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SUPPLEMENTARY INFORMATION

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# Future flood losses in major coastal cities

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## Supplementary Methods

A first screening study by Hanson and colleagues[1] provided a global overview of coastal flood exposure in world coastal cities, including rankings. That study considered several drivers of floods including demographic and socio-economic changes (including urbanization), climate-induced sea-level rise, and human-induced subsidence where appropriate.

The methodology was based on determining the numbers of people and the value of assets that would be exposed to extreme water levels in the absence of coastal defenses and protection. The reference extreme water level was the 100-year coastal flood event. This metric of exposure reveals much about the risks faced in each city, because people in the flood plain rely on formal or informal flood defenses, and thus will be at some level of risk. This risk could arise from a failure of existing flood defenses due to breaching, or from a high return-period event which exceeds the height of existing protection and overtops the defense. In other words the exposure metric can be viewed as a worst case scenario, and exposure can translate into major losses during extreme events (e.g. New Orleans and Hurricane Katrina in 2005).

While the first screen exercise[1] considered how exposure will change in response to socio-economic drivers of economic and population growth, and in response to environmental changes (e.g., sea-level rise, subsidence), a more interesting and useful question is how losses would evolve. To look at economic losses, it necessary to take into account infrastructure-based adaptation (e.g., upgrading dikes and sea walls) and consider how these actions might be taken over time to mitigate flood risk and reduce losses from a city to a global scale. This is what is done by the present analysis.

## 1. Assessing current flood risks

The investigation took the form of an elevated-based GIS (Geographical Information Systems) analysis.[2,3]

### 1.1. Current population and population exposure

Population exposure is taken from Hanson and colleagues, following the methodology used in previous studies.[1,4] In each 50 cm "elevation layer" from current mean sea level (e.g., the area located between 0.5 and 1 m above normal sea level), exposed population is computed using topographic and population data.

Topographic data is the 90m resolution data from the Shuttle Radar Topography Mission (SRTM), except in the USA where 30m SRTM data is available, and in the UK, where a 10m Digital Elevation Model (provided by Infoterra) was used. Population data for the selected cities were taken from Landscan 2002 and constrained using city extents from post code data. Postcodes were largely taken from Risk Management Solutions (RMS) geocoding data and, in the USA, Metropolitan Statistical Areas (MSAs) from Census. Where postcode data were unavailable, internet-based city maps were used. The 1km resolution Landscan 2002 data was resampled to 100m for all cities, with the exception of those in the USA and UK, which were resampled to 30m. From this process, we obtain the number of inhabitants who would be flooded by various water levels, assuming no protection and uniform inundation.

At the pixel level, the SRTM elevation data can have errors of up to 10 m, which is large compared with sea level changes we are considering. These errors, however, are much lower in flat areas, where flood risks are concentrated, and have a large long-wavelength component (at the continent scale) that is not a problem when investigating local elevation differences; complete analyses are available in the literature.[5] However, this dataset is not adequate for the engineering design of sea walls and dykes. Nevertheless, when aggregated over larger areas (e.g., neighbourhoods), this data is able to provide a fair estimate of the elevation and can, therefore, be used to estimate the exposed population and assets and to rank cities according to their risk level to identify where detailed analyses are most necessary.

### 1.2. Asset exposure

The exposed population was translated into exposed assets using an estimate of the amount of capital per inhabitant. This capital per inhabitant was computed from the GDP per capita in each country and an estimate of the ratio of "produced capital" to GDP.

The ratio of produced capital to GDP is calculated using the World Bank dataset published with the "Changing Wealth of the Nations" report[6]. As shown in Figure S1, there is almost a linear relationship between the two. To calculate the average ratio, we averaged the ratio of produced capital to GDP for all countries, with a weight calculated on the basis of each country's population. The resulting ratio is equal to 2.8 and is applied to all countries. This ratio is significantly lower than the value of 5 used in the previous exposure analysis.[1]

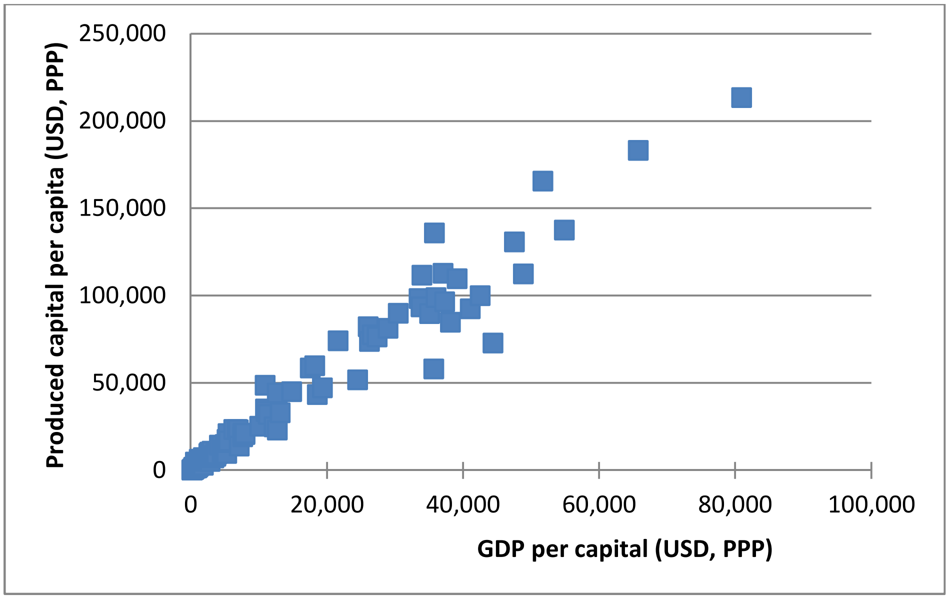



**Figure S1.** Relationship between GDP per capital and produced capital per capita (in USD, purchase power parity (PPP) exchange rate). Data from the World Bank.

### 1.3. Data on current defense levels in coastal cities

There is no global database of defense level in coastal cities, but patchy evidence is available on many of them with a bias towards richer countries and cities. It could be assumed that optimal defenses are present in all coastlines, designed using cost-benefit analyses as a decision framework.

However, it is observed that optimal defenses are rather exceptional and this assumption appears more useful as a baseline than a realistic description of existing protection. The recent landfall of Sandy illustrates for instance that Greater New York, despite having a larger GDP than London, Tokyo and Amsterdam, is currently only protected to a standard of roughly a 1 in 100 year flood with little formal flood defenses compared to those that exist for many European and Asian cities, and even New Orleans. The emphasis is on flood warning and evacuation as it is in most of the USA. Shanghai, a developing country city with a lower GDP than New York City and European cities, has a relatively high protection level similar to London. These examples highlight that protection levels are also strongly influenced by cultural, political and historical issues.

Here, we collected evidence on existing defenses starting from a previous analysis[7], and we completed the defense database with estimates from the authors. Because of the uncertainty in some cases, we built two data sets, one with maximum protection level and minimum protection levels.

This defense database should not be considered as complete or exhaustive. Instead, it is a starting point created from limited information. We invite knowledgeable people to correct and improve the database using more detailed information as appropriate.

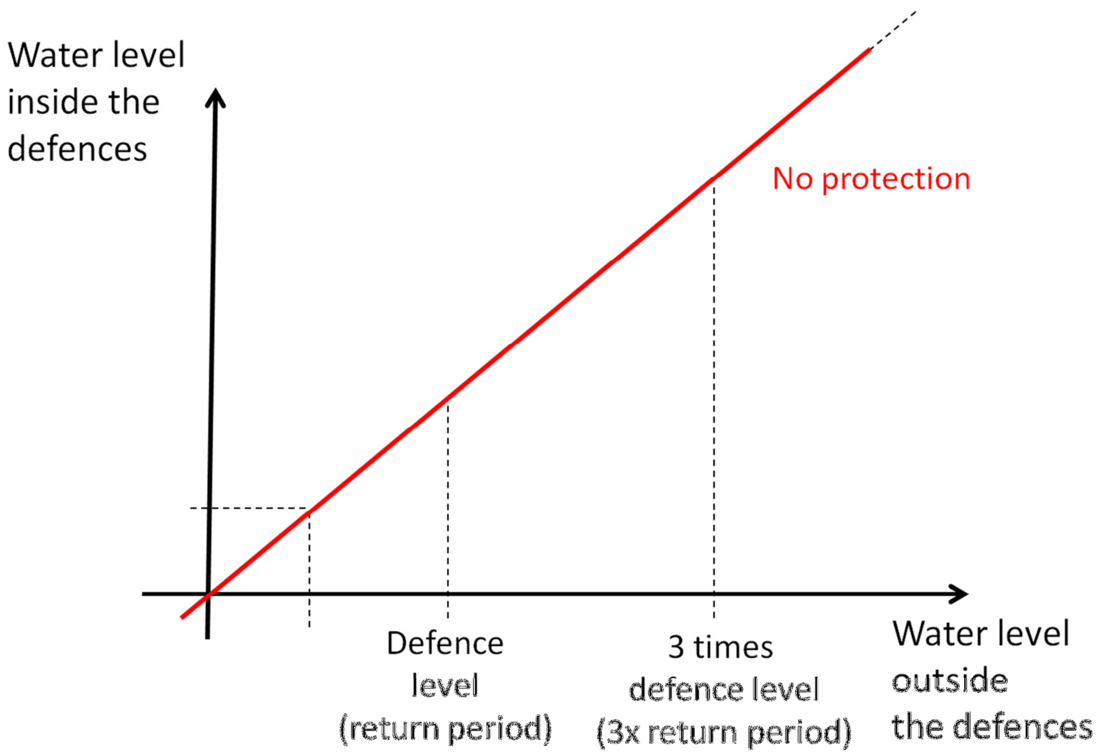
### 1.4. Water level in the city, accounting for defenses

The DIVA database provides information about the 10-yr, 100-yr and 1000-yr water levels on 12,148 segments around the world coasts.[8] For all cities, these values were translated into water level probability distribution functions, assuming that these functions are in logarithm form.

To assess flood losses, however, what matters is the water level within the defense system. To assess the probability distribution function of water levels within the defenses, assumptions are required on defense failure probabilities. In this analysis, we assume that defenses are designed to resist to a given standard of protection, expressed in terms of return period, and this standard of protection corresponds to a given defense water level.[9]

We assume that when the water level is below the designed defense level, failure probability is zero. Several simple assumptions can be made on how defenses behave when the defense level is exceeded, since this resistance depends on the protection type and characteristics (e.g., dikes vs. seawalls).

