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Current and future Exposure of Critical Infrastructure to Coastal Flooding in Rostock, Germany

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We assess the exposure of Critical Infrastructure (CI) to storm surge flooding in the city of Rostock, Germany. The city endured two severe storm surges in 2006 and 2017 that caused the flooding of a main road in the city centre and proved the existing coastal protection measures to be insufficient regarding future sea-level rise (SLR). Using the hydrodynamic model Delft3D-FLOW, we simulate severe storm surge flooding under SLR scenarios of + 30 cm, + 50 cm, + 80 cm and + 100 cm and assess the extent to which CI in the city is affected. Our results show that Rostock's city harbour (german: Stadthafen) and the adjacent primary road are highly exposed to coastal flooding in all scenarios. Furthermore, transport infrastructure, such as road and railway networks, as well as fire stations are potentially at risk of getting flooded. Besides direct monetary damage, flooding can cause so-called "cascading effects" which are damages that are directly linked to the flooding but occur outside of the directly affected areas. Hence, the cut-off of the primary road can lead to sensitive time loss during emergency situations. The results also indicate that the train connection between Hamburg and large parts of the federal state of Mecklenburg-West Pomerania could fail due to flooding, already in the + 30 cm scenario.
Our study does not account for impacts on the electricity grid as relevant data are not openly available because of data sensitivity. However, electricity data would lead to an improved assessment of the magnitude of the cascading effects more accurately.
We conclude that the critical infrastructure of the city of Rostock is not sufficiently protected against storm surges in the future and emphasise the importance of the plans of the federal state of Mecklenburg-West Pomerania to build new coastal protection measures until the year 2030.