Ad Hoc Expert Meeting on

Climate Change Impacts and Adaptation: A Challenge for Global Ports

29 – 30 September 2011

Transport Infrastructure and Network Adaptation to Climate Change: Issues and Strategies for Ports

Presentation by

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UNCTAD Ad-Hoc Expert Meeting on "Climate Change Impacts and Adaptation: A Challenge for Ports" , 29-30 September, 2011, Geneva

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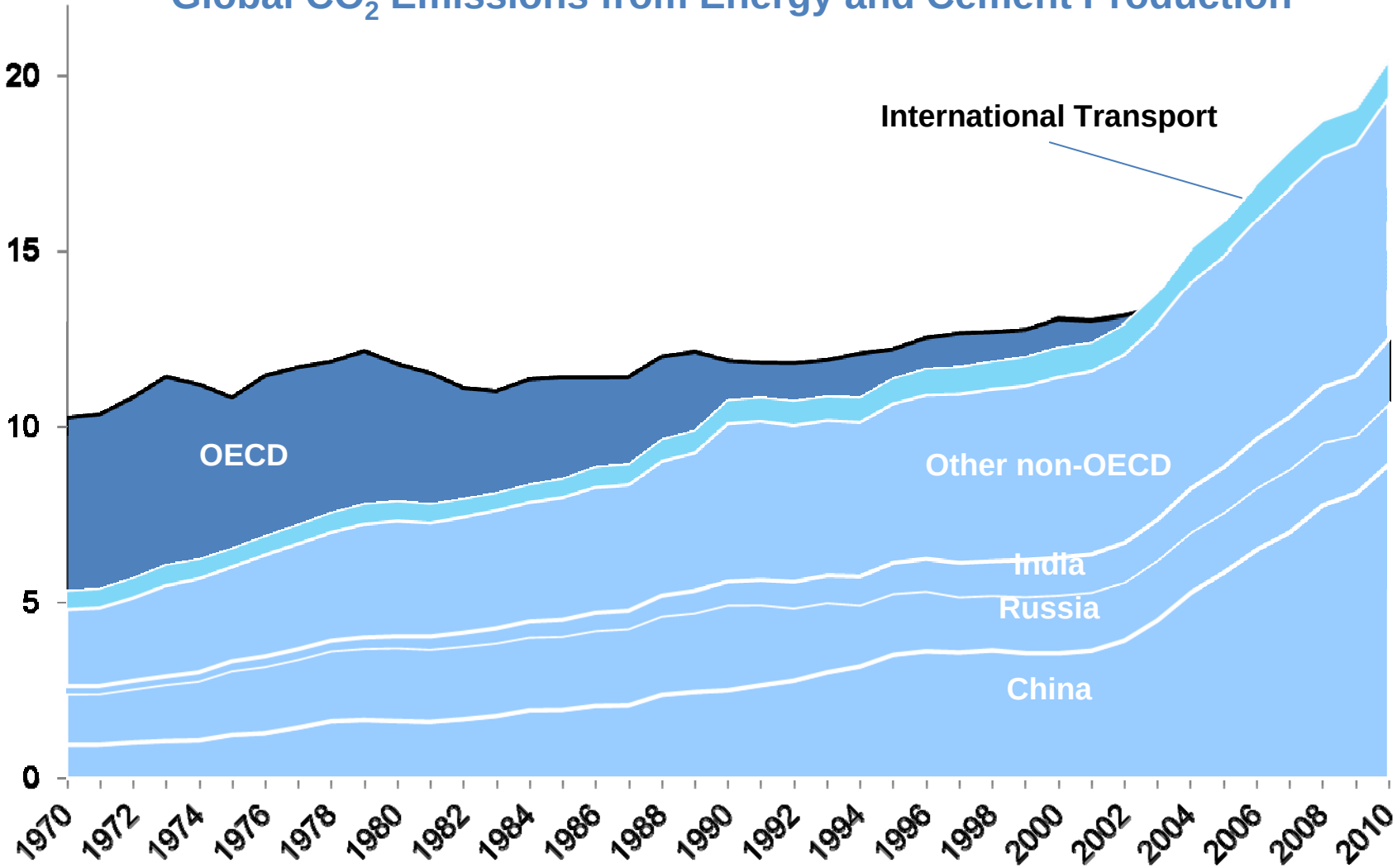
Global CO_2 Emissions from Energy and Cement Production