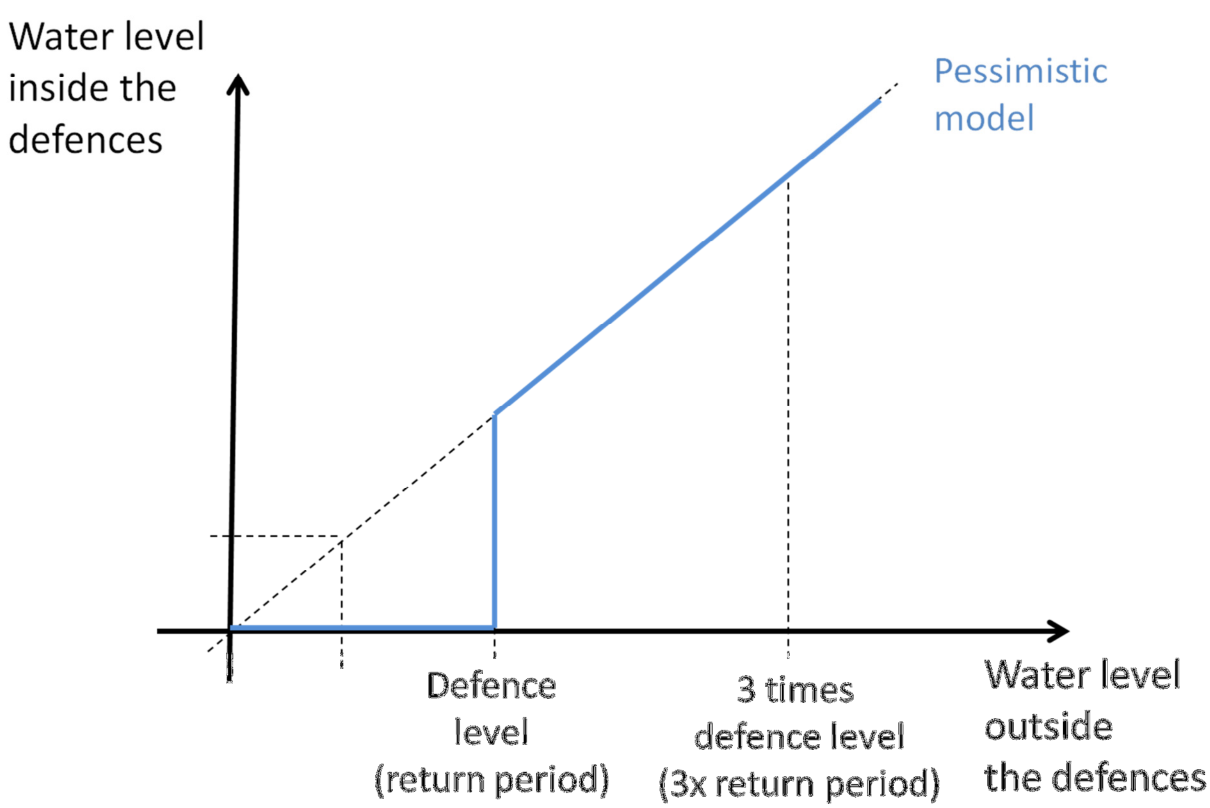
Here, we consider three distinct failure models, which in simple terms describe the range of possible behaviors (see also, Figure S2):



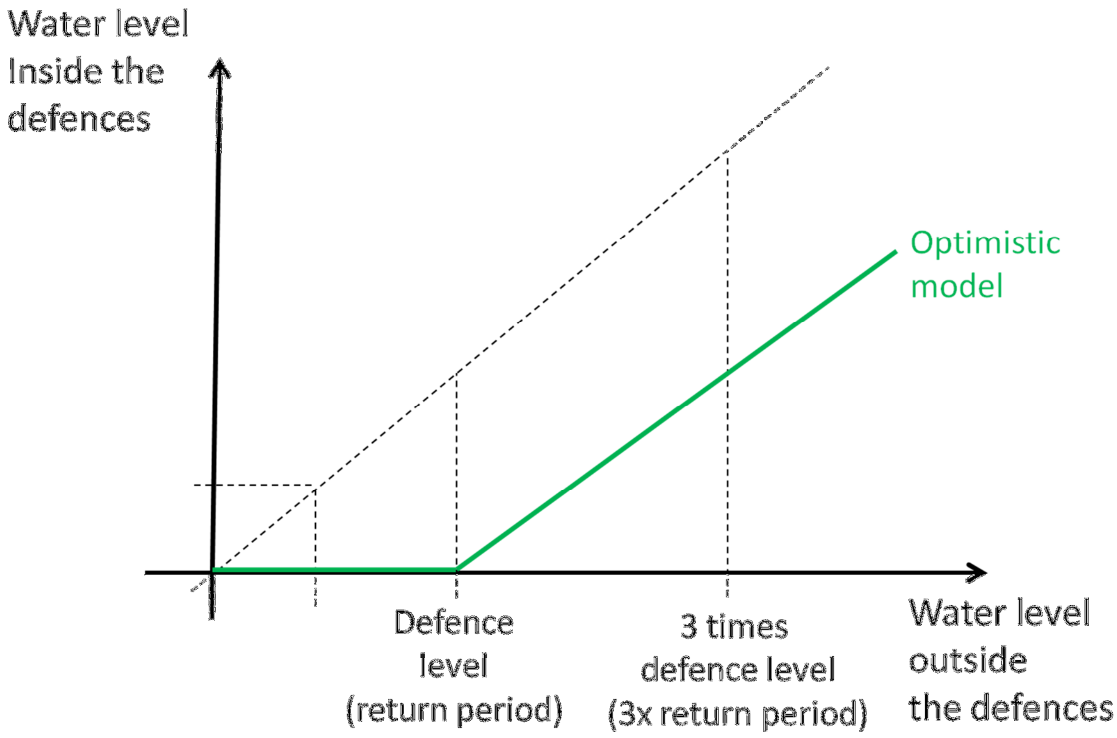
Water level inside the defences
No protection
Defence level (return period)
3 times defence level (3x return period)
Water level outside the defences


(a)

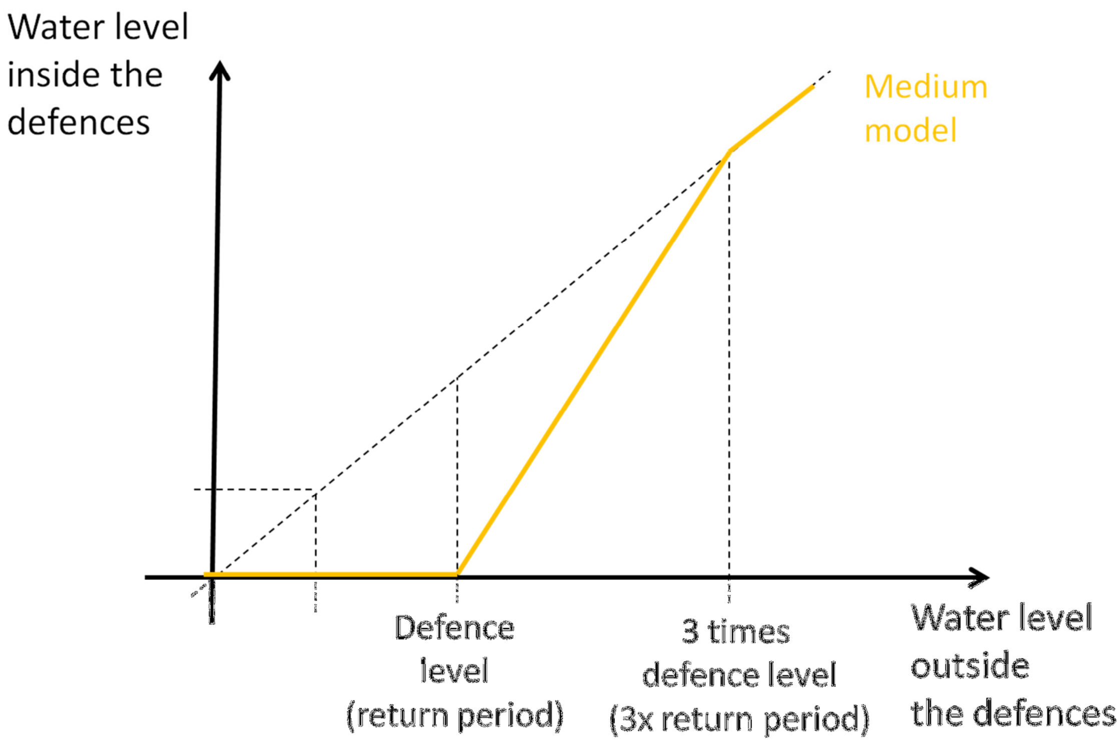
(b)



Water level inside the defences
Pessimistic model
Defence level (return period)
3 times defence level (3x return period)
Water level outside the defences




(c)




(d)

**Figure S2.** Representation of the relationship between the water level outside the city defenses and the water level inside the defenses, in the absence of protection (panel a), and with the three defenses failure models, i.e. the simplest and pessimistic model (panel b), the optimistic model (panel c), and the medium model (panel d).

The simplest assumption is that the defenses breaches when the design level is exceeded; in that case, there is no difference between the failed defenses and no defenses for events above the design standard. This model is also the most pessimistic.

The most optimistic assumption is that when defenses are first overtopped, this does not rapidly lead to breaching and they continue to provide some residual protection. Here, we assume that when defenses are exceeded by x cm, then the water level within the protection system is equal to x cm. In other terms, if a 2m protection experiences a 3m water level, the water level inside the protection will be reduced to 1m. This is a very simplistic assumption, but going beyond this assumption is beyond the scope of this study, and would require more detailed flood modeling more appropriate in an individual city assessment.

An intermediate assumption in which defenses progressively collapse as the water level increases until it reaches three times the design level (also expressed in return period), when total breaching is assumed.[9] Hence, flooding increases linearly between the overtopping level and the collapse level. Above the collapse level, there is no difference between the failed defenses and no defenses for events above the design standard.

### 1.5. Flood losses, as a function of water level

Exposed assets as a function of water level were then translated into asset losses. To do this, assets in each elevation layer were first distributed into six categories: (1) lightweight-timber-framed dwellings; (2) masonry dwellings; (3) low-income-country dwellings; (4) dwelling contents; (5) non-residential structures; and (6) non-residential content.

Following Linham and colleagues[7], we first distribute assets at risk in different broad categories, as shown in Table S1. The distribution of residential buildings then depends on the countries. For instance, North America and Australia are assumed to have mainly lightweight-timber-framed dwellings, while Europe and Asia have mainly masonry dwellings.

**Table S1**. Share of asset categories.

| Asset type | % total value of net fixed assets |
|---|---|
| Non-domestic buildings and structures | 42 |
| Residential buildings | 36 |
| Equipment | 14 |
| Domestic durables | 9 |

Then, assets are assumed to be homogenous distributed in each 50-cm elevation layer. And for each elevation (practically this is calculated using 0.5cm layers), we calculate the local water level (i.e. the water level measured against normal sea level minus the elevation, also measured against normal sea level) and the density of assets for each asset type.

Then depth-damage functions are used to calculate losses for each elevation and each asset type. Six depth-damage curves linking flood depth to the ratio of damage have been used for lightweight timber buildings, brick or concrete buildings, low-income country buildings, dwelling content, non-residential structures, and non-residential contents.[7] The depth-damage curves for the six categories of assets are reproduced in Table S2.

**Table S2.** Depth-damage curves for the six asset types used in this study. The function provides the share of losses (total loss divided by the total value) as a function of flood depth (depth is zero in this table when flood depth is larger than zero, i.e. when there is a flood).

| | Proportion of damage by depth and asset category (%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Depth (meters)** | **0** | **0.25** | **0.50** | **1.00** | **1.50** | **2.00** | **2.50** | **3.00** |
| Dwellings: lightweight timber framed Source: Dale (2009)[10] | 1.6 | 16.9 | 44.5 | 61.8 | 62.9 | 63.3 | 69.4 | 69.4 |
| Dwellings: Masonry Source: Yan (2005)[11] | 0.0 | 1.0 | 2.0 | 5.0 | 8.0 | 11.0 | 22.0 | 35.0 |
| Dwellings: structural, low income countries Source: Islam (1997)[12] | 0.0 | 3.4 | 5.0 | 7.7 | 10.6 | 13.4 | 15.1 | 15.1 |
| Dwellings: contents Penning-Rowsell et al. (2003)[13] | 0.0 | 31.0 | 34.0 | 36.0 | 38.0 | 38.0 | 38.0 | 38.0 |
| Non-residential: structures Source: Penning-Rowsell et al. (2003)[13] | 4.0 | 18.3 | 39.1 | 50.4 | 59.7 | 64.6 | 66.5 | 68.1 |
| Non-residential: contents Source: Penning-Rowsell et al. (2003)[13] | 0.6 | 17.0 | 37.4 | 55.0 | 63.2 | 68.9 | 73.3 | 76.8 |

### 1.6. Calculation of mean annual flood losses.

Using the flood losses for each water level, and the probability of each water level, we can estimate the mean annual flood losses in each city, taking into account the estimated level of protection following the methodology from Hallegatte and colleagues[3]. Results differ largely for the different models of defense failure discussed above.

