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A climate, energy, science & politics blog

Report Describes the Unfathomable Cost of Inaction on Rising Seas

Worst-case dollar cost of a few feet of rising seas could reach $100 trillion every year, according to the most rigorous scientific study of its kind.

By John H. Cushman Jr., InsideClimate News Feb 12, 2014

Flooding caused by Hurricane Katrina in the New Orleans area in 2005. The global economic damages of failing to build dikes, levees, sea walls and other flood protections could be almost beyond comprehension as seas rise from global warming, a new scientific study has found. Credit: Paul Morse

The world needs to invest tens of billions of dollars a year in beefing up shoreline defenses against rising oceans or it will face mind-boggling costs in the decades to come, according to new research published this week in the Proceedings of the National Academy of Sciences.

If nations don't build up dikes, levees and sea walls, harden existing infrastructure, and preserve natural sponges like wetlands and barrier islands—and if they also do nothing to cut the emissions of greenhouse gases that cause global warming and are driving sea levels higher—the damages could be almost beyond comprehension, the researchers warned.

In a worst case, almost five percent of the world's population could be exposed to flooding at the start of the next century, and the damage could surpass nine percent of future global GDP each year.

This future damage from floods, they wrote, "may be one of the most costly aspects of climate change."

Rounded off, this worst-case dollar cost of rising sea levels could reach $100 trillion by the year 2100, they estimated. That's no typo: It's one hundred thousand billions.

Even taking into account the uncertainties in any such work, which the authors recognize, that is a pretty impressive cost to be paid for a few feet of rising seas.

And its publication in such a prestigious peer-reviewed journal means it is not to be lightly shrugged off.

They called for a better understanding of the future costs of today's emissions, saying this is "essential for supporting efforts to reduce emissions driving sea-level rise as well as for designing strategies to adapt to increased coastal flood risk."

If their assessment holds up, global average storm surge damages, on a business-as-usual track, would have increased from between roughly $10 and $40 billion per year today to up to $100 trillion a year by the end of century.

The authors, from the Berlin-based think-tank Global Climate Forum and Britain's University of Southampton, said their study described for the first time the findings of a comprehensive global simulation of future flood damages to buildings and infrastructure in coastal flood plains.

Quoted in a press release from the University of Southampton, Jochen Hinkel of GCF, the chief author, said: "If we ignore this problem, the consequences will be dramatic."

He warned that "if we do not reduce greenhouse gases swiftly and substantially, some regions will have to seriously consider relocating significant numbers of people in the longer run."

What's most striking, though, is not the unfathomable figure they cited as their high-end cost. It is that by investing between $10 billion and $70 billion a year, the world could cut back the damages to a mere $80 billion or so a year in the early 22nd century.

Cutting dollar damages from rising seas from $100,000 billion to $80 billion a year would be a hearty return on investment, and well worth the expense, the authors argued.

Robert Nicholls of the University of Southampton, a co-author of the paper, said: "If we ignore sea-level rise, flood damages will progressively rise and presently good defenses will be degraded and ultimately overwhelmed. Hence we must start to adapt now, be that planning higher defenses, flood proofing buildings and strategically planning coastal land use."

"Poor countries and heavily impacted small-island states are not able to make the necessary investments alone, they need international support," he said.

But Nicholls questioned whether nations were capable of acting now to stave off devastation a hundred years from now.

"This long-term perspective is however a challenge to bring about, as coastal development tends to be dominated by short-term interests of, for example, real-estate and tourism companies, which prefer to build directly at the waterfront with little thought about the future," he said.