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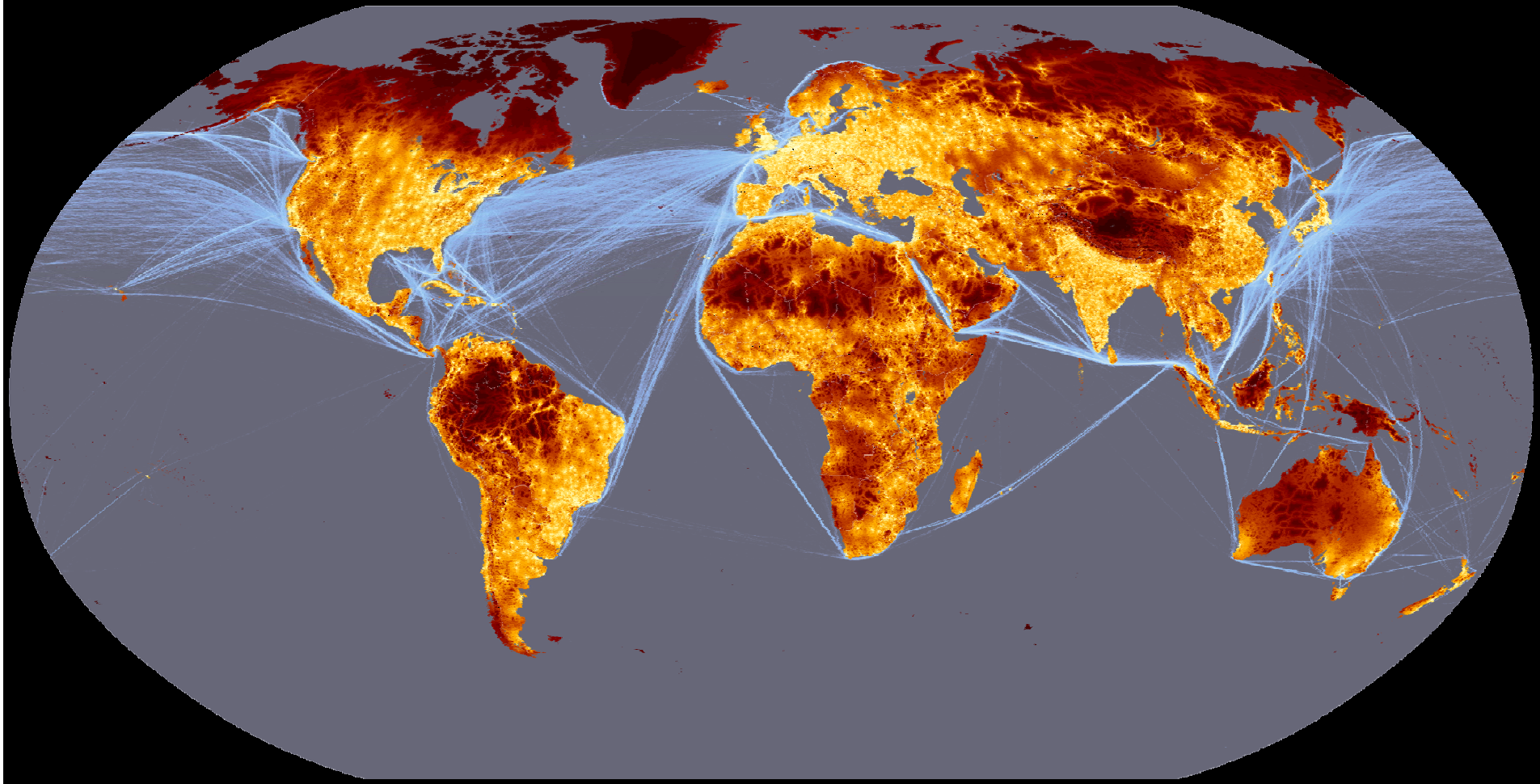
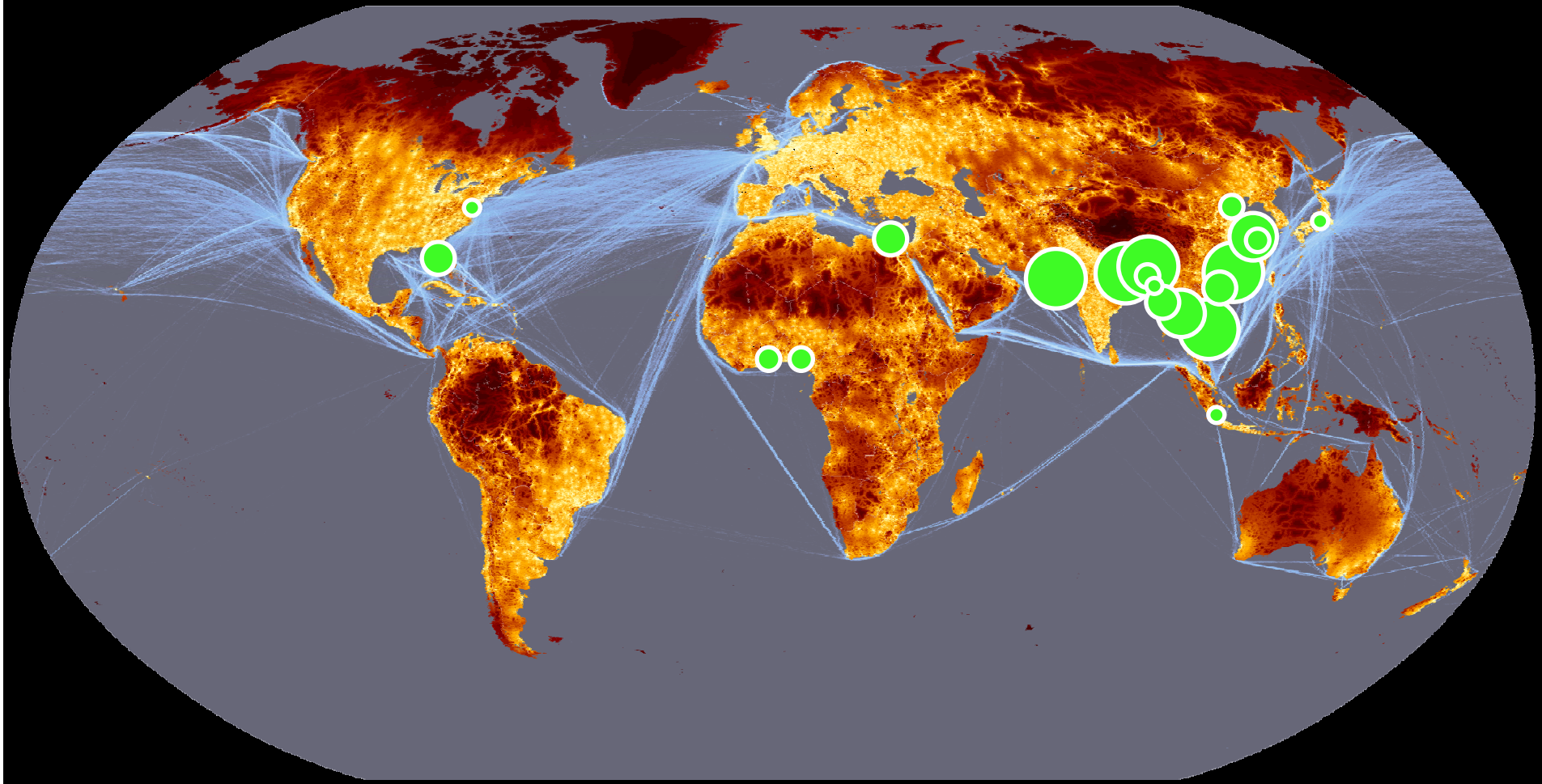
Travel time to major cities: A global map of Accessibility