This analysis provides an estimate of aggregated average annual flood losses in the 136 coastal cities, and world average losses are shown in Table S3. Results are highly dependent on the defense overtopping model. The most optimistic overtopping model gives an aggregate annual flood loss worth $46 million with the optimistic estimate of protection levels and $90 million with the pessimistic estimate of protection level. These numbers are clearly overoptimistic: assuming that the return period of Katrina is 400 years, as in the Interagency Performance Evaluation Taskforce report[14], average annual losses for New Orleans alone would be around

$50 million, which is more than half of our assessment for all 136 port cities with the optimistic failure model.

**Table S3.** Aggregated global mean annual losses due to coastal floods in the 136 port cities in 2005, depending on the protection failure model and protection standard.

| | Aggregated global mean annual losses (million USD) | |
|---|---|---|
| Protection failure model | Protection standard | |
| | Minimum | Maximum |
| Pessimistic | 8,823 | 5,744 |
| Medium | 5,153 | 3,375 |
| Optimistic | 90 | 46 |

The losses are much larger with the pessimistic and the medium overtopping models, with aggregate losses ranging from $3 billion to $9 billion per year, depending on the protection failure model. Using these two models thus provide some bounds for aggregate losses. Investigating how sea level rise affects these losses with these different models provide an idea of the result robustness.

In the main text, all assessments are made using the simplest (pessimistic) model that assumes that defenses fail when their protection design is exceeded. We also use the maximum protection standard (corresponding to average flood losses of $5.7 billion in the current situation).

Table S4 ranks the most vulnerable cities in 2005 using three different metrics of vulnerability. In the left column, the table provides a ranking that is comparable to the previous exposure analysis[1], based on exposure to the 100-yr flood, i.e. the assets below the 100-yr flood irrespective of defence standard. In the central column, the table shows a ranking in terms of absolute average annual losses (AAL in million USD), taking into account all potential floods and existing protection. Some of these estimates can be compared with more sophisticated approaches. For instance, the annual losses in New Orleans are estimated at $600 million, close to the $650 million estimates from the Interagency Performance Evaluation Taskforce.[8] In the right column, cities are ranked according to relative vulnerability, namely the ratio of AAL to the city's GDP. This value can be understood as the share of the city's economic output that should be saved annually to pay for future flood losses.

| Ranking by exposure | | | | | Ranking by AAL (million USD) | | | | | Ranking by relative AAL (% of city GDP) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Urban Agglomeration | 100-yr exposure | AAL, with protection (millions USD) | AAL, with protection (% of GDP) | | Urban Agglomeration | 100-yr exposure | AAL, with protection (millions USD) | AAL, with protection (% of GDP) | | Urban Agglomeration | 100-yr exposure | ALL, with protection (millions USD) | AAL, with protection (% of GDP) |
| 1 | Miami | 366 421 | 672 | 0.30% | 1 | Guangzhou | 38,508 | 687 | 1.32% | 1 | Guangzhou | 38,508 | 687 | 1.32% |
| 2 | New York-Newark | 236 530 | 628 | 0.08% | 2 | Miami | 366,421 | 672 | 0.30% | 2 | New Orleans | 143,963 | 507 | 1.21% |
| 3 | Osaka-Kobe | 149 935 | 120 | 0.03% | 3 | New York-Newark | 236,530 | 628 | 0.08% | 3 | Guayaquil | 3,687 | 98 | 0.95% |
| 4 | New Orleans | 143 963 | 507 | 1.21% | 4 | New Orleans | 143,963 | 507 | 1.21% | 4 | Ho Chi Minh City | 18,708 | 104 | 0.74% |
| 5 | Tokyo | 122 910 | 27 | 0.00% | 5 | Mumbai | 23,188 | 284 | 0.47% | 5 | Abidjan | 1,786 | 38 | 0.72% |
| 6 | Amsterdam | 83 182 | 3 | 0.01% | 6 | Nagoya | 77,988 | 260 | 0.26% | 6 | Zhanjiang | 2,780 | 46 | 0.50% |
| 7 | Nagoya | 77 988 | 260 | 0.26% | 7 | Tampa-St Petersburg | 49,593 | 244 | 0.26% | 7 | Mumbai | 23,188 | 284 | 0.47% |
| 8 | Rotterdam | 76 585 | 2 | 0.01% | 8 | Boston | 55,445 | 237 | 0.13% | 8 | Khulna | 2,073 | 13 | 0.43% |
| 9 | Virginia Beach | 61 507 | 89 | 0.15% | 9 | Shenzen | 11,338 | 169 | 0.38% | 9 | Palembang | 1,161 | 27 | 0.39% |
| 10 | Boston | 55 445 | 237 | 0.13% | 10 | Osaka-Kobe | 149,935 | 120 | 0.03% | 10 | Shenzen | 11,338 | 169 | 0.38% |
| 11 | Tampa-St Petersburg | 49 593 | 244 | 0.26% | 11 | Vancouver | 33,456 | 107 | 0.14% | 11 | Hai Phòng | 6,348 | 19 | 0.37% |
| 12 | London | 45 130 | 5 | 0.00% | 12 | Tianjin | 11,408 | 104 | 0.24% | 12 | N'ampo | 507 | 6 | 0.31% |
| 13 | Fukuoka-Kitakyushu | 39 096 | 82 | 0.09% | 13 | Ho Chi Minh City | 18,708 | 104 | 0.74% | 13 | Miami | 366,421 | 672 | 0.30% |
| 14 | Guangzhou | 38 508 | 687 | 1.32% | 14 | Kolkata | 14,769 | 99 | 0.21% | 14 | Kochi | 855 | 14 | 0.29% |
| 15 | Shanghai | 34 306 | 4 | 0.00% | 15 | Guayaquil | 3,687 | 98 | 0.95% | 15 | Tampa-St Petersburg | 49,593 | 244 | 0.26% |
| 16 | Vancouver | 33 456 | 107 | 0.14% | 16 | Philadelphia | 22,132 | 89 | 0.04% | 16 | Nagoya | 77,988 | 260 | 0.26% |
| 17 | Hong Kong | 26 988 | 8 | 0.00% | 17 | Virginia Beach | 61,507 | 89 | 0.15% | 17 | Surat | 3,288 | 30 | 0.25% |
| 18 | Hamburg | 26 260 | 6 | 0.01% | 18 | Fukuoka-Kitakyushu | 39,096 | 82 | 0.09% | 18 | Tianjin | 11,408 | 104 | 0.24% |
| 19 | St Peterburg | 23 384 | 3 | 0.00% | 19 | Baltimore | 14,042 | 76 | 0.08% | 19 | Grande_Vitória | 6,738 | 32 | 0.23% |
| 20 | Hiroshima | 23 331 | 37 | 0.06% | 20 | Jakarta | 4,256 | 73 | 0.14% | 20 | Xiamen | 4,486 | 33 | 0.22% |

**Table S4**. City ranking by estimated exposure and risk for 2005. All monetary values are in million USD.

## 2. Scenarios for the future

### 2.1. Future cities: population, income, assets

To develop future scenarios, our analysis combines three scenarios for socio-economic changes. The first scenario (labelled NC) assumes an unchanged (or baseline) population and wealth.

The second and third scenarios start from the OECD long-term scenarios for population and GDP, and use extrapolations of UN scenarios for urbanization rate to project future city population. The OECD socio-economic baseline scenario used here are updated from those used in the previous analysis[1] and an extension of those recently published the OECD as part of the OECD Environmental Outlook to 2050.[15,16]

The scenario is constructed using the OECD ENV-Linkages model – a recursive dynamic neo-classical general equilibrium model (GE). It is a global economic model built primarily on a database of national economies. In its current form, the model represents the world economy in 15 countries/regions, each with 22 economic sectors. The scenario creates a consistent projection of economic activity for the coming decades to 2070, applying the general framework of "conditional convergence." The assumption of "conditional convergence" assumes that there will be some gradual convergence of income levels towards those of the most developed economies. The methodology used to derive per capita GDP trend pathways on a country basis relies on a conditional convergence hypothesis for the key drivers of per capita economic growth in the long run, i.e. for population, total factor productivity, physical capital, employment and human capital.

Urbanization scenarios are similar to the ones used in the previous analysis[1] and are based on an extrapolation to 2070 of UN urbanization scenarios.

The second scenario (labelled S) assumes that all cities in a given country grow at the same rate leading by the 2070s to several coastal cities with populations exceeding 50 million people[1]; the third scenario (labelled L) assumes that no city can exceed 35 million inhabitants.

The assessment is based on the assumption that the future assets (infrastructure, housing, productive capital) that will be built in coastal cities will have the elevation distribution than the assets that are already installed. Under this assumption, future assets in one elevation layer increase linearly with total assets in the city. As a result, future exposures (and losses) are proportional to current exposures (and losses) and to the increase in capital in the cities.

### 2.2.Taking into account climate-induced sea level rise

Considering the uncertainty on future sea level[17], we make simple assumptions with optimistic and pessimistic scenarios. We assume that climate-induced sea level rise is homogeneous globally and that climate change and sea level rise do not change storm surge likelihood. The analysis combines three scenarios on sea level rise. The first one (labelled "s") assumes a stable sea level over the 21st century; the second scenario (labelled "o") is optimistic and assumes that sea level rise will reach 10 cm in 2030, 20 cm in 2050, and 30 cm in 2070; the last – and most pessimistic – scenario (labelled "p") assumes that sea level rise reaches 20 cm in 2030, 40 cm in 2050, and 70 cm in 2070.

A significant difference with the previous analysis[1] is that storminess is assumed to remain unchanged. This change makes results more conservative, considering the uncertainty on change in storm intensity.[17]

### 2.3. Taking into account local subsidence

Small magnitudes of land uplift and subsidence are almost universal, contributing to local sea-level change[17]. However, the magnitudes are generally small and not considered here. In addition, in susceptible locations such as deltaic areas, human-induced subsidence due to groundwater withdrawal and drainage can be significant, especially in cities built on deltas. Maximum subsidence during the 20th Century has been up to 5 metres[18-22] and subsidence is seen as a major threat comparable to climate change in many coastal Asian cites[21]. The mean subsidence in these cities is less well measured and further, future subsidence is uncertain as it depends on human action. Hence reasonable high-end mean scenarios of human-induced subsidence are developed following Nicholls and colleagues[4], and applied to the entire flood prone area of the cities where such subsidence may occur.

Two scenarios on subsidence are considered. The first scenario assumes no subsidence (natural or artificial) and is labelled “0”; in the second scenario, labelled “1”, natural and artificial subsidence affects susceptible cities that are mainly located wholly or partly on a delta, making local sea level rise by 20 cm more in 2030, 40 cm more in 2050, and 50 cm more in 2070. This would largely constitute human-induced subsidence. In cities potentially affected by human-induced subsidence, the local sea level can thus rise by up to 120 cm by the 2070s in the most pessimistic scenario when global sea-level rise and subsidence are combined.

