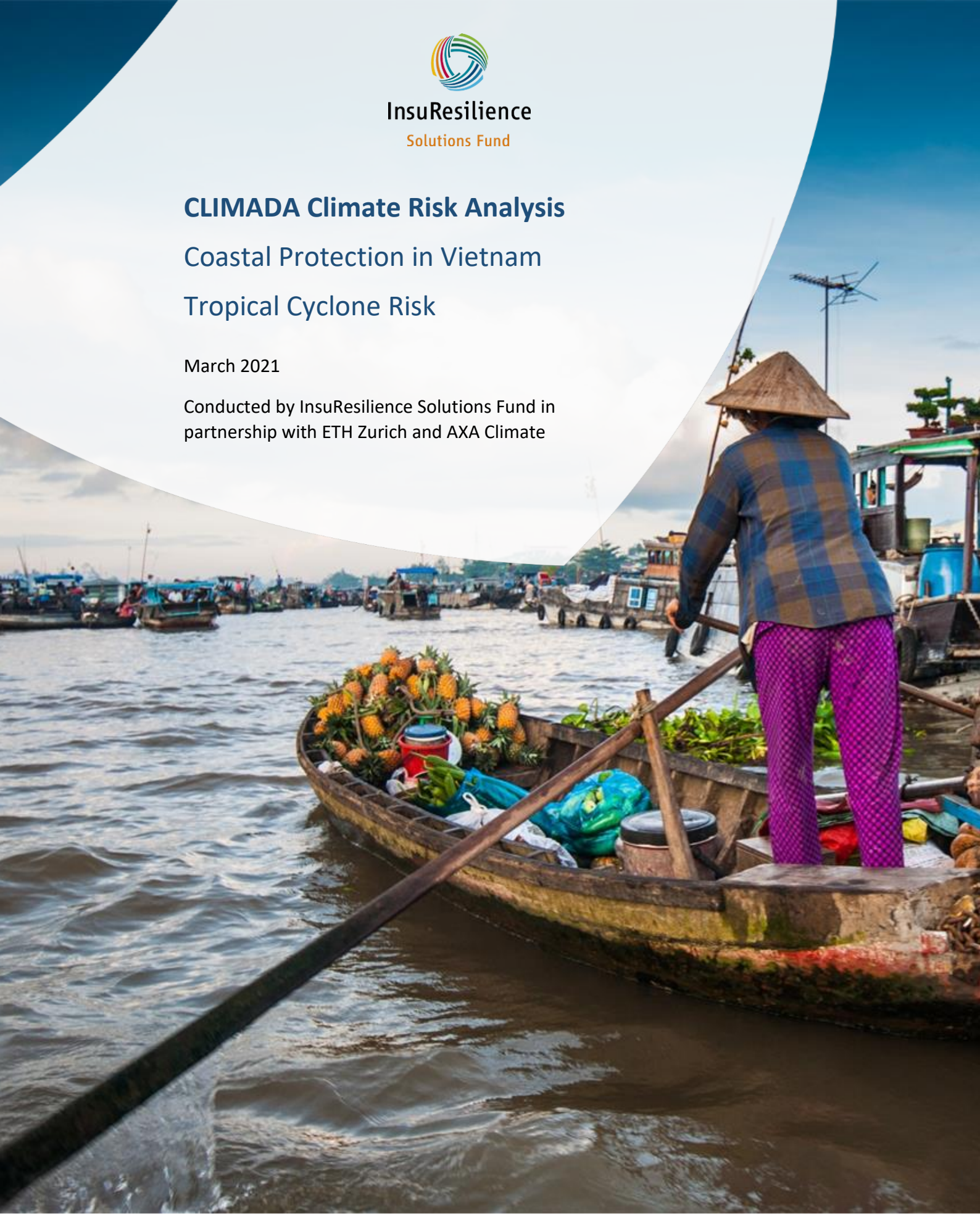
Conducted by InsuResilience Solutions Fund in partnership with ETH Zurich and AXA Climate



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Summary

Comprehensive assessment of climate risk becomes increasingly important to develop effective adaptation strategies. **Climate Risk Analysis** provides an essential tool to **quantify the expected impact of climate risks** but also to **identify cost-effective adaptation measures** necessary to foster resilience against climate change. **It offers decision-makers answers to the following questions:**

- What are our climate risks today and in the coming decades?
- How can we deal with these risks and what could potential adaptation measures be?
- How effective are these adaptation measures and will their expected benefits outweigh the costs?