http://bioval.jrc.ec.europa.eu/products/gam/index.htm

Population Exposure to Coastal Flooding and Storms: 2070



Exposed Population (millions)

< 3 | 3-4 | 4-5 | 5-6 | > 6

RANKING OF THE WORLD'S CITIES MOST EXPOSED TO COASTAL FLOODING TODAY AND IN THE FUTURE OECD Environment Working Paper No. 1 (ENV/WKP(2007)1)

http://bioval.jrc.ec.europa.eu/products/gam/index.htm

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Ports:

Long lifetimes – exposed to changing climate (uncertainty)

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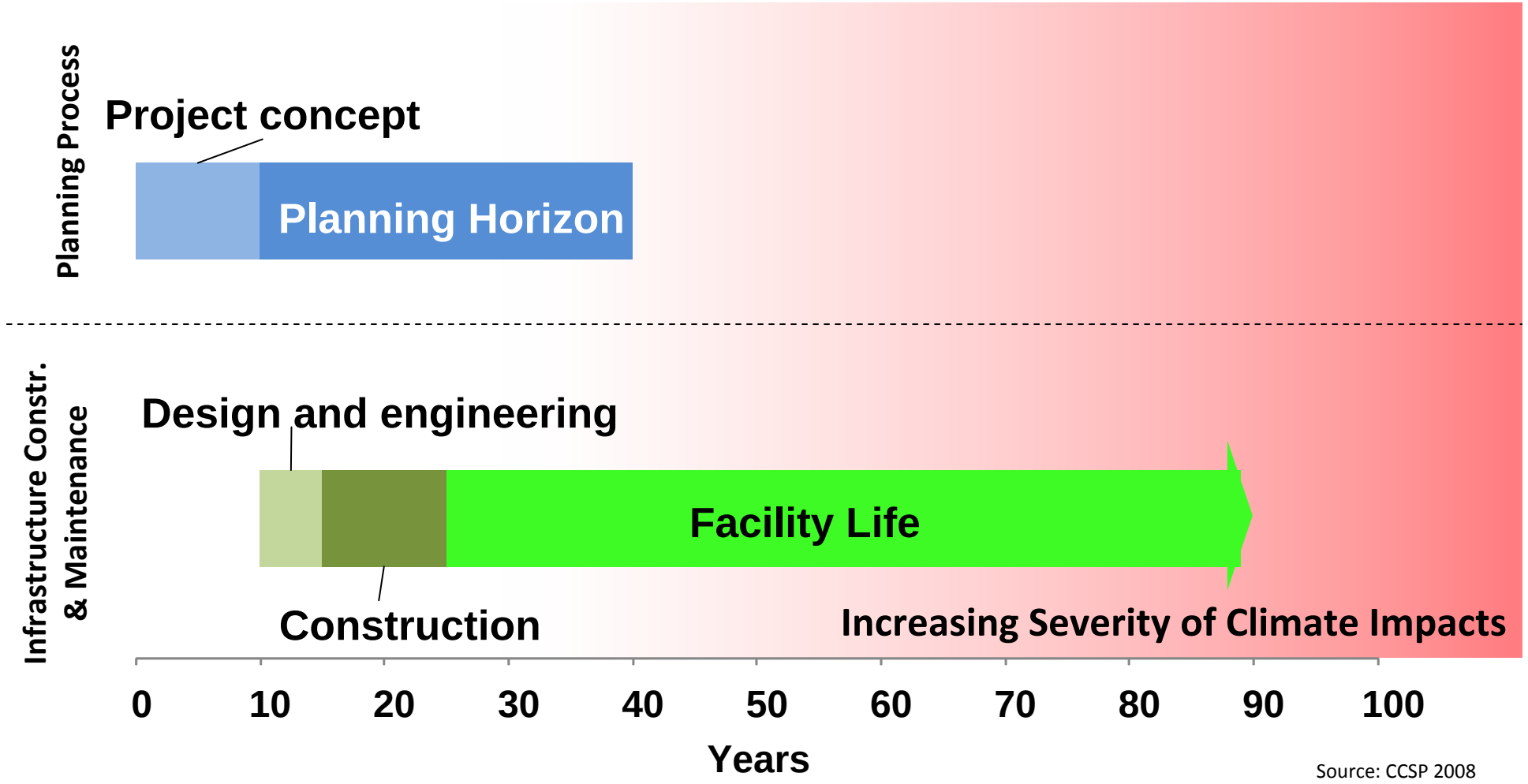
Infrastructure planned and built with past climate and weather in mind – no longer a good predictor of future conditions, and all we have for the future are (uncertain) predictions