### 2.4.Combining scenarios

Combining all these assumptions leads to 3x3x2x3x2=108 scenarios. Because it would be too complex to present all results, the main paper focuses on five future scenarios summarized in Table S5. Supplementary data provide results for all scenarios.

| | | Scenarios | | | | |
|---|---|---|---|---|---|---|
| | | NC (present situation) | SEC (socio-economic change, no SLR, no subsidence) | SEC-S (socio-economic change, no SLR, with subsidence) | SLR-1 (socio-economic change, optimistic SLR, subsidence) | SLR-2 (socio-economic change, pessimistic SLR, subsidence) |
| Socio-economic trend | Constant (NC) | X | | | | |
| | Scenario with no city limit (S) | | | | | |
| | Scenario with city limit (L) | | X | X | X | X |
| Sea Level Rise | Stable (s) | X | X | X | | |
| | Optimistic rise (o) | | | | X | |
| | Pessimistic rise (p) | | | | | X |
| Subsidence | No (0) | X | X | | | |
| | Yes (1) | | | X | X | X |
| Defense failure model | Optimistic | | | | | |
| | Medium | | | | | |
| | Pessimistic | X | X | X | X | X |
| Protection levels | Min | | | | | |
| | Max | X | X | X | X | X |

**Table S5.** Characteristics of the five scenarios analyzed in the main text.

### 3. Taking into account adaptation.

Changes in sea levels will trigger investments in new and/or reinforced coastal defenses. However, there is a large uncertainty on how adaptation will be implemented. Here, we tested three assumptions about adaptation, termed adaptation options:

- No upgrade: The most pessimistic, which is an absence of defense upgrade (Option NA).
- Maintain defense standards: The defenses will be improved to maintain coastal flooding likelihood. In practical terms, this is equivalent to assuming that dikes and seawalls will be raised by the same magnitude as relative sea level rise in each city, including subsidence as appropriate (Option PD).
- Maintain relative risk: The most optimistic assumption considered is that flood risk (i.e. the relative mean annual losses) will be maintained unchanged by raising protection by more than the relative sea level rise. In practical terms, this adaptation scenario assumes that the Standard of Protection rises appropriately to maintain risk levels and the probability of mean annual losses remains unchanged, allowing for the effect of socio-economic change. (Option PL).

To maintain constant absolute levels of risk would require that the Standard of Protection rises even more than the PL scenario, to compensate for the increase in value at risk due to economic and population growth.

Table S6 presents aggregate losses for the 136 cities, for different scenarios and different adaptation scenarios. It shows the strong increase in the absence of adaptation, with total losses largely exceeding $1 trillion per year. It also show the increase in risk when adaptation only maintain the probability of occurrence of a flood.

| | Mean annual losses (million USD) in 2050 | | |
|---|---|---|---|
| | Adaptation Options | | |
| | No adaptation (NA) | Maintain present defences & constant flood probability (PD) | Maintain present average losses relative to local wealth (PL) |
| Scenario NC (no change – the current situation) | 5,744 | 5,744 | 5,744 |
| Scenario SEC (only socio-economic changes) | 52,015 | 52,015 | 52,015 |
| Scenario SEC-S (adds subsidence) | 687,186 | 58,579 | 52,015 |
| Scenario SLR-1 (adds optimistic sea-level rise) | 1,192,785 | 59,767 | 52,015 |
| Scenario SLR-2 (same as Scenario 1 with pessimistic sea-level rise) | 1,566,856 | 63,273 | 52,015 |

**Table S6.** Change in aggregated annual losses in 2050 in the 136 cities, due to different driver Scenarios and possible adaptation options.

| City | If adaptation maintains flood probability (Option PD) | | Adaptation needs to maintain mean annual losses (Option PL) | | | | Flood losses in event of defence failure (million USD – total losses for single event) (Option PL) | | |
|---|---|---|---|---|---|---|---|---|---|
| | AAL (M$) | Increase (%) (Fig. 1) | Local sea-level rise (cm) | Rise in dike height (cm) | Protection standard in 2005 (Return period (yrs)) | Required Protection standard in 2050 (Return period (yrs)) | Scenario SEC | Scenario SLR-1 | Increase (%) |
| Alexandria | 504 | 154% | 60 | 67 | 100 | 268 | 16,533 | 50,551 | 206% |
| Barranquilla | 10 | 116% | 60 | 66 | 10 | 23 | 39 | 100 | 156% |
| Napoli | 2 | 82% | 20 | 24 | 50 | 97 | 39 | 80 | 105% |
| Sapporo | 4 | 76% | 60 | 64 | 100 | 179 | 218 | 417 | 91% |
| Santo Domingo | 34 | 65% | 20 | 23 | 10 | 17 | 179 | 325 | 82% |
| Bayrut | 2 | 63% | 20 | 23 | 100 | 172 | 91 | 162 | 78% |
| Houston | 190 | 60% | 60 | 68 | 50 | 84 | 5,110 | 9,053 | 77% |
| Istanbul | 21 | 57% | 20 | 23 | 100 | 167 | 1,120 | 1,972 | 76% |
| Jakarta | 1,750 | 54% | 60 | 63 | 10 | 16 | 10,513 | 17,276 | 64% |
| Izmir | 11 | 51% | 20 | 22 | 100 | 157 | 625 | 1,023 | 64% |
| Marseille-Aix-en-Provence | 5 | 51% | 20 | 24 | 100 | 160 | 266 | 453 | 70% |
| Athens | 1 | 50% | 20 | 23 | 100 | 156 | 48 | 78 | 63% |
| Shanghai | 93 | 48% | 60 | 66 | 1000 | 1,519 | 57,646 | 89,545 | 55% |
| Banghazi | 22 | 46% | 20 | 23 | 100 | 154 | 1,223 | 2,019 | 65% |
| Tel Aviv-Yafo | 0 | 45% | 20 | 23 | 100 | 152 | 7 | 11 | 57% |
| Fuzhou_Fujian | 199 | 45% | 60 | 62 | 20 | 29 | 2,697 | 3,873 | 44% |
| Ningbo | 256 | 45% | 60 | 62 | 20 | 29 | 3,397 | 5,001 | 47% |
| La Habana | 0 | 42% | 20 | 22 | 100 | 146 | 14 | 21 | 50% |
| Port-au-Prince | 1 | 41% | 20 | 22 | 10 | 14 | 6 | 10 | 67% |
| Algiers | 9 | 41% | 20 | 22 | 50 | 72 | 291 | 439 | 51% |

**Table S7.** The twenty cities with the largest increase in average annual losses (from 2005 to 2050) (scenario SLR-1, adaptation option PD), if adaptation only maintains present defence standards. It provides the increase in defence height needed to maintain flood risk, and corresponding increase in protection standard. The three last columns describe the consequence of a storm that exceeds protection standards, in the case without and with sea-level rise and subsidence.

Results for all scenarios, all defense level estimates, the three overtopping model, and all time horizons (2030-2050-2070) are provided in Supplementary Data, together with the MatLab files used to produce them.

These data are organized as follows.

The directory "CODES" includes all MatLab codes. They reproduce all results. Running "City_Loop.m" produces all the information by running the risk assessment for all cities and storing results as MatLab variables.

Then, running "write_results_subs.m" writes all results in Excel format.

The main input file is located in the directory "INPUT CITY SCENARIOS": The file "City_Scenarios_Input.xls" provides the input data, namely population and economic data and scenarios, water extreme level data, protection level data, and a marker to indicate which city is subject to subsidence. This file also includes all socio-economic and urbanization scenarios.

GIS Inputs are located in the directory "GIS DATA". There is one file per city, and it provides the population in each 50cm elevation layer.

The results files are the following.

In the directory "RESULTS MAIN PAPER", there are:

- The file "All_scenarios_aggregated.xls" provides the global aggregated results for all scenarios, and the five ones used in the main text are highlighted in yellow.
- The five scenarios that are described in details in the main text of the letter: "SEC Scenario.xls", "SEC-S Scenario.xls", "SLR-1 Scenario.xls" and "SLR-2 Scenario.xls" provides the results for these five scenarios, for the 136 cities, the two assumptions on the current protection level, and the three adaptation options. Each file has one tab for each defense failure model and for each time horizon (2005, 2030, 2050, and 2070). There is no file for the NC scenario, because it corresponds to the 2005 situation in all other scenarios.

All other scenarios (a total of 108 scenarios) are in the folder "OTHER SCENARIOS", and they are named according to the scenario terminology (see Table S5):

**First letter:**

N for no socio-economic change,

S for socio-economic change without city limit and,

L for socio-economic change with city limit;

**Second letter:**

s for stable sea level

o for optimistic sea level rise

p for pessimistic sea level rise

**Third letter:**

0 for no subsidence

1 for the scenario with subsidence

Each file has then different tabs for different time horizons (2005, 2030, 2050 and 2070) and different defense failure models. And in each tab, one can find the three adaptation options.

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This table provides the results of the loss analysis for the 136 cities
In 2050, without sea level rise and with 20 cm of sea level rise and subsidence (40cm in cities prone to subsidence)
With socio-economic change, and city population limited to 35 million inhabitants
The protection level is taken at its optimistic bound (maximum protection).
The protection failure model is the simplest one (model #1, panel a in Figure S2)

