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Reducing Economic Losses Caused by Disasters

UNCTAD, UNISDR, ITC Interactive Discussion

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Climate change impacts on critical international transportation assets of Small Island Developing States (SIDS)

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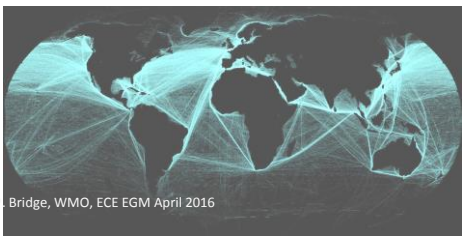
Transport: a critical facilitator of global trade and development



Global shipping movements

Over 80% of volume -70 % of value - of world merchandise trade carried by sea (port to port): shipping and ports are key nodes in international supply chains

Globalization: interconnectedness/interdependence of shipping/ports

60% of goods loaded and 63% of goods unloaded in developing countries (UNCTAD)

Environmental challenges: two sides of the coin

- **Effects of transport on the environment** (e.g. pollution, CO2 emissions)
- **Environmental impacts on transport** (e.g. natural hazards; Climatic Variability and Change)

Important to address these global challenges effectively, also in the light of the *Paris Agreement* and the *2030 Sustainable Development Agenda*

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Climate Variability and Change

- A global challenge and "*a defining issue of our era*" (former UN SG)
- "*Nothing less than our future and the fate of humankind depends on how we rise to the climate challenge*"(UN SG)
- Increasingly compelling scientific evidence (IPCC AR5, 2013; IPCC 1.5 degrees, 2018)
  - 1.5 degrees warming may be reached as early as 2030s; intensity of climate-related extreme events and associated disasters expected to increase – DRR and early warning critical, but may become more difficult (Hurricane Michael, Oct 2018)
- Huge potential costs associated with inaction (5-20 % of the Global GDP, annually (STERN 2006);
  - By 2100, global flood damages due to sea-level rise (and related extreme events) might amount to up to US$ 27 trillion per year – about 2.8% of global GDP in 2100 (S Jevrejeva et al 2018 Environ. Res. Lett)
- A serious development threat particularly for the LDCs and the SIDS
- Since 2008, integration of climate change considerations into UNCTAD's work on transportation
  - UNCTAD mandate regarding *climate change adaptation and DRR for transport infrastructure, services and operations* strengthened in 2016 (Maafikiano)

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CV & C implications for Transport

The Climate Change debate: two sides of the "coin": causes - effects

- **Mitigation**: action directed at addressing CC causes (long-term)
- **Adaptation**: action directed at coping with impacts of CV & C (short- and long- term); requires understanding of impacts, which vary considerably by physical setting, type of forcing, sector, mode, region etc.

In Transport:

- much of international debate/policy action focuses on CC mitigation (i.e. reduction / control of GHG emissions)
- Comparatively little focus on study of impacts and development of adaptation policies/actions

BUT: Transport is not just a 'culprit', it is also a victim

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CV & C Impacts on Transport

Climate change/extreme events likely to have *direct* and *indirect* impacts on transport infrastructure, operations and services

Sea-level rise, temperature and precipitation changes, extreme storms and floods and other climatic factors are likely to

- affect ports, airports, and other coastal transport infrastructure, hinterland transport and the broader supply-chain

  potential for damage, disruption and delay - economic and trade related losses

- affect demand for air transport/shipping
- exacerbate other transport-related challenges

Climate change adaptation and DRR for key transport infrastructure is of strategic economic importance

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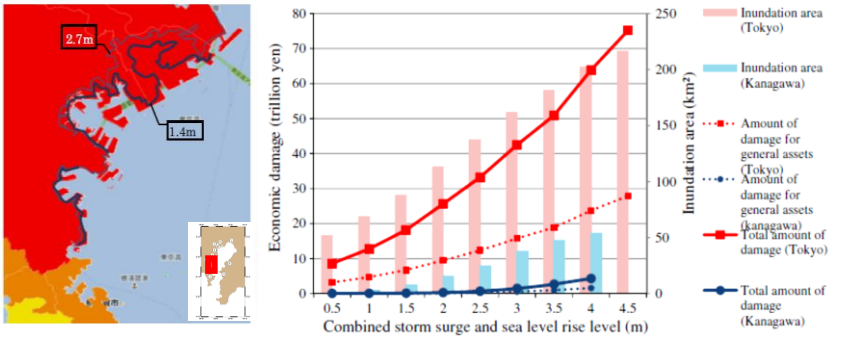
Projected port city damages due to combined MSL rise and storm surge