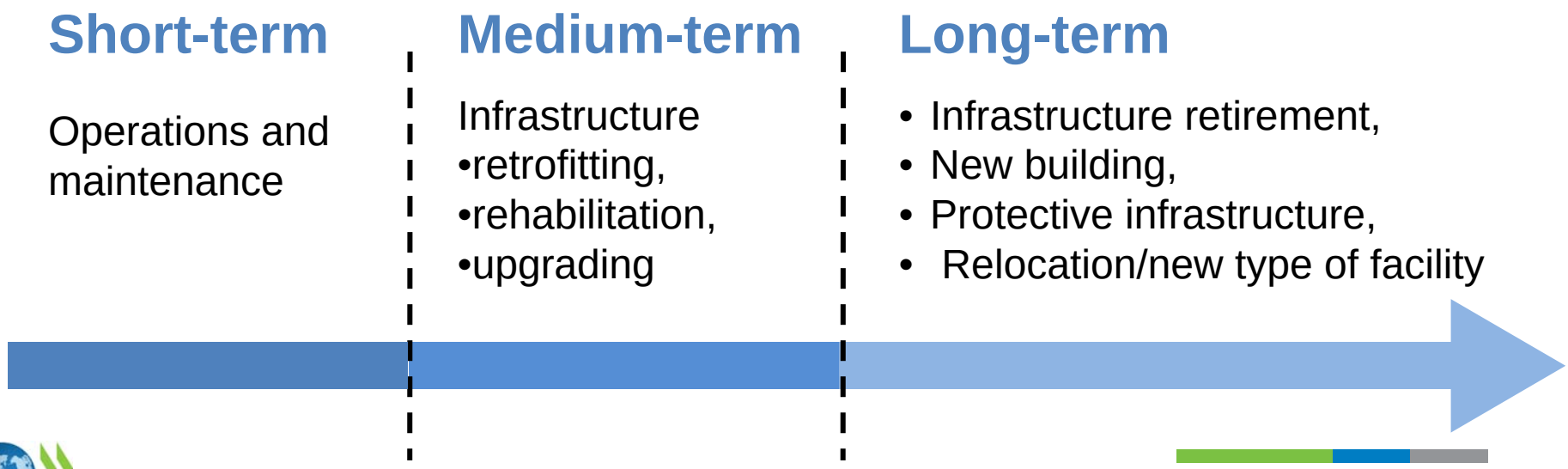


Source: CCSP 2008

Timing is Important

Gradual vs. Sudden Impacts

Time Horizon for Action



Source: Mission Climat Caisse des Depots

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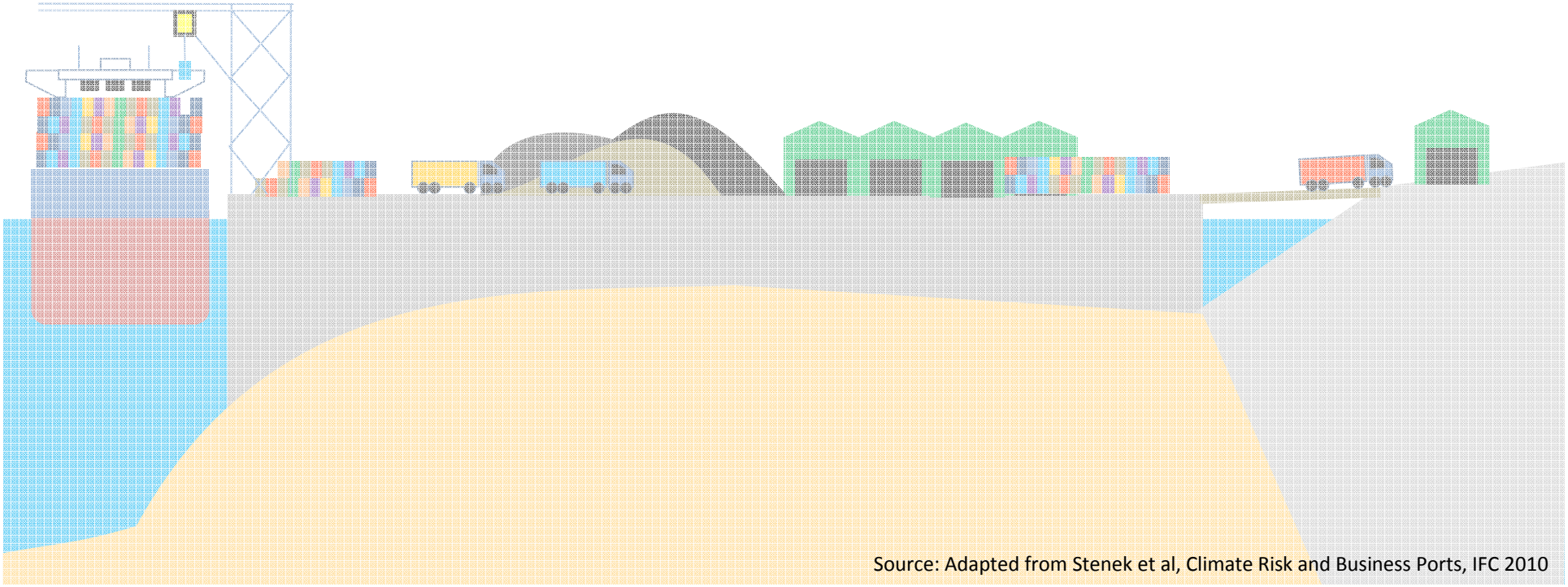
Ports:

Long lifetimes – exposed to changing climate (uncertainty)