| | No change in sea level | | | | | 20cm sea level rise and subsidence (no adaptation) | | 20 cm sea level rise and subsidence (adaptation at constant probability, adaptation scenario PD) | | | 20cm sea level rise and subsidence (adaptation at constant relative risk, adaptation scenario PL) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Urban Agglomeration | 100-yr exposition (M$) | 100-yr losses with no protection (M$) | Protection level in 2005 (return period in years) | Mean annual loss (M$) | Mean annual loss (% city GDP) | Mean annual loss (M$) | Mean increase due to SLR and subsidence | Mean annual loss (M$) | Mean annual loss (% city GDP) | Mean increase due to SLR and subsidence | Increase in dike height (for 20cm SLR + subsidence) | New protection level to maintain relative risk (return period in years) | New loss if protection is overtopped |
| Abidjan | 4,017 | 1,328 | 10 | 826 | 0.72% | 8,968 | 986% | 1,023 | 0.89% | 24% | 21.3 | 13 | 9,839 |
| Accra | 190 | 57 | 10 | 36 | 0.03% | 393 | 993% | 43 | 0.04% | 20% | 20.9 | 12 | 418 |
| Adelaide | 1,278 | 643 | 100 | 4 | 0.00% | 19 | 368% | 4 | 0.00% | 7% | 20.93 | 107 | 417 |
| Al Kuwayt (Kuwait City) | 1,579 | 549 | 100 | 9 | 0.00% | 235 | 2627% | 9 | 0.00% | 5% | 20.31 | 105 | 896 |
| Al-Iskandariyah (Alexandria) | 27,675 | 3,669 | 100 | 199 | 0.09% | 34,621 | 17300% | 504 | 0.22% | 154% | 67 | 268 | 50,551 |
| Amsterdam | 187,159 | 103,598 | 10000 | 9 | 0.01% | 56 | 521% | 10 | 0.01% | 9% | 63.06 | 10,976 | 93,122 |
| Athínai (Athens) | 487 | 113 | 100 | 1 | 0.00% | 18 | 3140% | 1 | 0.00% | 50% | 23 | 156 | 78 |
| Auckland | 1,119 | 563 | 100 | 4 | 0.00% | 42 | 905% | 4 | 0.00% | 6% | 20.56 | 107 | 435 |
| Baixada Santista (Santos) | 788 | 218 | 50 | 9 | 0.01% | 274 | 3041% | 9 | 0.01% | 8% | 20.45 | 54 | 463 |
| Baltimore | 31,595 | 15,406 | 50 | 238 | 0.08% | 1,178 | 396% | 271 | 0.09% | 14% | 21.76 | 58 | 12,741 |
| Banghazi | 3,048 | 734 | 100 | 15 | 0.01% | 180 | 1112% | 22 | 0.02% | 46% | 23 | 154 | 2,019 |
| Barcelona | 2,370 | 549 | 100 | 3 | 0.00% | 37 | 1195% | 4 | 0.00% | 40% | 22.93 | 146 | 372 |
| Barranquilla | 94 | 28 | 10 | 5 | 0.00% | 87 | 1782% | 10 | 0.01% | 116% | 66 | 23 | 100 |
| Bayrut_(Beirut) | 336 | 45 | 100 | 1 | 0.00% | 71 | 6658% | 2 | 0.00% | 63% | 23 | 172 | 162 |
| Belém | 2,007 | 542 | 50 | 12 | 0.01% | 93 | 698% | 13 | 0.01% | 8% | 20.8 | 54 | 609 |
| Boston | 124,752 | 69,675 | 50 | 741 | 0.13% | 5,557 | 650% | 793 | 0.14% | 7% | 20.7 | 54 | 38,400 |
| Brisbane | 12,803 | 5,486 | 100 | 29 | 0.02% | 178 | 504% | 33 | 0.02% | 11% | 21.21 | 111 | 3,102 |
| Buenos Aires | 6,847 | 1,868 | 50 | 44 | 0.00% | 161 | 268% | 49 | 0.00% | 13% | 22.07 | 57 | 2,258 |
| Cape Town | 757 | 209 | 100 | 4 | 0.00% | 51 | 1036% | 5 | 0.00% | 7% | 20.59 | 107 | 471 |
| Chennai (Madras) | 3,457 | 966 | 10 | 825 | 0.12% | 7,392 | 796% | 939 | 0.14% | 14% | 21.24 | 11 | 9,001 |
| Chittagong | 4,751 | 1,186 | 20 | 154 | 0.08% | 671 | 337% | 162 | 0.09% | 6% | 20.76 | 21 | 3,138 |
| Ciudad de Panama (Panama City) | 468 | 200 | 10 | 42 | 0.06% | 431 | 916% | 44 | 0.06% | 4% | 20.23 | 10 | 437 |
| Conakry | 449 | 166 | 10 | 66 | 0.09% | 716 | 981% | 78 | 0.10% | 18% | 20.87 | 12 | 760 |
| Dakar | 177 | 48 | 10 | 35 | 0.04% | 377 | 973% | 41 | 0.05% | 16% | 20.78 | 12 | 398 |
| Dalian | 1,973 | 750 | 20 | 143 | 0.04% | 1,223 | 757% | 155 | 0.05% | 9% | 20.8 | 22 | 3,008 |
| Dar-el-Beida (Casablanca) | 940 | 301 | 100 | 12 | 0.01% | 191 | 1458% | 13 | 0.01% | 8% | 20.56 | 108 | 1,288 |
| Dar-es-Salaam | 101 | 41 | 10 | 62 | 0.07% | 624 | 910% | 65 | 0.08% | 6% | 20.43 | 11 | 642 |
| Davao | 61 | 22 | 10 | 5 | 0.01% | 56 | 921% | 6 | 0.01% | 7% | 20.4 | 11 | 57 |
| Dhaka | 10,126 | 2,774 | 20 | 451 | 0.10% | 6,287 | 1294% | 506 | 0.11% | 12% | 62.72 | 23 | 9,734 |
| Douala | 162 | 48 | 10 | 24 | 0.03% | 284 | 1070% | 31 | 0.04% | 29% | 62.62 | 13 | 304 |
| Dubayy (Dubai) | 49,574 | 16,861 | 100 | 286 | 0.11% | 4,180 | 1362% | 305 | 0.12% | 7% | 20.49 | 107 | 29,881 |
| Dublin | 6,825 | 1,866 | 70 | 7 | 0.01% | 85 | 1046% | 8 | 0.01% | 11% | 20.87 | 78 | 554 |
| Durban | 1,094 | 317 | 500 | 1 | 0.00% | 38 | 2444% | 2 | 0.00% | 7% | 20.38 | 531 | 774 |
| El_Djazaïr (Algiers) | 363 | 88 | 50 | 7 | 0.00% | 253 | 3755% | 9 | 0.00% | 41% | 22 | 72 | 439 |
| Fortaleza | 493 | 160 | 50 | 2 | 0.00% | 52 | 2762% | 2 | 0.00% | 23% | 21.33 | 62 | 105 |
| Fukuoka-Kitakyushu | 87,966 | 42,913 | 100 | 177 | 0.09% | 19,904 | 11134% | 221 | 0.12% | 25% | 61.47 | 125 | 21,789 |
| Fuzhou_Fujian | 2,651 | 919 | 20 | 137 | 0.05% | 3,525 | 2471% | 199 | 0.08% | 45% | 62 | 29 | 3,873 |
| Glasgow | 4,365 | 1,757 | 200.00 | 4 | 0.00% | 95 | 2243% | 4 | 0.00% | 6% | 20.36 | 212 | 842 |
| Grande_Vitória | 15,160 | 4,712 | 50 | 190 | 0.23% | 2,643 | 1289% | 211 | 0.26% | 11% | 20.82 | 56 | 10,266 |
| Guangzhou_Guangdong | 86,644 | 37,105 | 20 | 11,928 | 1.32% | 254,721 | 2036% | 13,200 | 1.46% | 11% | 60.88 | 22 | 261,495 |
| Guayaquil | 8,296 | 3,133 | 10 | 2,813 | 0.95% | 31,288 | 1012% | 3,189 | 1.08% | 13% | 60.64 | 11 | 31,645 |
| Hai Phòng | 14,283 | 4,728 | 50 | 320 | 0.37% | 6,209 | 941% | 383 | 0.44% | 30% | 64 | 61 | 17,867 |
| Hamburg | 59,084 | 28,626 | 1000 | 14 | 0.01% | 61 | 339% | 15 | 0.01% | 6% | 20.79 | 1,060 | 14,225 |
| Hangzhou | 586 | 149 | 20 | 6 | 0.00% | 125 | 2109% | 7 | 0.00% | 22% | 62.17 | 24 | 134 |
| Helsinki | 2,482 | 936 | 200 | 3 | 0.00% | 11 | 245% | 3 | 0.00% | 8% | 21.35 | 217 | 645 |
| Hiroshima | 52,494 | 23,307 | 100 | 80 | 0.06% | 9,456 | 11660% | 109 | 0.08% | 35% | 62.07 | 137 | 10,696 |
| Hong Kong | 60,722 | 31,300 | 900 | 140 | 0.00% | 1,269 | 808% | 150 | 0.00% | 7% | 20.63 | 964 | 131,051 |
| Houston | 29,147 | 12,337 | 50 | 119 | 0.02% | 6,088 | 5017% | 190 | 0.03% | 60% | 68 | 84 | 9,053 |
| Inchon | 22,825 | 9,493 | 100 | 29 | 0.01% | 191 | 553% | 30 | 0.02% | 2% | 20.24 | 102 | 2,953 |
| Istanbul | 3,162 | 419 | 100 | 13 | 0.00% | 327 | 2348% | 21 | 0.00% | 57% | 23 | 167 | 1,972 |
| Izmir | 1,415 | 341 | 100 | 7 | 0.00% | 314 | 4299% | 11 | 0.01% | 51% | 22 | 157 | 1,023 |
| Jakarta | 9,577 | 2,553 | 10 | 1,139 | 0.14% | 16,354 | 1336% | 1,750 | 0.22% | 54% | 63 | 16 | 17,276 |
| Jiddah | 1,092 | 393 | 10 | 60 | 0.02% | 631 | 943% | 67 | 0.02% | 10% | 20.47 | 11 | 651 |
| Karachi | 792 | 260 | 10 | 121 | 0.02% | 1,385 | 1040% | 145 | 0.02% | 20% | 61.64 | 12 | 1,432 |
| Khulna | 4,665 | 1,748 | 20 | 295 | 0.43% | 6,172 | 1989% | 409 | 0.60% | 39% | 66.11 | 29 | 7,650 |
| København (Copenhagen) | 9,567 | 2,462 | 200 | 7 | 0.01% | 36 | 391% | 8 | 0.01% | 15% | 21.79 | 231 | 1,573 |
| Kochi (Cochin) | 1,923 | 505 | 10 | 430 | 0.29% | 4,327 | 907% | 481 | 0.33% | 12% | 20.97 | 11 | 4,648 |
| Kolkata (Calcutta) | 33,231 | 12,649 | 20 | 2,704 | 0.21% | 56,303 | 1983% | 3,350 | 0.26% | 24% | 63.76 | 25 | 64,760 |
| Krung_Thep (Bangkok) | 49,065 | 16,462 | 50 | 596 | 0.07% | 20,778 | 3387% | 734 | 0.09% | 23% | 63.86 | 63 | 34,145 |
| Kuala Lumpur | 19,437 | 6,696 | 100 | 56 | 0.03% | 253 | 355% | 63 | 0.04% | 13% | 21.69 | 114 | 5,897 |
| La Habana (Havana) | 31 | 8 | 100 | 0 | 0.00% | 9 | 5939% | 0 | 0.00% | 42% | 22 | 146 | 21 |
| Lagos | 2,750 | 728 | 10 | 287 | 0.15% | 3,026 | 954% | 328 | 0.17% | 14% | 20.79 | 11 | 3,196 |
| Lima | 47 | 14 | 10 | 4 | 0.00% | 39 | 1009% | 4 | 0.00% | 26% | 21.29 | 13 | 43 |
| Lisboa (Lisbon) | 4,764 | 1,770 | 100 | 13 | 0.01% | 100 | 650% | 15 | 0.01% | 10% | 20.95 | 110 | 1,406 |