(a) Areas at flood risk in the Kanagawa area (Tokyo Bay) for the mean expected storm surge due to future storm typhoon in the year 2100 for a 0.59-m (thick blue line) and 1.9-m (thin blue line) mean sea-level-rise (MSLR) scenarios and
(b) Simulated damages for Tokyo and Kanagawa port areas due to combined MSLR and storm surge (Hoshino et al., 2015) (*30 trillion yen approx. 267 billion US dollars*)

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Major climate change impacts on coastal transport infrastructure

Factor	Impacts
Sea level (mean and extreme)	Coastal transport infrastructure (open sea ports, estuarine ports and inland waterway ports; airports; roads; railroads; bridges)
• Mean sea level changes • Increased destructiveness of storms/storm surges • Changes in the wave energy and direction	Damages in port and airport infrastructure/cargo from incremental and/or catastrophic inundation and wave regime changes; higher infrastructure construction/maintenance costs; sedimentation/dredging issues in port/navigation channels; effects on key transit points; increased risks for coastal road/railway links; relocation of people/businesses; insurance issues
Precipitation	
• Changes in the intensity and frequency of extremes • (floods and droughts)	Seaport, airport, and road infrastructure inundation; damage to cargo/equipment; navigation restrictions in inland waterways; network inundation and vital node damage (e.g. bridges); changes in demand
Temperature	
• Higher mean temperatures, • Heat waves and droughts • Increased spatio-temporal variability in temperature extremes	Damage to infrastructure/equipment/cargo and asset lifetime reduction ; higher energy consumption for cooling cargo; lower water levels and restrictions for inland navigation effects on estuarine ports (e.g. port of Rotterdam); reductions in snow/ice removal costs; extension of the construction season; changes in transport demand; lower aircraft payloads allowed-need for runway extension
• Permafrost degradation • Reduced arctic ice coverage	Major damages in infrastructure; coastal erosion affecting road and rail links to ports Longer shipping seasons-NSR; new shorter shipping routes-NWP/less fuel costs, but higher support service costs

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Recent regulatory developments

Enhanced climate resilience / climate change adaptation for critical transport infrastructure is going to be key in achieving progress on many of the Sustainable Development Goal and targets

- Legal / regulatory approaches will be important in the longer run
- Some examples already in existence, e.g.

EU: Amended EIA Directive (Directive 2014/52/EU of 16 April 2014, amending Directive 2011/92/EU); in force since May 2017

requires *climate change impacts of the project* and *on the project* to be considered; *return periods for extreme events (engineering design parameters):*
- need to take into account projections under climate change

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The special case of Small Island Developing States (SIDS)

Large dependency on imports (i.e. international transport)

High Transport costs (e.g. transport costs in Caribbean trade at least 30 % higher than the world average, see Pinnock and Ajagunna, 2012) and limited connectivity

Coastal transport infrastructure (seaports and airports): critical lifelines for external trade, food, energy, tourism (cruise-ships and air transport), disaster response

These assets are threatened by sea level rise and extreme events (storms)

Strong nexus between transport and tourism: "Sea, Sun and Sand - 3S tourism", often a very significant SIDS industry, is threatened by climate - driven coastal and beach erosion; the same applies to its facilitating transport infrastructure (i.e. seaports, airports, coastal access roads)

UNCTAD Project: *"Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States (SIDS)"*

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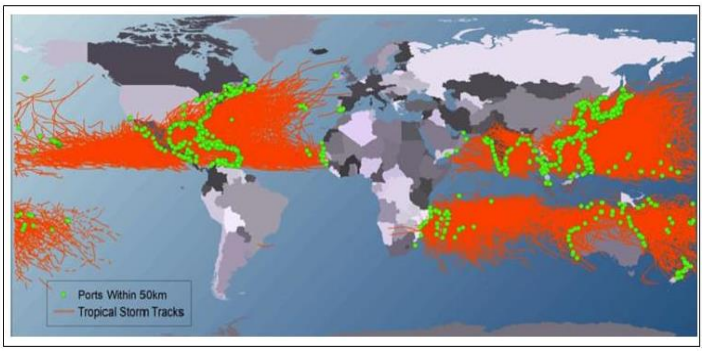
SIDS are vulnerable to storms



Seaports within 50 km of tropical sea storm tracks (1960–2010). Port and storm data from National Geospatial-Intelligence Agency (2011) and Knapp et al. (2010). (Becker et al., 2013)

N.B. Airports in SIDS are mostly located at low coastal elevations, due to physical constraints (volcanic islands with little level land)