Applied to the coastal protection measures in Vietnam, Climate Risk Analysis demonstrates how expected losses due to climate related hazards can be quantified and be accounted for in political decision-making.

Context

Ranking among the top 10 countries affected by natural disasters worldwide[1], Vietnam already has a critical need for adaptation and climate risk management today. Due to its extensive coastline and major river deltas, large parts of the population will be exposed to the impacts of rising sea levels and more powerful typhoons and storm surges. Given its dynamic economy and continuous growth, this entails even higher risks for Vietnam over the coming decades. In response to climate risks, Vietnam has adopted an increasingly proactive approach in managing disaster risk in recent years. Furthermore, the national government has made considerable investments in disaster risk reduction and preparedness. Nonetheless, an implementation gap remains with regard to risk-informed spatial planning and investments, as well as climate change adaptation measures.[2]

Without action, climate risks jeopardize development efforts already achieved and threaten future economic growth in Vietnam. Natural disasters and extreme events continue to cause significant damage to key economic sectors and public services of the country. According to the World Bank, about 0.5% of the national GDP is at direct risk from riverine and coastal flooding each year.[3] This does not only weigh heavily on fiscal budgets but also puts earlier development success at risk. However, as highlighted in the Global Risks Report, at present, spending on disaster recovery is still almost nine times higher than on prevention.[4] To turn this around and to secure a sustainable development of the country, the implementation of appropriate risk reduction and adaptation measures are therefore key factors.

What actions can Vietnam take to mitigate these risks and implied financial losses? As fiscal capacities are limited, it is imperative for political decision-makers to prioritize the most cost-effective adaptation measures, i.e. those investments which will render the highest reduction of future damage for the same amount of investment costs implied. To support the Vietnamese government on the national as well as the provincial and community level, a quantitative cost-benefit analysis of different adaptation measures provided by the risk modelling platform CLIMADA offers a helpful tool to assess and prioritize the options available. This implies a prioritization with respect to a) **which regional focus should be chosen** and b) **which adaptation measures and investments should be implemented.**

[1] Germanwatch e.V., 2019. Global Climate Risk Index 2020

[2] The World Bank, 2020. Resilient Shores: Vietnam's Coastal Development between Opportunity and Disaster Risk.

[3] Ibid.

[4] World Economic Forum, 2019. The Global Risks Report, 14th Edition. Geneva

CLIMADA – Risk modelling

Climate risk modelling and analysis provide an essential instrument for comprehensive climate risk management. The open-source platform CLIMADA[5] uses state-of-the-art probabilistic risk modelling techniques, to quantify current and future climate risks. It allows to model climate risks like droughts and storms to assess today´s probability of such a climate hazard in any region of the world, as well as to simulate and assess this risk for future decades. Developed by the insurance sector, the platform conducts a comprehensive mapping of climate hazards, exposed assets and people, and their specific vulnerability on scales from national to community levels, allowing the user full flexibility. Based on the risk assessment CLIMADA provides a robust analysis of the costs and benefits of adaptation measures, enabling decision-makers to make informed decisions on adaptation measures to reduce and transfer future climate risks. The output can be customized to cover the needs of a variety of stakeholders.

Applying climate risk analysis

Applied to Vietnam, the results of this climate risk analysis demonstrate how climate risks can be quantified and accounted for in political decision-making. Taking into account economic development paths, population growth and additional risks due to climate change, the results also reflect the dynamics of the value at risk over the next decades. **The study assesses the current and future climate[6] impacts facing Vietnam due to tropical cyclones, as a combination of wind and surge including expected sea level rise, on residential houses, agricultural production, and people across Vietnam.** The extensive coastline of Vietnam is highly exposed to the impact of tropical cyclones. Therefore the study analyses different coastal adaptation measures to strengthen the climate and disaster risk resilience of Vietnam. The analysis evaluates the cost-benefits of three physical adaptation measures, providing a combination of grey and green strategies, as well as financial risk adaptation via insurance.