The full paper:


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SPECIAL FEATURE

PNAS

Coastal flood damage and adaptation costs under 21st century sea-level rise

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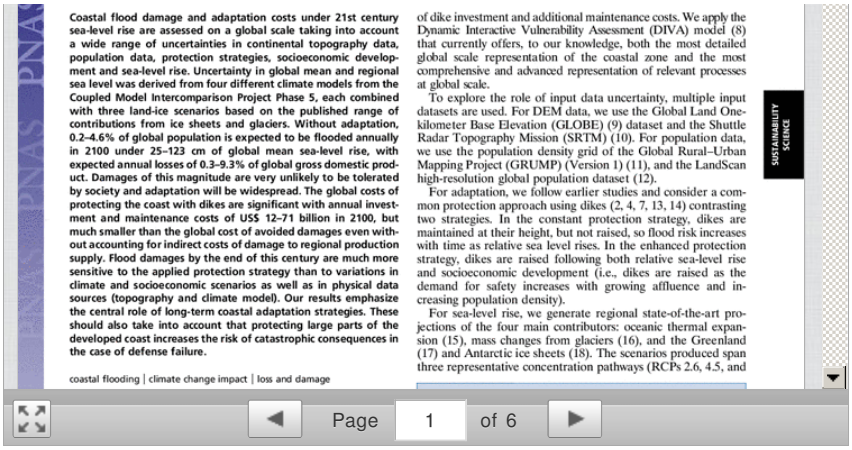

Coastal flood damage and adaptation costs under 21st century sea-level rise are assessed on a global scale taking into account a wide range of uncertainties in continental topography data, population data, protection strategies, socioeconomic development and sea-level rise. Uncertainty in global mean and regional sea level was derived from four different climate models from the Coupled Model Intercomparison Project Phase 5, each combined with three land-ice scenarios based on the published range of contributions from ice sheets and glaciers. Without adaptation, 0.2–4.6% of global population is expected to be flooded annually in 2100 under 25–123 cm of global mean sea-level rise, with expected annual losses of 0.3–9.3% of global gross domestic product. Damages of this magnitude are very unlikely to be tolerated by society and adaptation will be widespread. The global costs of protecting the coast with dikes are significant with annual investment and maintenance costs of US$ 12–71 billion in 2100, but much smaller than the global cost of avoided damages even without accounting for indirect costs of damage to regional production supply. Flood damages by the end of this century are much more sensitive to the applied protection strategy than to variations in climate and socioeconomic scenarios as well as in physical data sources (topography and climate model). Our results emphasize the central role of long-term coastal adaptation strategies. These should also take into account that protecting large parts of the developed coast increases the risk of catastrophic consequences in the case of defense failure.

coastal flooding | climate change impact | loss and damage

of dike investment and additional maintenance costs. We apply the Dynamic Interactive Vulnerability Assessment (DIVA) model (8) that currently offers, to our knowledge, both the most detailed global scale representation of the coastal zone and the most comprehensive and advanced representation of relevant processes at global scale.

To explore the role of input data uncertainty, multiple input datasets are used. For DEM data, we use the Global Land One-kilometer Base Elevation (GLOBE) (9) dataset and the Shuttle Radar Topography Mission (SRTM) (10). For population data, we use the population density grid of the Global Rural–Urban Mapping Project (GRUMP) (Version 1) (11), and the LandScan high-resolution global population dataset (12).

For adaptation, we follow earlier studies and consider a common protection approach using dikes (2, 4, 7, 13, 14) contrasting two strategies. In the constant protection strategy, dikes are maintained at their height, but not raised, so flood risk increases with time as relative sea level rises. In the enhanced protection strategy, dikes are raised following both relative sea-level rise and socioeconomic development (i.e., dikes are raised as the demand for safety increases with growing affluence and increasing population density).

For sea-level rise, we generate regional state-of-the-art projections of the four main contributors: oceanic thermal expansion (15), mass changes from glaciers (16), and the Greenland (17) and Antarctic ice sheets (18). The scenarios produced span three representative concentration pathways (RCPs 2.6, 4.5, and

SUSTAINABILITY SCIENCE

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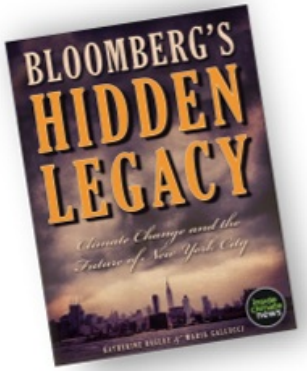

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