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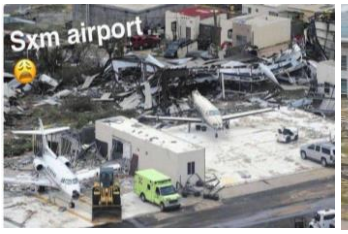
Storm impacts on SIDS: Recent hurricanes 2017

- Hurricanes Irma and Maria have had major impacts on coastal transport infrastructure across the Caribbean region (Dominica, Dominican Republic, Guadeloupe, Montserrat, Antigua & Barbuda, Saint Kitts and Nevis, Puerto Rico, Turks & Caicos, Virgin Islands)
- Too recent events for detailed assessments of *full economic losses*
- Most costly hurricane season on record (WMO 2018)
- Estimated losses for Dominica: US$ 1.3 billion or 224% of GDP; estimated losses for BVI: approx. 300% of GDP; St. Maarten: 797% of GDP (French part of island 584% of GDP) (UNISDR CRED)
- Estimated losses for Anguilla, Bahamas, BVI, St Maarten, Turks & Caicos: US$ 5.4 billion (UNECLAC 2018)

St Maarten



Source: https://sxmgovernment.files.wordpress.com/2017/09/hurricane-irma-destroys-st-maarten-princess-juliana-airport-photo.jpg

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Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States

DRR/adaptation of coastal transport infrastructure to CV&C critical for sustainable development

- Focus on key coastal transport infrastructure (i.e. airports and ports) in SIDS
- Case-study approach involving 2 Caribbean SIDS (Jamaica and St Lucia) to
  - enhance the adaptive capacity at the national level (case-study countries)
  - develop a transferable methodology for assessing climate change impacts and adaptation options for coastal transport infrastructure in Caribbean SIDS
- Technical EG meeting (2016) to review, discuss and provide substantive inputs
- 2 national and 1 regional capacity building workshops in 2017 – seaports and airports authorities from 21 countries/territories, regional/international stakeholders and experts
- Web-platform - *SIDSport-ClimateAdapt.unctad.org*
- Key outcomes include *assessment of potential vulnerabilities to CV & C of two Caribbean SIDS, focusing on potential operational disruptions and marine inundation risk to coastal internat'l airports and seaports of Jamaica and Saint Lucia under different climate scenarios*
- Innovative methodological approaches, validated by scientific peer-review

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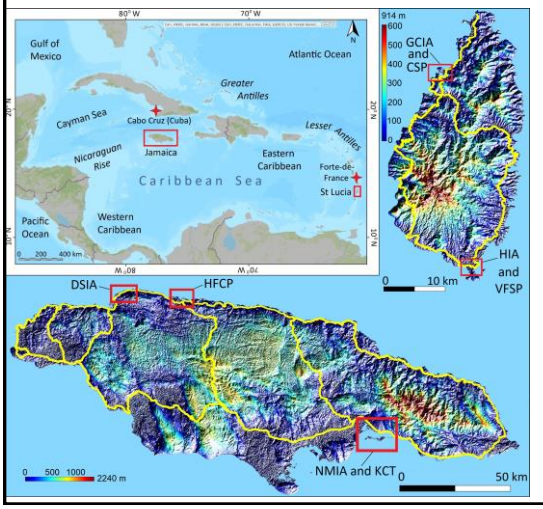
Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States



Some findings:

High risk of marine flooding for key international transport assets under extreme events and different Climate Change scenarios

See also:
Monioudi, et al. Reg Environ Change (2018). **Climate change impacts on critical international transportation assets of Caribbean Small Island Developing States (SIDS): The case of Jamaica and Saint Lucia**. https://doi.org/10.1007/s10113-018-1360-4; https://rdcu.be/Q1OY

Cited in **IPCC Special Report on Global Warming of 1.5ºC** (Ch. 3)

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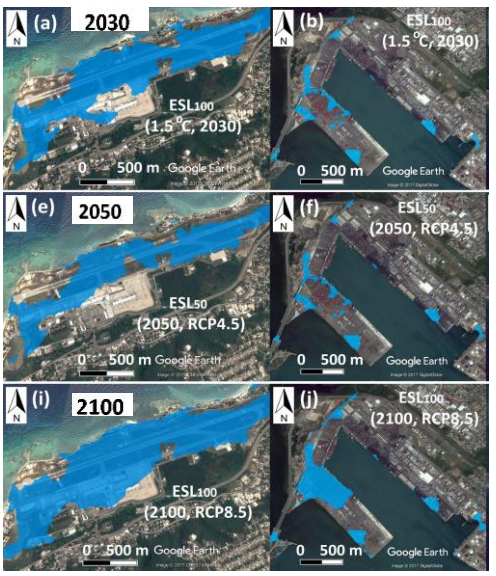
Marine flooding projections for coastal transportation assets under CV & C: Jamaica