The results enable political decision-makers to answer the most urgent questions regarding future climate risks:

1. What are expected climate-related economic losses due to the identified climate risks?

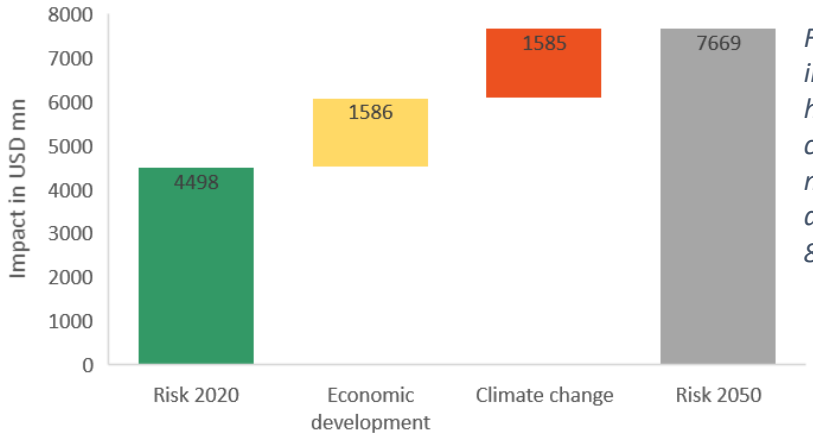

Figure 1: Accumulated economic impact of wind on residential houses by 2050, taking into account economic growth and climate change over the next decades (under future scenario RCP 8.5)

[5] ETH Zürich: CLIMADA; available at: https://wcr.ethz.ch/research/climada.html

[6] Climate scenarios imply changes in intensity and frequency based on IPCC climate scenarios. RCP4.5 (Global temperature increase is more likely not to exceed 2 °C) and RCP8.5 (Global temperature increase likely to exceed 2 °C).

The simulation results of the climate risk analysis (see *Figure 1*) indicate that by 2050 the expected accumulated damage from wind, associated with tropical cyclones on residential houses could increase by approximately 70% compared to today, summing up to more than 7 billion USD over the coming decades. This increase of expected damage over the coming decades can be attributed to two factors: on one side a higher value at risk, as economic growth will lead to the construction of new houses potentially damaged by tropical cyclones, and on the other side by climate change, as the intensity of tropical cyclones is expected to increase in the region. Climate change is expected to increase damages not only from wind, but also from storm surge. The expected accumulated damage to houses from surge could increase by over 45% by 2050 due to climate change and economic growth.

The results of the analysis also show that in the agricultural sector, the expected cumulative damage from wind and storm surge could increase by up to 70% each by 2050, amounting to 4 billion and 7 billion USD respectively.

Housing, agriculture and the population in coastal and low-lying areas of Vietnam are especially exposed to severe risks of storm surge, with the Mekong Delta being over-proportionately affected. Today, 1.94 million people in coastal provinces are already affected annually by the impact of storm surge. By 2050, the simulation results imply that this number may increase by up to 11% due to climate change and economic growth.

2. What actions can Vietnam take to mitigate these risks and implied financial losses?

Applying a quantitative cost-benefit analysis for different adaptation measures, the risk modelling platform CLIMADA also offers a helpful tool to assess and prioritize the options available.

Quantifying the expected benefits of different adaptation measures in terms of future damage averted and comparing them to the respective costs of implementation, this Climate Risk Analysis provides answers to the following questions: a) **which regional focus should be taken?** and b) **which adaptation measures and investments should be prioritized?**

Which regional focus should be taken?