Vulnerable Location – exposure to climate change impacts



Source: Adapted from Stenek et al, Climate Risk and Business Ports, IFC 2010

Navigation and Berthing

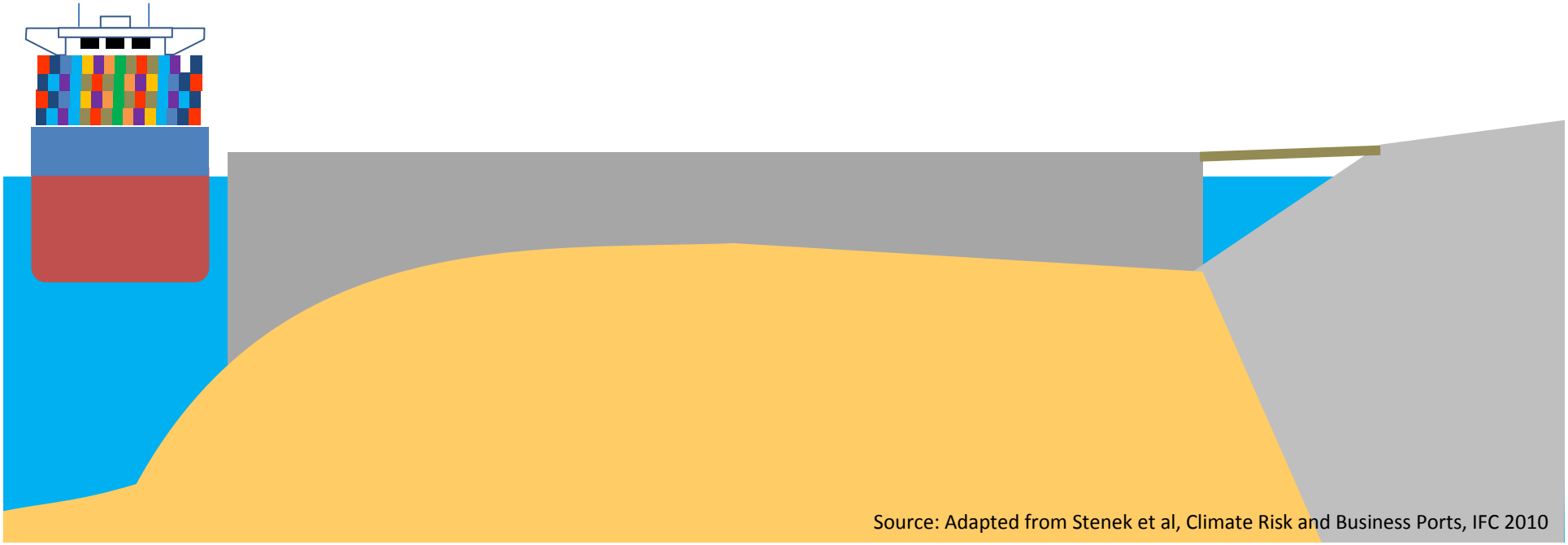
Sea level rise – decreased dredging, quay upgrading, bridge headways

Storm surge and winds – inability to dock, congestion

Increased Precipitation – silting, increased dredging,

Decreased Precipitation – inland navigation limitations

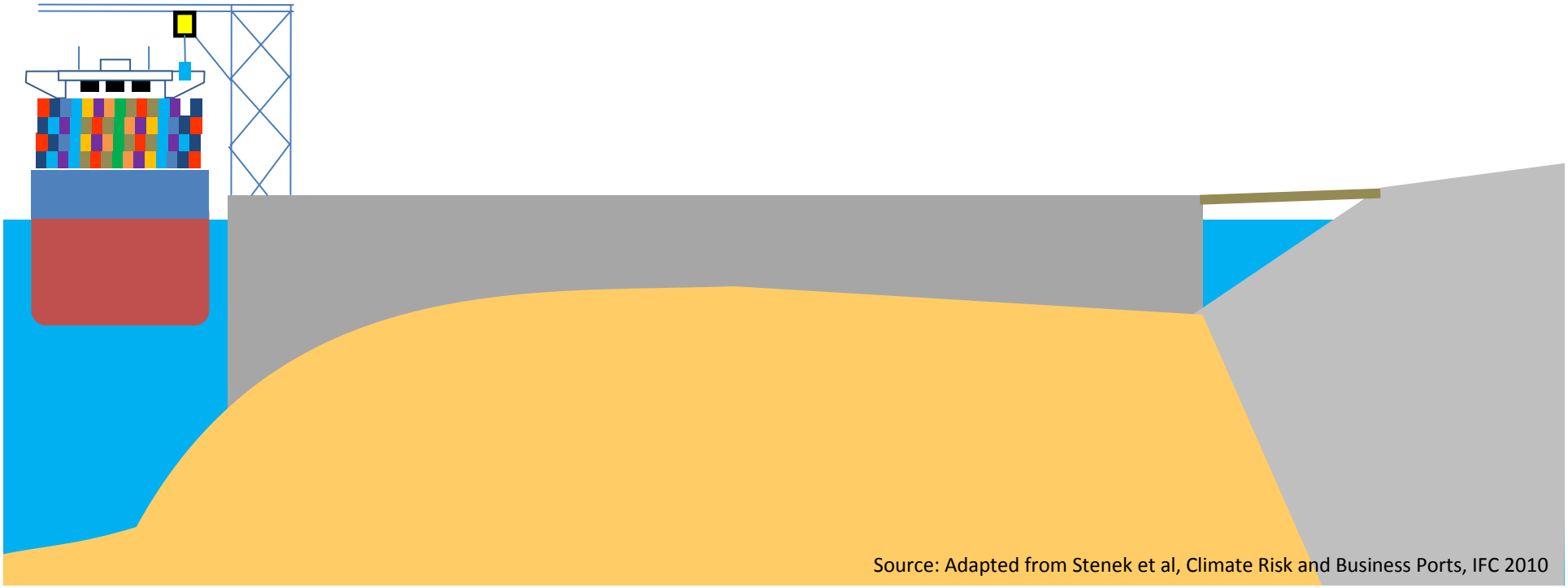
Sea ice? – change in port access



Source: Adapted from Stenek et al, Climate Risk and Business Ports, IFC 2010

Goods Handling

Increased storm frequency and strength – damage, restriction of crane operations or loading of bulk/ liquid cargoes due to winds and lightning

