

Flood risk ranking reveals vulnerable cities

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(Phys.org) -- A new study of nine coastal cities around the world suggests that Shanghai is most vulnerable to serious flooding. European cities top the leader board for their resilience.

These findings are based on a new method to calculate the [flood](#) vulnerability of cities, developed by a team of researchers from the Netherlands and the University of Leeds. The work is published in the latest edition of the journal [Natural Hazards](#).

The index does not just look at the [likelihood](#) of a city's exposure to a major 'once in a hundred years' flood. The researchers have been careful to include social and economic factors in their calculations too.

The index incorporates 19 components, including measures of the level of economic activity in a city, its speed of recovery, and social issues such as the number of flood shelters, the awareness of people about flood risks, and the number of disabled people in the population. Several index components also look at the level of administrative involvement in flood management.

The researchers used their index to analyse the vulnerability to coastal flooding of nine cities built on river deltas: Casablanca (Morocco), Calcutta (India), Dhaka (Bangladesh), Buenos Aires (Argentina), Osaka (Japan), [Shanghai](#) (China), Manila (Philippines), Marseille (France) and Rotterdam (the [Netherlands](#)).

The results of the analysis reveal that the highly prosperous megapolis of Shanghai, in China, is more vulnerable than much poorer cities such as Dhaka in Bangladesh.

“Vulnerability is a complex issue,” explains Professor Nigel Wright, who led the team from the University of Leeds. “It is not just about your exposure to flooding, but the effect it actually has on communities and business and how much a major flood disrupts economic activity. Our index looks at how cities are prepared for the worst – for example, do they have flood defences, do they have buildings that are easy to clean up and repair after the flood? It is important to know how quickly a city can recover from a major flood.”

Shanghai’s is particularly vulnerable because it is exposed to powerful storm surges and the land is subsiding as sea levels rise. Moreover, although a large population lives along the coast in flood-prone areas, but the city is poorly prepared, with little resilience to a major flood and insufficient flood shelters for victims.

“A 1-in-100 year flood in Shanghai would lead to widespread damage,

with serious consequences for the city, across China and, through wider economic links, for the whole world,” Professor Wright comments.

The vulnerability index also revealed that Dhaka, which sits just metres above current sea levels, is regularly hit by tropical cyclones and floods, yet it has few defences in place and little resilience. Manila in the Philippines and Calcutta in India are also highly vulnerable largely because of their large populations and degree of expose to storms.

The European cities of Marseille and Rotterdam are also exposed to flood risks, with violent storms, high river levels and significant low-lying areas. But the cities are least vulnerable with good flood management infrastructure and tight building regulations for flood-prone areas, for example. “When a big flood hits you will still get flooding,” says Professor Wright, “but these European cities will bounce back quickly.”

The researchers also used their vulnerability index to assess how climate change would affect the vulnerability of these cities in the future. With sea levels predicted to rise over the next 100 years, the study found that Shanghai and Dhaka will remain the most vulnerable cities in 2100, although the [vulnerability](#) of all the cities will increase (doubled in the case of Manila).

“Our index provides a flexible tool for cities to explore how they are currently exposed to flooding and how this may change in the future. It will help them to prioritise their flood risk and [resilience](#) strategies,” says Professor Wright.

More information: The full paper: SF Baliga et al, 'A flood vulnerability index for coastal cities and its use in assessing climate change impacts' *Natural Hazards* (2012) is available to download ([DOI 10.1007/s11069-012-0234-1](https://doi.org/10.1007/s11069-012-0234-1)).

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