| Lomé | 1,005 | 308 | 100 | 28 | 0.05% | 1,017 | 3521% | 33 | 0.06% | 16% | 20.86 | 117 | 3,169 |
| London | 101,543 | 36,751 | 1000 | 13 | 0.00% | 65 | 384% | 14 | 0.00% | 9% | 21.09 | 1,090 | 13,789 |
| Los Angeles-Long Beach Santa Ana | 35,833 | 15,517 | 50 | 188 | 0.08% | 9,427 | 4912% | 203 | 0.09% | 8% | 20.37 | 54 | 9,960 |
| Luanda | 21 | 7 | 10 | 9 | 0.00% | 95 | 952% | 10 | 0.00% | 12% | 20.62 | 11 | 99 |
| Maceió | 518 | 188 | 50 | 6 | 0.01% | 54 | 887% | 6 | 0.01% | 10% | 20.83 | 55 | 290 |
| Manila | 2,339 | 872 | 10 | 254 | 0.05% | 2,846 | 1019% | 329 | 0.06% | 29% | 63.62 | 13 | 3,122 |
| Maputo | 404 | 169 | 100 | 24 | 0.03% | 184 | 656% | 26 | 0.03% | 7% | 20.63 | 107 | 2,523 |
| Maracaibo | 775 | 236 | 100 | 6 | 0.01% | 67 | 1086% | 7 | 0.01% | 22% | 21.71 | 124 | 658 |
| Marseille-Aix-en-Provence | 3,403 | 788 | 100 | 3 | 0.00% | 43 | 1233% | 5 | 0.00% | 51% | 24 | 160 | 453 |
| Melbourne | 682 | 328 | 100 | 2 | 0.00% | 10 | 334% | 2 | 0.00% | 9% | 21.23 | 109 | 229 |
| Miami | 824,448 | 387,360 | 100 | 2,099 | 0.30% | 7,340 | 250% | 2,549 | 0.36% | 23% | 23.57 | 125 | 228,589 |
| Montevideo | 992 | 334 | 50 | 14 | 0.02% | 50 | 258% | 15 | 0.02% | 9% | 21.38 | 55 | 716 |
| Montréal | 4,235 | 2,482 | 50 | 14 | 0.00% | 86 | 496% | 15 | 0.00% | 4% | 20.4 | 52 | 729 |
| Mumbai (Bombay) | 52,173 | 19,827 | 20 | 6,109 | 0.47% | 107,285 | 1656% | 6,414 | 0.49% | 5% | 20.34 | 21 | 126,406 |
| Muqdisho (Mogadishu) | 21 | 8 | 10 | 13 | 0.04% | 128 | 920% | 13 | 0.04% | 6% | 20.37 | 11 | 131 |
| Nagoya | 175,473 | 99,196 | 100 | 564 | 0.26% | 57,954 | 10183% | 644 | 0.30% | 14% | 61.44 | 114 | 63,344 |
| N'ampo | 1,141 | 383 | 10 | 24 | 0.31% | 87 | 255% | 25 | 0.32% | 3% | 20.47 | 10 | 246 |
| Napoli (Naples) | 981 | 125 | 50 | 1 | 0.00% | 35 | 2895% | 2 | 0.00% | 82% | 24 | 97 | 80 |
| Natal | 647 | 250 | 50 | 9 | 0.02% | 150 | 1505% | 10 | 0.02% | 7% | 20.49 | 53 | 489 |
| New Orleans | 323,917 | 180,646 | 100 | 1,583 | 1.21% | 161,141 | 10080% | 1,864 | 1.42% | 18% | 61.99 | 118 | 182,592 |
| New York-Newark | 532,194 | 291,729 | 100 | 1,960 | 0.08% | 7,914 | 304% | 2,056 | 0.08% | 5% | 20.7 | 105 | 198,885 |
| Ningbo | 6,272 | 1,373 | 20 | 176 | 0.09% | 4,548 | 2479% | 256 | 0.13% | 45% | 62 | 29 | 5,001 |
| Odessa | 2,733 | 859 | 100 | 19 | 0.04% | 280 | 1339% | 22 | 0.05% | 14% | 21.04 | 115 | 2,146 |
| Osaka-Kobe | 337,354 | 177,054 | 300 | 261 | 0.03% | 84,968 | 32516% | 336 | 0.04% | 29% | 61.86 | 390 | 98,671 |
| Palembang | 2,612 | 934 | 10 | 418 | 0.39% | 4,764 | 1040% | 506 | 0.48% | 21% | 62.08 | 12 | 4,974 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Perth | 4,220 | 2,145 | 100 | 16 | 0.01% | 65 | 309% | 17 | 0.01% | 8% | 21.18 | 109 | 1,626 |
| Philadelphia | 49,797 | 27,432 | 50 | 279 | 0.04% | 1,017 | 265% | 294 | 0.04% | 5% | 20.83 | 53 | 14,127 |
| Port-au-Prince | 9 | 3 | 10 | 1 | 0.00% | 8 | 1090% | 1 | 0.00% | 41% | 22 | 14 | 10 |
| Portland | 3,753 | 1,716 | 50 | 3 | 0.00% | 114 | 3965% | 3 | 0.00% | 12% | 20.62 | 56 | 152 |
| Porto | 1,756 | 722 | 100 | 6 | 0.01% | 34 | 426% | 7 | 0.01% | 7% | 20.86 | 107 | 669 |
| Porto Alegre | 0 | 0 | 50 | 10 | 0.00% | 71 | 641% | 10 | 0.01% | 8% | 20.8 | 54 | 497 |
| Providence | 17,857 | 9,479 | 50 | 118 | 0.07% | 525 | 344% | 127 | 0.08% | 7% | 20.96 | 54 | 6,084 |
| Pusan | 16,852 | 4,523 | 100 | 30 | 0.01% | 384 | 1165% | 34 | 0.01% | 10% | 20.8 | 111 | 3,262 |
| Qingdao | 3,055 | 958 | 20 | 163 | 0.05% | 3,260 | 1904% | 177 | 0.06% | 9% | 20.56 | 22 | 3,461 |
| Rabat | 248 | 71 | 100 | 2 | 0.00% | 60 | 2930% | 2 | 0.00% | 15% | 20.84 | 115 | 220 |
| Rangoon | 4,177 | 1,387 | 10 | 163 | 0.17% | 1,818 | 1017% | 202 | 0.21% | 24% | 63.34 | 12 | 1,962 |
| Recife | 1,218 | 477 | 50 | 19 | 0.01% | 259 | 1279% | 20 | 0.01% | 7% | 20.49 | 53 | 977 |
| Rio_de_Janeiro | 4,132 | 1,010 | 50 | 35 | 0.01% | 411 | 1088% | 38 | 0.01% | 9% | 20.72 | 55 | 1,839 |
| Rotterdam | 172,316 | 96,071 | 10000 | 7 | 0.01% | 256 | 3416% | 8 | 0.01% | 11% | 61.84 | 11,153 | 79,289 |
| Salvador | 377 | 143 | 50 | 5 | 0.00% | 245 | 4903% | 5 | 0.00% | 7% | 20.34 | 53 | 257 |
| San Diego | 1,369 | 731 | 50 | 12 | 0.00% | 410 | 3299% | 13 | 0.00% | 7% | 20.39 | 53 | 634 |
| San Francisco - Oakland | 34,156 | 13,240 | 50 | 149 | 0.03% | 1,703 | 1045% | 168 | 0.04% | 13% | 21.02 | 57 | 8,071 |
| San Jose | 2,826 | 932 | 50 | 2 | 0.00% | 10 | 551% | 2 | 0.00% | 11% | 21.13 | 56 | 83 |
| San Juan | 7,342 | 2,235 | 50 | 68 | 0.02% | 1,680 | 2365% | 89 | 0.03% | 31% | 21.78 | 66 | 4,239 |
| Sankt Peterburg (St. Petersburg) | 52,615 | 11,899 | 1000 | 11 | 0.00% | 187 | 1572% | 12 | 0.00% | 8% | 20.53 | 1,077 | 11,748 |
| Santo Domingo | 636 | 153 | 10 | 21 | 0.02% | 263 | 1166% | 34 | 0.03% | 65% | 23 | 17 | 325 |
| Sapporo | 1,339 | 591 | 100 | 2 | 0.00% | 346 | 14308% | 4 | 0.00% | 76% | 64 | 179 | 417 |
| Seattle | 10,235 | 6,100 | 50 | 85 | 0.02% | 545 | 542% | 87 | 0.02% | 3% | 20.33 | 52 | 4,304 |
| Shanghai | 77,189 | 28,576 | 1000 | 63 | 0.00% | 5,563 | 8721% | 93 | 0.01% | 48% | 66 | 1,519 | 89,545 |
| Shenzen | 25,510 | 10,362 | 20 | 2,929 | 0.38% | 17,553 | 499% | 3,136 | 0.40% | 7% | 20.79 | 21 | 60,550 |
| Singapore | 3,412 | 2,020 | 2000 | 2 | 0.00% | 27 | 1222% | 2 | 0.00% | 3% | 20.26 | 2,068 | 4,208 |
| Stockholm | 517 | 152 | 100 | 1 | 0.00% | 14 | 1613% | 1 | 0.00% | 26% | 21.73 | 128 | 98 |
| Surabaya | 727 | 163 | 10 | 80 | 0.04% | 1,052 | 1222% | 110 | 0.06% | 39% | 62.05 | 14 | 1,089 |
| Surat | 7,399 | 3,078 | 10 | 905 | 0.25% | 9,070 | 902% | 928 | 0.26% | 3% | 20.21 | 10 | 9,201 |
| Sydney | 8,293 | 4,314 | 100 | 28 | 0.01% | 172 | 509% | 31 | 0.01% | 9% | 21.03 | 110 | 2,943 |
| Taipei | 2,713 | 1,042 | 20 | 274 | 0.10% | 6,436 | 2250% | 344 | 0.12% | 26% | 61.25 | 25 | 6,757 |
| Tampa-St Petersburg | 111,585 | 56,155 | 50 | 763 | 0.26% | 2,997 | 293% | 859 | 0.29% | 13% | 21.87 | 57 | 40,022 |
| Tarabulus (Tripoli) | 267 | 64 | 100 | 2 | 0.00% | 19 | 1058% | 2 | 0.00% | 37% | 22.83 | 141 | 207 |
| Tel Aviv-Yafo (Tel Aviv-Jaffa) | 26 | 6 | 100 | 0 | 0.00% | 1 | 1255% | 0 | 0.00% | 45% | 23 | 152 | 11 |
| Thành-Pho-Ho-Chi-Minh (Ho Chi Minh City) | 42,093 | 20,216 | 50 | 1,743 | 0.74% | 7,335 | 321% | 1,953 | 0.83% | 11% | 65.16 | 57 | 90,365 |
| Tianjin | 25,667 | 9,779 | 20 | 1,810 | 0.24% | 40,492 | 2137% | 2,276 | 0.30% | 26% | 62.85 | 25 | 44,463 |
| Tokyo | 276,547 | 140,711 | 1000 | 58 | 0.00% | 61,737 | 106550% | 77 | 0.00% | 33% | 62 | 1,346 | 75,503 |
| Ujung Pandang | 156 | 33 | 10 | 11 | 0.01% | 67 | 515% | 12 | 0.02% | 12% | 21.29 | 11 | 116 |
| Ulsan | 1,209 | 368 | 100 | 2 | 0.00% | 53 | 2189% | 3 | 0.00% | 30% | 21.81 | 133 | 286 |
| Vancouver | 75,276 | 43,232 | 50 | 325 | 0.14% | 18,912 | 5714% | 423 | 0.18% | 30% | 61.64 | 65 | 20,674 |
| Virginia Beach | 138,390 | 62,671 | 140 | 278 | 0.15% | 1,520 | 446% | 303 | 0.16% | 10% | 21.05 | 153 | 40,549 |
| Visakhapatnam | 369 | 111 | 10 | 110 | 0.08% | 1,129 | 926% | 122 | 0.08% | 11% | 20.73 | 11 | 1,189 |
| Washington, D C | 12,326 | 5,972 | 50 | 74 | 0.01% | 1,045 | 1321% | 82 | 0.01% | 12% | 20.89 | 56 | 3,976 |
| Wenzhou | 3,187 | 921 | 20 | 152 | 0.06% | 3,367 | 2119% | 174 | 0.07% | 15% | 60.85 | 23 | 3,447 |
| Xiamen | 10,093 | 3,682 | 20 | 572 | 0.22% | 12,182 | 2029% | 729 | 0.29% | 27% | 63.67 | 26 | 13,902 |
| Yantai | 679 | 164 | 20 | 21 | 0.01% | 406 | 1878% | 24 | 0.01% | 18% | 21.16 | 24 | 461 |
| Zhanjiang | 6,256 | 2,865 | 20 | 806 | 0.50% | 16,709 | 1973% | 891 | 0.55% | 11% | 61.24 | 22 | 17,440 |