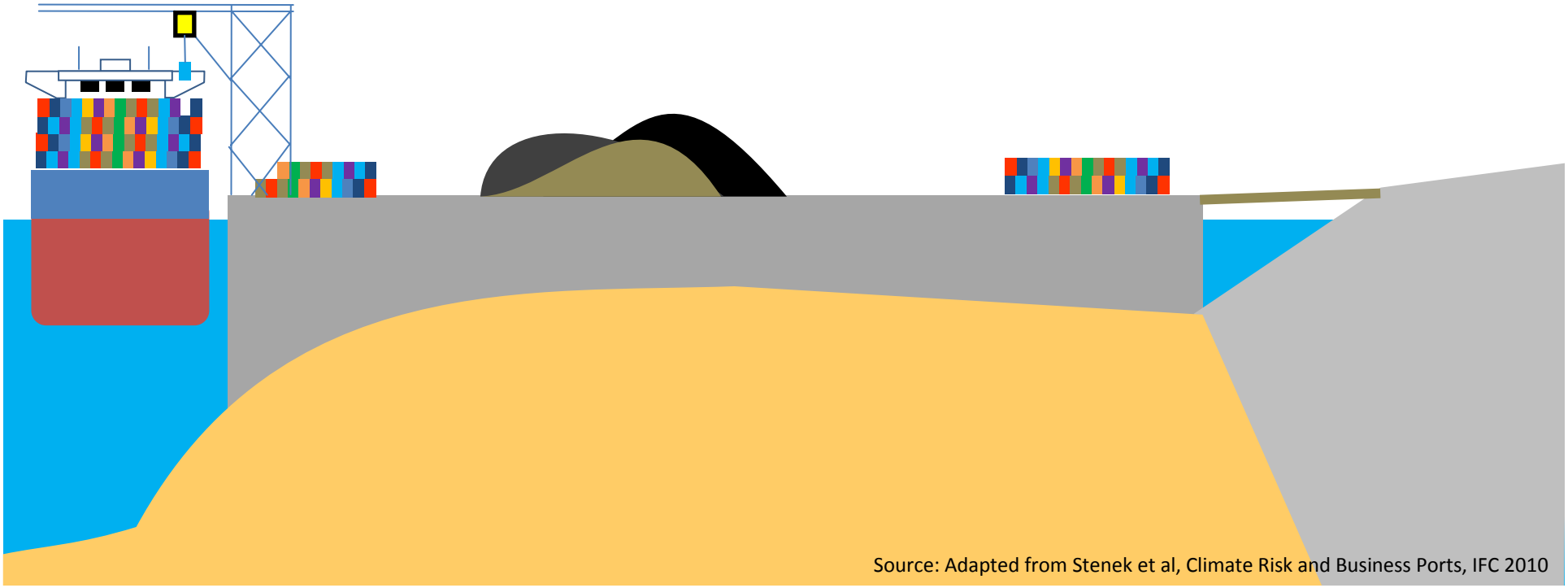


Source: Adapted from Stenek et al, Climate Risk and Business Ports, IFC 2010

Storage

Storm surges and increased precipitation – coastal or fluvial flooding of storage platforms and facilities, damages, material losses of infrastructure, spoiling of goods

