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Disaster prevention, mitigation and management

A Numerical Simulation Of Future Storm Surges

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The present study focuses on the risks of storm surge caused by future increases in typhoon intensity due to climate change. These risks were analyzed by integrating weather, wave, storm surge and tide prediction systems into a new simulation methodology. This model makes it possible to calculate the weather fields of typhoons in the past as well as in the future on the basis of meteorology and can simulate waves. The model was verified by comparing it to the storm surge that took place during the passage of typhoon 200709 through Tokyo Bay in 2007. Good agreement was obtained between the observed and simulated water levels in the Bay. In addition, the model was extended to allow for the simulation of future typhoons by taking into account the effects of climate change and sea level rise (SLR). For this, typhoon 200709 was compared to a similar event arriving in the same computational domain in the year 2100, but taking into account increases in SLR and SST (sea surface temperature) inside this domain. Wind speed due to typhoons is expected to become higher by the year 2100 inside the Tokyo Bay area due to these increases in SST. As a consequence, the wave heights and the storm surges are also expected to become higher, and through the model proposed it was possible to quantitatively compare the wave and storm surge between present day and future events. When sea level rise is taken into account, the surface of the water is likely to be 1.5m higher during the passage of a typhoon that arrives to the vicinity of Tokyo Bay with the same strength as 200709, compared with the height of the historical event. This will require the strengthening of storm surge defences throughout Tokyo Bay, as they are unlikely to be able to cope with such increased water levels (as outlined also in Hoshino et al. 2012). The model was verified to accurately reproduce historical typhoons and waves and thus is a useful tool for the analysis of future climate risks in coastal zone.