This table provides the results of the loss analysis for the 136 cities
In 2050, without sea level rise and with 40 cm of sea level rise and subsidence (40cm in cities prone to subsidence)
With socio-economic change, and city population limited to 35 million inhabitants
The protection level is taken at its optimistic bound (maximum protection).
The protection failure model is the simplest one (model #1, panel a in Figure S2)

| | No change in sea level | | | | | 40cm sea level rise and subsidence (no adaptation) | | 40 cm sea level rise and subsidence (adaptation at constant probability, adaptation scenario PD) | | | 40cm sea level rise and subsidence (adaptation at constant relative risk, adaptation scenario PL) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Urban Agglomeration | 100-yr exposition (M$) | 100-yr losses with no protection (M$) | Protection level in 2005 (return period in years) | Mean annual loss (M$) | Mean annual loss (% city GDP) | Mean annual loss (M$) | Mean increase due to SLR and subsidence | Mean annual loss (M$) | Mean annual loss (% city GDP) | Mean increase due to SLR and subsidence | Increase in dike height (for 40cm SLR + subsidence) | New protection level to maintain relative risk (return period in years) | New loss if protection is overtopped |
| Abidjan | 4,017 | 1,328 | 10 | 826 | 0.72% | 10,836 | 1213% | 1,187 | 1.03% | 44% | 42.18 | 15 | 11,623 |
| Accra | 190 | 57 | 10 | 36 | 0.03% | 458 | 1174% | 49 | 0.05% | 36% | 41.52 | 14 | 480 |
| Adelaide | 1,278 | 643 | 100 | 4 | 0.00% | 88 | 2086% | 5 | 0.00% | 14% | 41.73 | 114 | 446 |
| Al Kuwayt (Kuwait City) | 1,579 | 549 | 100 | 9 | 0.00% | 892 | 10242% | 9 | 0.00% | 10% | 40.55 | 110 | 936 |
| Al-Iskandariyah (Alexandria) | 27,675 | 3,669 | 100 | 199 | 0.09% | 44,877 | 22455% | 581 | 0.25% | 192% | 87.88 | 304 | 58,470 |
| Amsterdam | 187,159 | 103,598 | 10000 | 9 | 0.01% | 102 | 1042% | 10 | 0.01% | 13% | 84.13 | 11,340 | 96,240 |
| Athinai (Athens) | 487 | 113 | 100 | 1 | 0.00% | 73 | 13246% | 1 | 0.00% | 98% | 44.18 | 207 | 107 |
| Auckland | 1,119 | 563 | 100 | 4 | 0.00% | 419 | 9914% | 5 | 0.00% | 13% | 41.1 | 114 | 463 |
| Baixada Santista (Santos) | 788 | 218 | 50 | 9 | 0.01% | 467 | 5256% | 10 | 0.01% | 15% | 40.82 | 58 | 493 |
| Baltimore | 31,595 | 15,406 | 50 | 238 | 0.08% | 5,841 | 2359% | 299 | 0.10% | 26% | 43.03 | 64 | 14,367 |
| Banghazi | 3,048 | 734 | 100 | 15 | 0.01% | 1,588 | 10595% | 28 | 0.02% | 89% | 45.56 | 200 | 2,748 |
| Barcelona | 2,370 | 549 | 100 | 3 | 0.00% | 307 | 10731% | 5 | 0.00% | 75% | 44.71 | 183 | 484 |
| Barranquilla | 94 | 28 | 10 | 5 | 0.00% | 102 | 2106% | 11 | 0.01% | 143% | 86.94 | 25 | 113 |
| Bayrut_(Beirut) | 336 | 45 | 100 | 1 | 0.00% | 164 | 15583% | 2 | 0.00% | 136% | 44.37 | 251 | 246 |
| Belém | 2,007 | 542 | 50 | 12 | 0.01% | 586 | 4955% | 13 | 0.01% | 15% | 41.41 | 58 | 654 |
| Boston | 124,752 | 69,675 | 50 | 741 | 0.13% | 37,206 | 4924% | 849 | 0.15% | 15% | 41.4 | 58 | 41,249 |
| Brisbane | 12,803 | 5,486 | 100 | 29 | 0.02% | 1,076 | 3552% | 36 | 0.02% | 22% | 42.35 | 124 | 3,459 |
| Buenos Aires | 6,847 | 1,868 | 50 | 44 | 0.00% | 592 | 1257% | 56 | 0.00% | 28% | 44.13 | 65 | 2,602 |
| Cape Town | 757 | 209 | 100 | 4 | 0.00% | 453 | 9998% | 5 | 0.00% | 15% | 41.15 | 115 | 501 |
| Chennai (Madras) | 3,457 | 966 | 10 | 825 | 0.12% | 9,347 | 1033% | 1,028 | 0.15% | 25% | 42.07 | 13 | 10,024 |
| Chittagong | 4,751 | 1,186 | 20 | 154 | 0.08% | 2,934 | 1811% | 171 | 0.09% | 11% | 41.5 | 22 | 3,288 |
| Ciudad de Panama (Panama City) | 468 | 200 | 10 | 42 | 0.06% | 451 | 962% | 47 | 0.06% | 10% | 40.51 | 11 | 459 |
| Conakry | 449 | 166 | 10 | 66 | 0.09% | 831 | 1155% | 89 | 0.12% | 34% | 41.51 | 14 | 872 |
| Dakar | 177 | 48 | 10 | 35 | 0.04% | 429 | 1121% | 45 | 0.05% | 29% | 41.32 | 13 | 446 |
| Dalian | 1,973 | 750 | 20 | 143 | 0.04% | 3,012 | 2010% | 166 | 0.05% | 16% | 41.43 | 23 | 3,241 |
| Dar-el-Beida (Casablanca) | 940 | 301 | 100 | 12 | 0.01% | 1,256 | 10159% | 14 | 0.01% | 16% | 41.13 | 117 | 1,395 |
| Dar-es-Salaam | 101 | 41 | 10 | 62 | 0.07% | 660 | 969% | 69 | 0.08% | 11% | 40.8 | 11 | 677 |
| Davao | 61 | 22 | 10 | 5 | 0.01% | 60 | 995% | 6 | 0.01% | 16% | 40.94 | 12 | 62 |
| Dhaka | 10,126 | 2,774 | 20 | 451 | 0.10% | 9,219 | 1944% | 524 | 0.11% | 16% | 83.55 | 23 | 10,154 |
| Douala | 162 | 48 | 10 | 24 | 0.03% | 311 | 1179% | 34 | 0.04% | 40% | 83.43 | 14 | 333 |
| Dubayy (Dubai) | 49,574 | 16,861 | 100 | 286 | 0.11% | 29,215 | 10114% | 326 | 0.13% | 14% | 41.01 | 115 | 31,900 |
| Dublin | 6,825 | 1,866 | 70 | 7 | 0.01% | 532 | 7114% | 9 | 0.01% | 20% | 41.53 | 84 | 606 |
| Durban | 1,094 | 317 | 500 | 1 | 0.00% | 746 | 27710% | 2 | 0.00% | 14% | 40.81 | 569 | 826 |
| El_Djazaïr (Algiers) | 363 | 88 | 50 | 7 | 0.00% | 452 | 6805% | 12 | 0.00% | 76% | 43.26 | 91 | 566 |
| Fortaleza | 493 | 160 | 50 | 2 | 0.00% | 108 | 5814% | 3 | 0.00% | 62% | 43.15 | 85 | 141 |
| Fukuoka-Kitakyushu | 87,966 | 42,913 | 100 | 177 | 0.09% | 21,434 | 11998% | 235 | 0.12% | 33% | 81.87 | 133 | 23,251 |
| Fuzhou_Fujian | 2,651 | 919 | 20 | 137 | 0.05% | 4,148 | 2926% | 237 | 0.09% | 73% | 82.89 | 35 | 4,637 |
| Glasgow | 4,365 | 1,757 | 200.00 | 4 | 0.00% | 824 | 20293% | 5 | 0.01% | 12% | 40.71 | 224 | 890 |
| Grande_Vitória | 15,160 | 4,712 | 50 | 190 | 0.23% | 10,096 | 5208% | 227 | 0.28% | 20% | 41.38 | 60 | 11,163 |
| Guangzhou_Guangdong | 86,644 | 37,105 | 20 | 11,928 | 1.32% | 262,207 | 2098% | 13,537 | 1.49% | 13% | 81.1 | 23 | 268,090 |
| Guayaquil | 8,296 | 3,133 | 10 | 2,813 | 0.95% | 32,267 | 1047% | 3,278 | 1.11% | 17% | 80.79 | 12 | 32,555 |
| Hai Phòng | 14,283 | 4,728 | 50 | 320 | 0.37% | 16,029 | 2482% | 418 | 0.48% | 40% | 85.97 | 67 | 19,432 |
| Hamburg | 59,084 | 28,626 | 1000 | 14 | 0.01% | 268 | 1825% | 15 | 0.01% | 11% | 41.49 | 1,116 | 15,064 |
| Hangzhou | 586 | 149 | 20 | 6 | 0.00% | 133 | 2252% | 7 | 0.00% | 27% | 82.68 | 26 | 141 |
| Helsinki | 2,482 | 936 | 200 | 3 | 0.00% | 38 | 1093% | 4 | 0.00% | 17% | 42.76 | 237 | 703 |
| Hiroshima | 52,494 | 23,307 | 100 | 80 | 0.06% | 10,421 | 12860% | 117 | 0.08% | 46% | 82.57 | 147 | 11,584 |
| Hong Kong | 60,722 | 31,300 | 900 | 140 | 0.00% | 11,514 | 6067% | 159 | 0.00% | 14% | 41.19 | 1,026 | 140,038 |
| Houston | 29,147 | 12,337 | 50 | 119 | 0.02% | 7,246 | 5990% | 214 | 0.04% | 80% | 89.45 | 95 | 10,389 |
| Inchon | 22,825 | 9,493 | 100 | 29 | 0.01% | 1,248 | 4166% | 31 | 0.02% | 5% | 40.55 | 105 | 3,030 |
| Istanbul | 3,162 | 419 | 100 | 13 | 0.00% | 1,746 | 12980% | 29 | 0.00% | 119% | 45.31 | 234 | 2,890 |
| Izmir | 1,415 | 341 | 100 | 7 | 0.00% | 997 | 13880% | 14 | 0.01% | 101% | 43.9 | 209 | 1,411 |
| Jakarta | 9,577 | 2,553 | 10 | 1,139 | 0.14% | 17,852 | 1467% | 1,872 | 0.23% | 64% | 83.32 | 17 | 18,540 |
| Jiddah | 1,092 | 393 | 10 | 60 | 0.02% | 702 | 1062% | 75 | 0.02% | 24% | 41.06 | 12 | 733 |
| Karachi | 792 | 260 | 10 | 121 | 0.02% | 1,451 | 1095% | 151 | 0.03% | 24% | 81.97 | 12 | 1,489 |
| Khulna | 4,665 | 1,748 | 20 | 295 | 0.43% | 6,851 | 2219% | 459 | 0.67% | 56% | 88.15 | 32 | 8,788 |
| København (Copenhagen) | 9,567 | 2,462 | 200 | 7 | 0.01% | 177 | 2308% | 9 | 0.01% | 28% | 43.24 | 259 | 1,784 |
| Kochi (Cochin) | 1,923 | 505 | 10 | 430 | 0.29% | 4,837 | 1026% | 521 | 0.36% | 21% | 41.64 | 12 | 5,096 |
| Kolkata (Calcutta) | 33,231 | 12,649 | 20 | 2,704 | 0.21% | 60,930 | 2154% | 3,515 | 0.27% | 30% | 84.56 | 26 | 68,537 |
| Krung_Thep (Bangkok) | 49,065 | 16,462 | 50 | 596 | 0.07% | 30,827 | 5073% | 818 | 0.10% | 37% | 85.93 | 71 | 38,153 |
| Kuala Lumpur | 19,437 | 6,696 | 100 | 56 | 0.03% | 1,153 | 1971% | 69 | 0.04% | 24% | 42.96 | 125 | 6,607 |
| La Habana (Havana) | 31 | 8 | 100 | 0 | 0.00% | 21 | 13660% | 0 | 0.00% | 80% | 42.99 | 185 | 28 |
| Lagos | 2,750 | 728 | 10 | 287 | 0.15% | 3,407 | 1087% | 360 | 0.19% | 26% | 41.33 | 13 | 3,549 |