Increased temperature – material damage to structures, increased energy costs

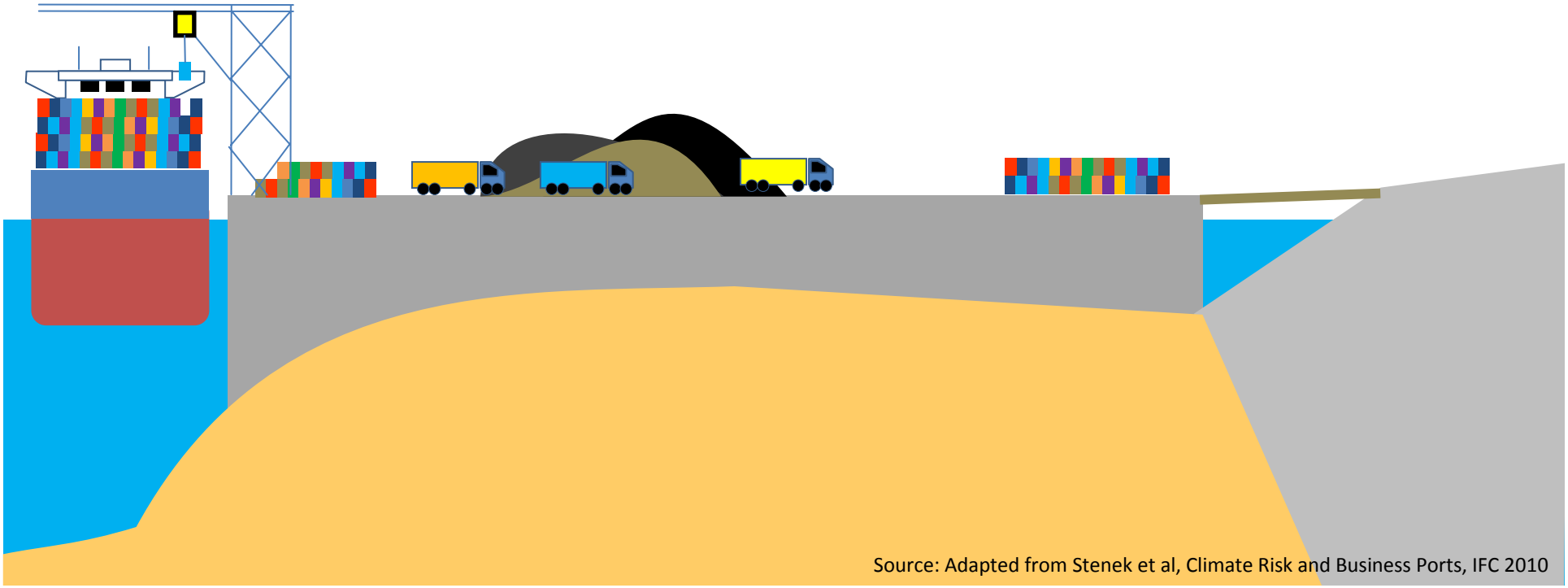


Source: Adapted from Stenek et al, Climate Risk and Business Ports, IFC 2010

Vehicle movements inside port

Storm surges and increased precipitation and inadequate drainage –flooding of port facilities prevents essential vehicle movements

Chronic/permanent flooding can render parts of port inoperable



Source: Adapted from Stenek et al, Climate Risk and Business Ports, IFC 2010

Infrastructure, building and equipment damage

Flooding and wind damage -- threat to buildings and equipment

Seal level rise and storm surges can damage essential protective infrastructure

Storm surges and flood-related scouring can weaken bridges, quay and pier foundations

Increased temperatures can lead to metal failure for equipment and infrastructure

Source: Adapted from Stenek et al, Climate Risk and Business Ports, IFC 2010

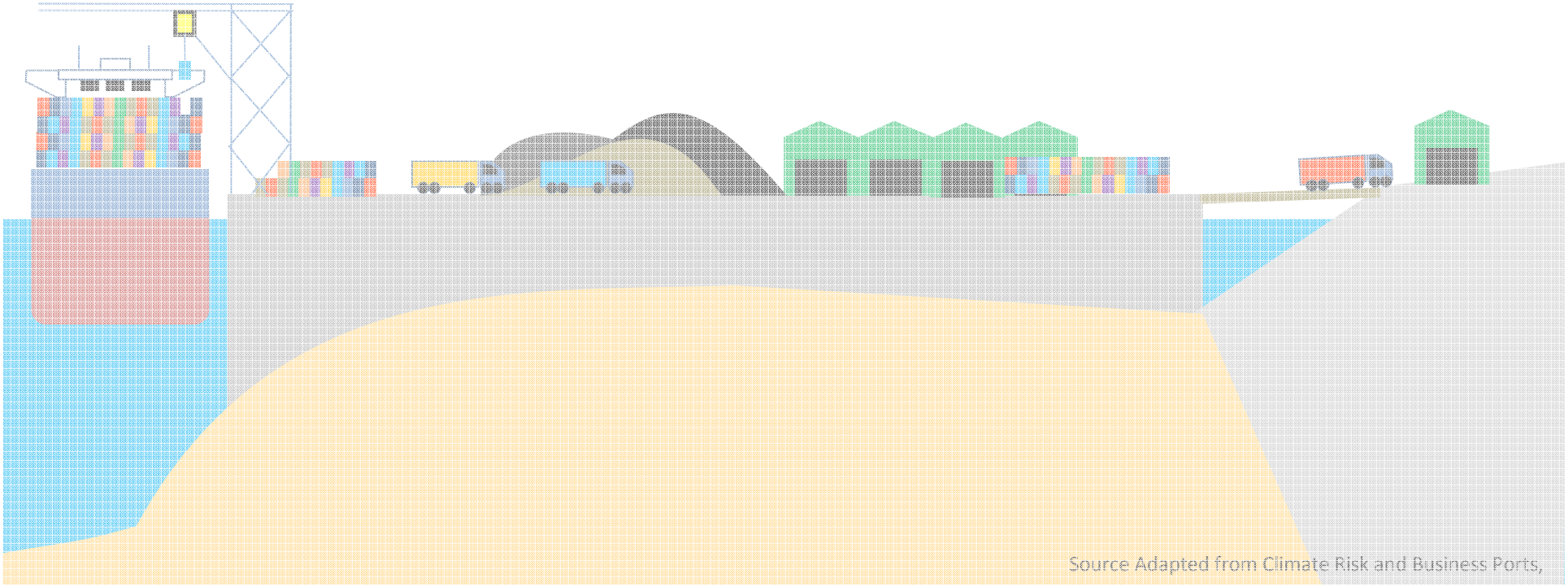
Inland transport networks

Inland transport networks essential for port operations

Failure of critical inland links can render the port inoperable

Source Adapted from Climate Risk and Business Ports,

Climate Vulnerable Port – Increased insurance costs and loss of trust by shippers due to unreliability.