- Dynamic modeling inundation projections for coastal assets
- Many scenarios were tested
- SIA (70% of international tourist arrivals) and Kingston seaport (KCT) appear vulnerable under all scenarios

Inundation maps for: (a, e, i) Sangster International Airport (SIA, Montego Bay, Jamaica); (b, f, and i) of Kingston Container Terminal (Kingston, Jamaica) under the 1-100 year extreme sea level event- ESL100 (for 1.5 ° C temperature increase, 2030), 1-50 year extreme sea level event -ESL50 (2050, RCP4.5) and ESL100 (2100, RCP8.5)

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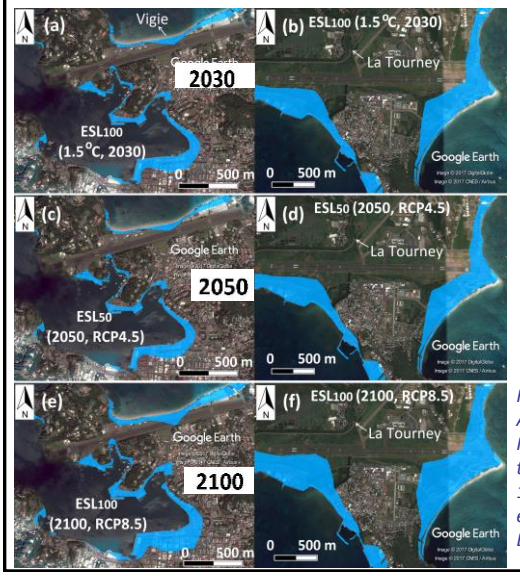
Marine flooding projections for coastal transportation assets under CV & C: Saint Lucia



All international transportation assets (seaports and airports) appear vulnerable under all scenarios

Flooding of (a, c, e) George Charles International Airport and Castries seaport and (b, d, f) Hewanorra International Airport and Vieux Fort seaport under the 1-100 year extreme sea level event- ESL100 (for 1.5 ° C temperature increase, 2030), 1-50 year extreme sea level event -ESL50 (2050, RCP4.5) and ESL100 (2100, RCP8.5).

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Thank you!

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Relevance in the context of the SDG 2030 Sustainable Development Agenda

Consensus by international community on a 'plan of action' involving 17 sustainable development goals with 169 associated targets, which are '***integrated and indivisible, global in nature and universally applicable***'

Sustainable and resilient transport among the cross-cutting issues, of relevance for achievement of progress on several of the goals and targets, e.g.

SDG 13	Take urgent action to **combat Climate Change and its impacts**
SDG 9	**Build resilient infrastructure**, promote inclusive and sustainable industrialization and foster innovation
SDG 14	**Conserve and sustainably use the oceans**, seas and marine resources for sustainable development
SDG 1.5	By 2030, **build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events** and other economic, social and **environmental shocks and disasters**

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UNCTAD work on climate change impacts and adaptation for coastal transport infrastructure and follow-up

(see further Policy and Legislation Section website unctad.org/ttl/legal)

2009 Follow-up	**UNCTAD Multiyear Expert Meeting: "*Maritime Transport and the Climate Change Challenge*"** UNCTAD edited multidisciplinary book: **Maritime Transport and the Climate Change Challenge** UN-Earthscan (Routledge/Taylor&Francis) (2012) 327 pp
2010 Follow-up	**Joint UNECE-UNCTAD Workshop:** **"*Climate change impacts and adaptation for international transport networks*"** UNECE *Group of Experts on Climate Change Impacts and Adaptation for International Transport Networks* (2011-2014); mandate extended in 2015; 2012 International Conference - including session on SIDS 2013 EG Report - *Climate Change Impacts and Adaptation for International Transport Networks*
2011 Follow-up	**UNCTAD Ad Hoc Expert Meeting**: **"*Climate Change Impacts and Adaptation: a Challenge for Global Ports*"** Academic paper co-published by Experts (2013) Becker et. al, **A note on climate change adaptation for seaports**, Climatic Change, 2013
2014	**UNCTAD Ad Hoc Expert Meeting: "Addressing the Transport and Trade Logistics Challenges of the Small Island Developing States (SIDS): Samoa Conference and Beyond"** **UNCTAD Multiyear Expert Meeting: "*Small Island Developing States: Transport and Trade Logistics Challenges***
2017	**UNCTAD Port-Industry Survey on Climate Change Impacts and Adaptation**
2015-2017	**UNCTAD DA Project *"Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States (SIDS)"***