| Lima | 47 | 14 | 10 | 4 | 0.00% | 48 | 1254% | 5 | 0.00% | 48% | 42.15 | 15 | 51 |
| Lisboa (Lisbon) | 4,764 | 1,770 | 100 | 13 | 0.01% | 747 | 5521% | 16 | 0.01% | 18% | 41.7 | 119 | 1,530 |
| Lomé | 1,005 | 308 | 100 | 28 | 0.05% | 3,148 | 11112% | 36 | 0.06% | 29% | 41.45 | 130 | 3,562 |
| London | 101,543 | 36,751 | 1000 | 13 | 0.00% | 313 | 2246% | 16 | 0.00% | 17% | 42.14 | 1,184 | 15,010 |
| Los Angeles-Long Beach Santa Ana | 35,833 | 15,517 | 50 | 188 | 0.08% | 10,158 | 5301% | 217 | 0.10% | 15% | 40.72 | 58 | 10,697 |
| Luanda | 21 | 7 | 10 | 9 | 0.00% | 105 | 1061% | 11 | 0.00% | 21% | 41.04 | 12 | 108 |
| Maceió | 518 | 188 | 50 | 6 | 0.01% | 283 | 5025% | 7 | 0.01% | 22% | 41.85 | 62 | 323 |
| Manila | 2,339 | 872 | 10 | 254 | 0.05% | 3,123 | 1128% | 365 | 0.06% | 44% | 85.11 | 15 | 3,489 |
| Maputo | 404 | 169 | 100 | 24 | 0.03% | 1,389 | 3289% | 27 | 0.03% | 13% | 41.15 | 112 | 2,672 |
| Maracaibo | 775 | 236 | 100 | 6 | 0.01% | 588 | 10238% | 8 | 0.01% | 40% | 42.84 | 142 | 773 |
| Marseille-Aix-en-Provence | 3,403 | 788 | 100 | 3 | 0.00% | 358 | 10971% | 6 | 0.01% | 100% | 45.86 | 214 | 637 |
| Melbourne | 682 | 328 | 100 | 2 | 0.00% | 42 | 1784% | 3 | 0.00% | 18% | 42.43 | 120 | 249 |
| Miami | 824,448 | 387,360 | 100 | 2,099 | 0.30% | 25,674 | 1123% | 2,964 | 0.42% | 45% | 46.15 | 147 | 277,610 |
| Montevideo | 992 | 334 | 50 | 14 | 0.02% | 180 | 1181% | 17 | 0.02% | 18% | 42.85 | 60 | 785 |
| Montréal | 4,235 | 2,482 | 50 | 14 | 0.00% | 510 | 3451% | 15 | 0.00% | 8% | 40.84 | 54 | 757 |
| Mumbai (Bombay) | 52,173 | 19,827 | 20 | 6,109 | 0.47% | 128,081 | 1997% | 6,664 | 0.51% | 9% | 40.61 | 22 | 131,802 |
| Muqdisho (Mogadishu) | 21 | 8 | 10 | 13 | 0.04% | 136 | 982% | 14 | 0.04% | 13% | 40.77 | 11 | 140 |
| Nagoya | 175,473 | 99,196 | 100 | 564 | 0.26% | 60,738 | 10677% | 666 | 0.31% | 18% | 81.81 | 118 | 65,731 |
| N'ampo | 1,141 | 383 | 10 | 24 | 0.31% | 245 | 906% | 26 | 0.33% | 6% | 40.88 | 11 | 253 |
| Napoli (Naples) | 981 | 125 | 50 | 1 | 0.00% | 81 | 6216% | 3 | 0.00% | 188% | 46.27 | 155 | 133 |
| Natal | 647 | 250 | 50 | 9 | 0.02% | 487 | 5100% | 11 | 0.02% | 15% | 41.05 | 58 | 527 |
| New Orleans | 323,917 | 180,646 | 100 | 1,583 | 1.21% | 171,210 | 10716% | 1,940 | 1.48% | 23% | 82.47 | 123 | 190,749 |
| New York-Newark | 532,194 | 291,729 | 100 | 1,960 | 0.08% | 31,949 | 1530% | 2,159 | 0.09% | 10% | 41.43 | 110 | 209,043 |
| Ningbo | 6,272 | 1,373 | 20 | 176 | 0.09% | 5,137 | 2813% | 282 | 0.14% | 60% | 83.08 | 32 | 5,561 |
| Odessa | 2,733 | 859 | 100 | 19 | 0.04% | 2,030 | 10333% | 24 | 0.06% | 26% | 41.75 | 126 | 2,391 |
| Osaka-Kobe | 337,354 | 177,054 | 300 | 261 | 0.03% | 92,559 | 35430% | 366 | 0.05% | 41% | 82.47 | 425 | 107,860 |
| Palembang | 2,612 | 934 | 10 | 418 | 0.39% | 5,016 | 1100% | 526 | 0.49% | 26% | 82.49 | 13 | 5,183 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Perth | 4,220 | 2,145 | 100 | 16 | 0.01% | 265 | 1575% | 18 | 0.01% | 17% | 42.34 | 118 | 1,762 |
| Philadelphia | 49,797 | 27,432 | 50 | 279 | 0.04% | 3,713 | 1232% | 309 | 0.04% | 11% | 41.66 | 56 | 14,908 |
| Port-au-Prince | 9 | 3 | 10 | 1 | 0.00% | 11 | 1482% | 1 | 0.00% | 77% | 42.81 | 18 | 12 |
| Portland | 3,753 | 1,716 | 50 | 3 | 0.00% | 156 | 5455% | 4 | 0.00% | 28% | 41.39 | 65 | 175 |
| Porto | 1,756 | 722 | 100 | 6 | 0.01% | 179 | 2667% | 7 | 0.01% | 13% | 41.57 | 114 | 715 |
| Porto Alegre | 0 | 0 | 50 | 10 | 0.00% | 483 | 4918% | 12 | 0.01% | 21% | 42 | 61 | 550 |
| Providence | 17,857 | 9,479 | 50 | 118 | 0.07% | 2,333 | 1872% | 135 | 0.08% | 14% | 41.82 | 57 | 6,515 |
| Pusan | 16,852 | 4,523 | 100 | 30 | 0.01% | 3,109 | 10127% | 36 | 0.01% | 18% | 41.36 | 119 | 3,529 |
| Qingdao | 3,055 | 958 | 20 | 163 | 0.05% | 3,546 | 2079% | 189 | 0.06% | 16% | 41 | 23 | 3,720 |
| Rabat | 248 | 71 | 100 | 2 | 0.00% | 217 | 10837% | 3 | 0.00% | 34% | 41.77 | 135 | 257 |
| Rangoon | 4,177 | 1,387 | 10 | 163 | 0.17% | 1,942 | 1093% | 211 | 0.22% | 30% | 84.05 | 13 | 2,062 |
| Recife | 1,218 | 477 | 50 | 19 | 0.01% | 970 | 5063% | 21 | 0.01% | 14% | 41.04 | 57 | 1,047 |
| Rio_de_Janeiro | 4,132 | 1,010 | 50 | 35 | 0.01% | 1,803 | 5108% | 40 | 0.01% | 17% | 41.28 | 59 | 1,971 |
| Rotterdam | 172,316 | 96,071 | 10000 | 7 | 0.01% | 840 | 11417% | 8 | 0.01% | 15% | 82.34 | 11,489 | 81,871 |
| Salvador | 377 | 143 | 50 | 5 | 0.00% | 262 | 5248% | 6 | 0.00% | 16% | 40.75 | 58 | 277 |
| San Diego | 1,369 | 731 | 50 | 12 | 0.00% | 641 | 5215% | 14 | 0.00% | 13% | 40.72 | 57 | 674 |
| San Francisco - Oakland | 34,156 | 13,240 | 50 | 149 | 0.03% | 7,834 | 5166% | 185 | 0.04% | 24% | 41.84 | 63 | 8,966 |
| San Jose | 2,826 | 932 | 50 | 2 | 0.00% | 67 | 4133% | 2 | 0.00% | 22% | 42.22 | 62 | 92 |
| San Juan | 7,342 | 2,235 | 50 | 68 | 0.02% | 4,238 | 6118% | 107 | 0.03% | 56% | 42.92 | 80 | 5,202 |
| Sankt Peterburg (St. Petersburg) | 52,615 | 11,899 | 1000 | 11 | 0.00% | 3,119 | 27857% | 13 | 0.01% | 17% | 41.13 | 1,173 | 12,643 |
| Santo Domingo | 636 | 153 | 10 | 21 | 0.02% | 410 | 1880% | 50 | 0.04% | 141% | 44.62 | 26 | 499 |
| Sapporo | 1,339 | 591 | 100 | 2 | 0.00% | 402 | 16647% | 5 | 0.00% | 95% | 84.19 | 198 | 464 |
| Seattle | 10,235 | 6,100 | 50 | 85 | 0.02% | 3,499 | 4026% | 90 | 0.02% | 6% | 40.66 | 53 | 4,439 |
| Shanghai | 77,189 | 28,576 | 1000 | 63 | 0.00% | 24,763 | 39168% | 102 | 0.01% | 62% | 86.82 | 1,664 | 99,775 |
| Shenzen | 25,510 | 10,362 | 20 | 2,929 | 0.38% | 59,948 | 1947% | 3,338 | 0.43% | 14% | 41.5 | 23 | 64,947 |
| Singapore | 3,412 | 2,020 | 2000 | 2 | 0.00% | 359 | 17364% | 2 | 0.00% | 7% | 40.48 | 2,128 | 4,339 |
| Stockholm | 517 | 152 | 100 | 1 | 0.00% | 90 | 10941% | 1 | 0.00% | 48% | 42.86 | 150 | 118 |
| Surabaya | 727 | 163 | 10 | 80 | 0.04% | 1,126 | 1316% | 119 | 0.06% | 50% | 82.55 | 15 | 1,170 |
| Surat | 7,399 | 3,078 | 10 | 905 | 0.25% | 9,298 | 927% | 949 | 0.27% | 5% | 40.4 | 10 | 9,403 |
| Sydney | 8,293 | 4,314 | 100 | 28 | 0.01% | 1,046 | 3609% | 34 | 0.01% | 20% | 42.11 | 121 | 3,240 |
| Taipei | 2,713 | 1,042 | 20 | 274 | 0.10% | 7,003 | 2458% | 375 | 0.13% | 37% | 81.74 | 28 | 7,390 |
| Tampa-St Petersburg | 111,585 | 56,155 | 50 | 763 | 0.26% | 11,777 | 1444% | 948 | 0.32% | 24% | 43.39 | 63 | 45,042 |
| Tarabulus (Tripoli) | 267 | 64 | 100 | 2 | 0.00% | 169 | 10365% | 3 | 0.00% | 68% | 44.56 | 175 | 265 |
| Tel Aviv-Yafo (Tel Aviv-Jaffa) | 26 | 6 | 100 | 0 | 0.00% | 9 | 10931% | 0 | 0.00% | 87% | 45.18 | 196 | 15 |
| Thành-Pho-Ho-Chi-Minh (Ho Chi Minh City) | 42,093 | 20,216 | 50 | 1,743 | 0.74% | 11,842 | 579% | 2,032 | 0.86% | 15% | 86.96 | 59 | 94,788 |
| Tianjin | 25,667 | 9,779 | 20 | 1,810 | 0.24% | 43,488 | 2303% | 2,383 | 0.31% | 32% | 83.4 | 26 | 46,759 |
| Tokyo | 276,547 | 140,711 | 1000 | 58 | 0.00% | 67,958 | 117297% | 85 | 0.00% | 47% | 82.65 | 1,482 | 83,432 |
| Ujung Pandang | 156 | 33 | 10 | 11 | 0.01% | 118 | 990% | 13 | 0.02% | 21% | 42.21 | 12 | 127 |
| Ulsan | 1,209 | 368 | 100 | 2 | 0.00% | 269 | 11584% | 4 | 0.00% | 56% | 42.98 | 159 | 350 |
| Vancouver | 75,276 | 43,232 | 50 | 325 | 0.14% | 20,765 | 6284% | 466 | 0.20% | 43% | 82.24 | 72 | 22,858 |
| Virginia Beach | 138,390 | 62,671 | 140 | 278 | 0.15% | 8,304 | 1773% | 328 | 0.17% | 19% | 42.02 | 166 | 44,202 |
| Visakhapatnam | 369 | 111 | 10 | 110 | 0.08% | 1,242 | 1029% | 131 | 0.09% | 19% | 41.23 | 12 | 1,289 |
| Washington, D C | 12,326 | 5,972 | 50 | 74 | 0.01% | 3,914 | 5225% | 91 | 0.02% | 23% | 41.63 | 62 | 4,410 |
| Wenzhou | 3,187 | 921 | 20 | 152 | 0.06% | 3,488 | 2199% | 180 | 0.08% | 19% | 81.06 | 24 | 3,557 |
| Xiamen | 10,093 | 3,682 | 20 | 572 | 0.22% | 13,216 | 2210% | 793 | 0.31% | 39% | 84.89 | 28 | 15,322 |
| Yantai | 679 | 164 | 20 | 21 | 0.01% | 484 | 2257% | 29 | 0.01% | 40% | 42.36 | 28 | 553 |
| Zhanjiang | 6,256 | 2,865 | 20 | 806 | 0.50% | 17,287 | 2045% | 926 | 0.57% | 15% | 81.72 | 23 | 18,128 |