Adaptation Response Strategy is Critical

Identify current and future climate changes that are relevant, accept uncertainty

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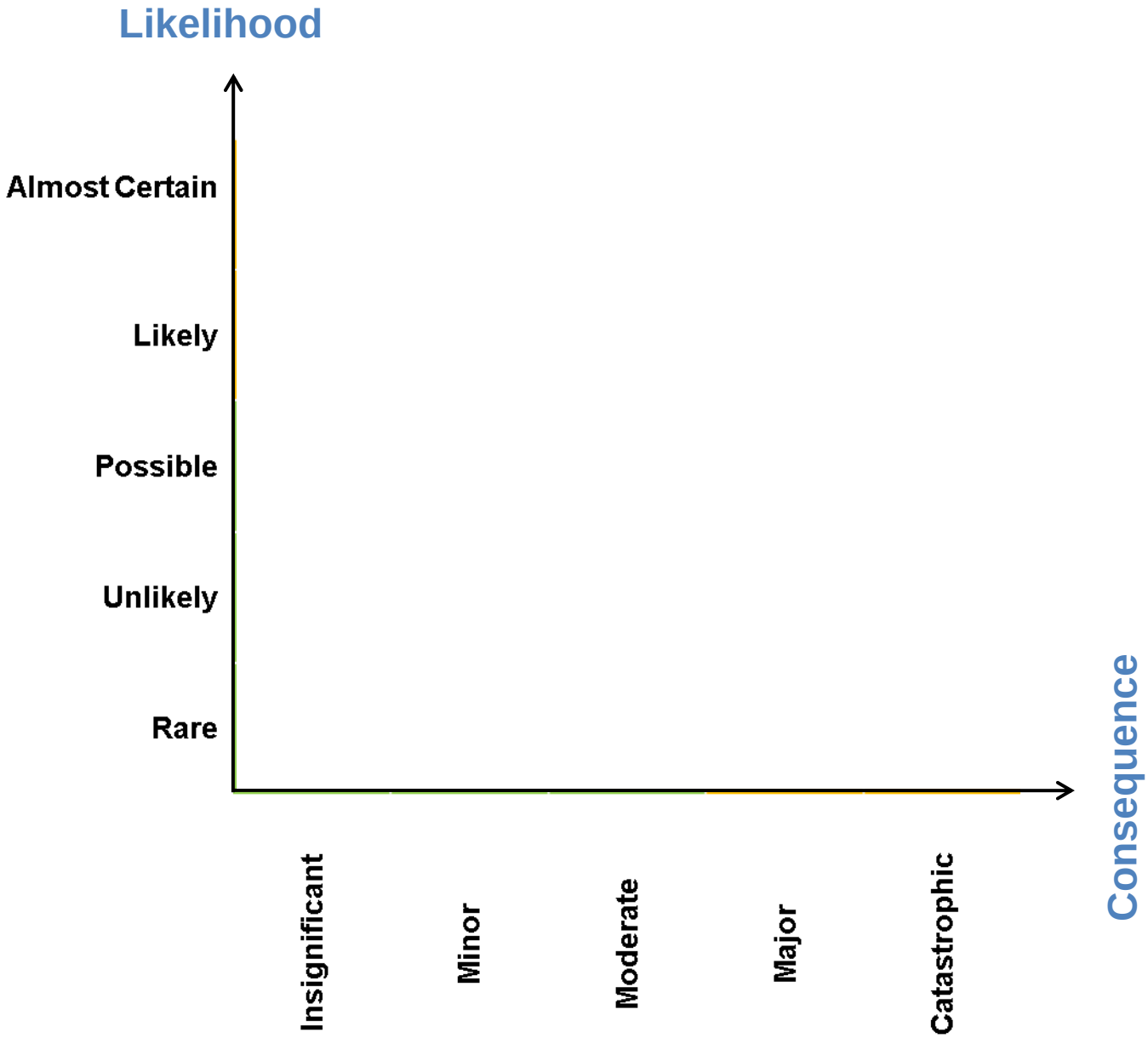
Assess vulnerabilities and risk to the port and inland transport networks

Risk assessment methodology



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Implement adaptation options

Monitor and re-evaluate implemented adaptation options

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Policy Implications

•3 adaptation strategies:
Avoid (retreat), **Protect** and/or **Accommodate**

- **Network unreliability** impacts at least as great as physical impacts on infrastructure.
- **Prioritisation** on network-essential infrastructure important – different strategies for different parts of the network
- **Design standards** and practices must account for increased uncertainty re. climate
- Focus on **robustness** for key infrastructure as well as network **redundancy** and **resilience**

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Thank You

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UNCERTAINTY OF CLIMATE SCIENCE

There are the inherent uncertainties or lack of specificity surrounding the science of climate change and these can be divided into three major issues.

1. Natural variations occur with climate systems, even when there are no external forcing factors such as volcanic eruptions or GHG emissions. One of the most important is the El Nino–La Nina southern oscillation in the Pacific Ocean off California. Other factors include sunspots and the wobble in the Earth's axis.
2. There is the uncertainty about the level of GHG emissions and what effect future mitigation measures may have on emissions.
3. There is the uncertainty about the response of Earth's climate to various perturbations including, most specifically, increased GHG emissions

Schwartz 5

THE ISSUE OF SCALE

Another issue that must be addressed is that of scale. Climate scientists are most confident in projecting climate changes at the global scale, e.g., average temperatures of the Earth's oceans and land mass. As the scale decreases, their confidence level goes down and so too does knowledge about specific impacts. Infrastructure planners, on the other hand, can do little with global climate change information. They need information at the regional and local scale for it to be useful.

Developing finer scale models or downscaling the current global climate models is essential to understanding

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GRADUAL CHANGES VERSUS EXTREME EVENTS

Of the five primary climate change impacts, it is readily apparent that some are gradual changes, such as sea level rise while others relate to extreme events such as floods and hurricanes. Indeed,

one of the important characteristics of climate change will be the increased frequency of extreme

weather events, i.e., surprises.

Planning, design, operation, and maintenance of transportation systems traditionally have