The outcome of the analysis reveals that climate change will add to economic losses until 2050 mainly in areas already severely affected today. *Figure 2* highlights the hotspots of climate risk located mainly in the Mekong Delta, which is especially exposed to storm surge.

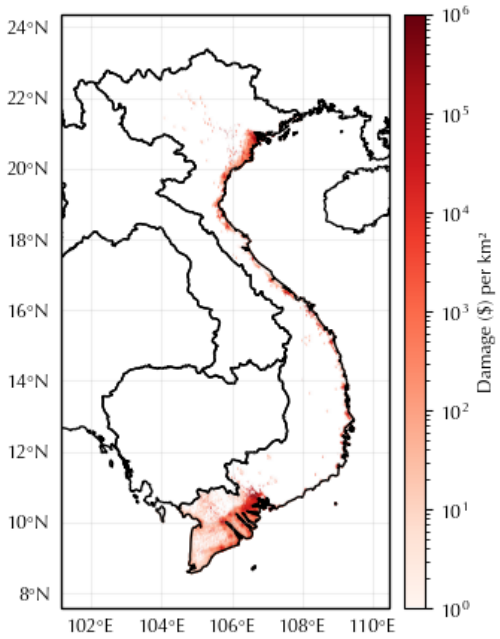

Figure 2: Expected increase of storm surge damage on houses by 2050 due to climate change

Based on the risk analysis, the Mekong Delta bears losses of 1.9 billion USD in the housing sector annually. Climate change might increase the impact further by 11% by 2050. As the centre of agriculture, crop production in the Mekong Delta will also face major risks due to climate change. The province of Can Tho for example is likely to suffer 45% more storm surge damages in the agricultural sector by 2050. However, also in the northern coastal regions, climate change is expected to increase future losses significantly.

Based on the analysis specific hotspots down to a resolution of 1 km^2 can be analysed in more detail, giving coastal communities and provincial governments guidance on where to focus planned efforts to increase resilience against tropical cyclones.

Which adaptation measures and investments should be prioritized?

In order to address this question, a set of different adaptation measures including the plantation of mangroves, installation of gabions and upgrading of sea-dyke systems was assessed in the study. Comparing these three adaptation measures large differences in both cost efficiency and benefit (in terms of absolute averted damage) can be observed.

The plantation of mangroves provides the best return on investment in averting expected losses due to storm surge compared to the respective costs. Upgrading of sea-dyke systems reduces the expected future losses by over 55% (reflected by a higher impact measured on the horizontal axis in *Figure 3*) and thus to a greater extent than e.g. mangroves. The decision on which measures to prioritise should take into account the cost-effectiveness of the different measures considered. As upgrading sea-dykes is associated with less benefits for each dollar invested, this measure turns out to be less cost-effective than e.g. the plantation of mangroves (reflected in *Figure 3* on the vertical axis measuring the benefit-cost ratio of the adaptation measures assessed).

As a combined set of measures, sea-dykes, gabions and mangroves are contributing each to avert the destructive impact of tropical cyclones. The results of the analysis indicate that total risk on residential housing and agriculture due to storm surge may be mitigated by up to 95% and 98% respectively.[7]

The methodology applied in this climate risk analysis thus renders a useful tool to identify the most cost-effective adaptation options. It also indicates that the possible risk reduction of a single measure is limited and thus a combination of physical adaptation measures should be considered.

