



## Flood defense dilemmas in New Orleans, San Francisco and the Netherlands

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By the mid of this century, the majority of the world population will live in cities in or near deltas, estuaries or coastal zones, vulnerable to rising sea levels and climate change with millions of people being exposed to the risk of extreme floods and storms. At the same time, many delta cities suffer from severe subsidence, and it is expected that the frequency, intensity, and duration of extreme precipitation will increase as well as the frequency and duration of dry spells.

As a consequence of this combined and accelerated urban development, subsidence and climate change, the vulnerability of our delta cities is expected to increase in the decades to come.

But how to protect our urban deltas against the future impacts of climate change in a sustainable way, keep the cities attractive and prosperous, and the environment sound, all at the same time? These are the dilemmas that delta cities like New Orleans, San Francisco and Rotterdam have to deal with. Their problems are comparable but differ as well.

New Orleans, completely unprotected after Katrina was in need of a rapid enhancement of the hurricane protection system, and decided to hide the water behind a system of concrete walls, levees and storm surge barriers. But at the same time, the city is struggling for economic recovery and needs an attractive identity as a delta city. And the Mississippi Delta is suffering from subsidence, loss and deterioration of wetlands, oil spills and other human interference. Many urban areas along the San Francisco Bay are built on land fill, just above sea level. At the same time, the fragile Bay Delta area is looking for a future perspective with a Delta Plan that balances the interest of agriculture, nature, infrastructure, urban development and water supply for Southern California. And this in an earth quake sensitive area, with reduced snow packs in the Sierra, and failing levees along the Sacramento and San Joaquin Rivers.

Rotterdam, with one of the largest ports in the world, wants to protect its citizens against the future impacts climate change by making Rotterdam completely “Climate Proof” by 2025. The protection level now against floods of 10.000 years is the highest standard in the world, but at the same time citizens live up to 7 meters below sea level and need the permanent protection of a complicated and expensive system of dikes, closure dams, storm surge barriers and gates. And the Dutch polders continue to subside. Up to what sea level rise is this system still operational? Can the Dutch continue to raise their dikes and keep the sea outside, or is it time to open up the system, let the sea water in and switch to new, more holistic and natural ways of protection?