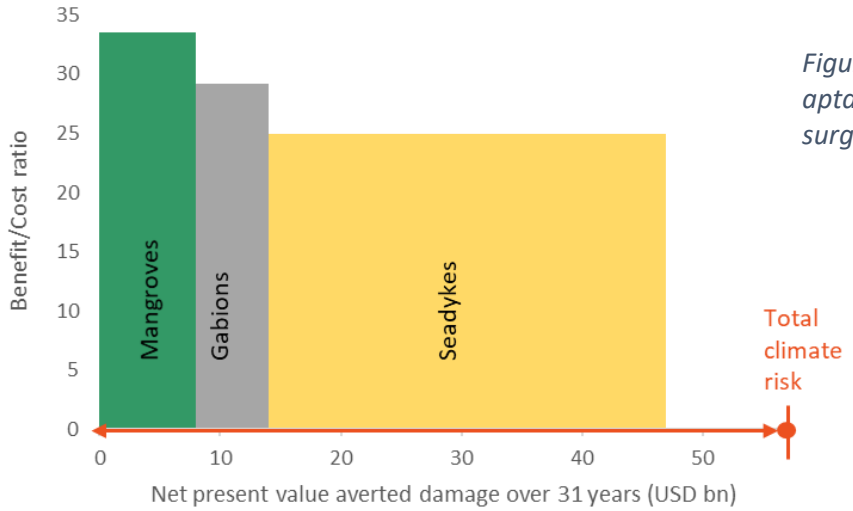

Figure 3: Cost-benefit of adaptation measures for storm surge risk on houses

[7] Risk reduction benefit on an average annual basis

3. How can Vietnam close the protection gap induced by these remaining risks?

Even after combining all three measures assessed, not all potential future losses can be avoided by physical or structural adaptation measures. Insurance solutions can provide an effective complementary measure to increase resilience against climate change.

By covering the remaining risks, climate risk insurance may further reduce the financial consequences associated with tropical cyclones. Rapid insurance payouts after a severe event offer additional funds and liquidity for relief efforts, a swift rehabilitation of houses, or compensation for encountered crop losses. Given e.g. the three physical adaptation measures are implemented consistently, complementary protection via climate risk insurance may reduce the remaining average annual loss due to storm surge on housing further by more than 60% (see *Figure 4*).

Depending on the options available and decisions taken to prevent climate risks on residential housing, complementary solutions to protect expected losses by climate risk insurance solutions in the sector may be developed. Possible concepts and design options are manifold and should be well adapted to the needs and priorities of local partners. Thus, the assumptions used and results derived in this first analysis are intended mainly to illustrate the possible relevance of complementary climate risk insurance as a financial adaptation measure to transfer future climate risks in the housing sector.

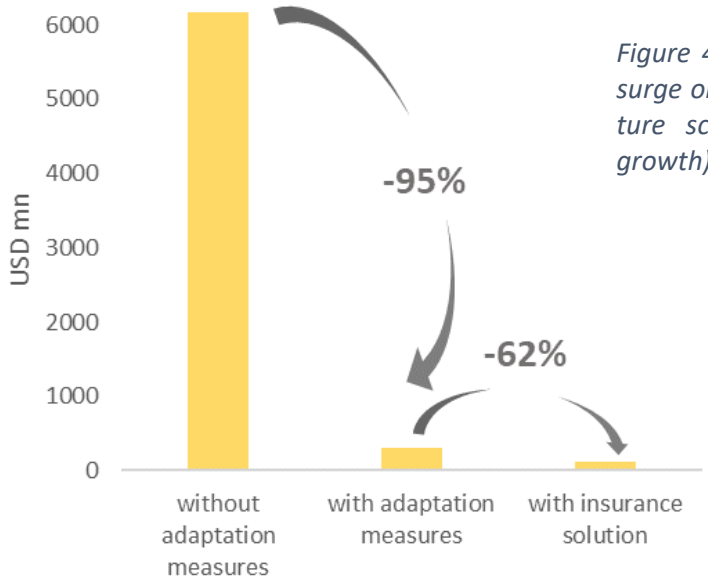

Figure 4: Average annual losses due to storm surge on residential housing in 2050 (under future scenario RCP 8.5; including economic growth)

Complementarity of risk reduction and insurance

The case study illustrates the importance of comprehensive climate risk analysis, including physical as well as financial adaptation measures. Physical adaptation investments successfully reduce risk to a high degree and form a resilient strategy, along with financial measures such as climate risk insurance. Applying a methodology that allows quantifying climate risks enables local and national policymakers to determine where to intensify adaptation investments, which measures to prioritize, and where additional climate risk financing can help to build resilience against climate risks. The analysis thus conveys a vivid example of the complementarity of physical risk reduction measures and insurance solutions.