Ad Hoc Expert Meeting on

Climate Change Adaptation for International Transport: Preparing for the Future

16 to 17 April 2019

Climate change impacts and adaptation for transport – key issues and UNCTAD work

Presentation by

Regina Asariotis
Chief, Policy and Legislation Section
UNCTAD

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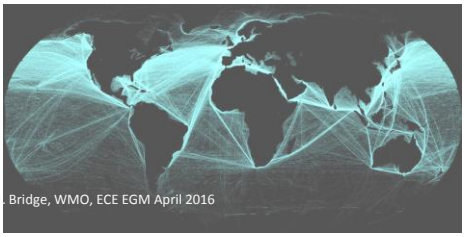
Transport: a critical facilitator of global trade and development



Global shipping movements

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

Globalization: interconnectedness/interdependence of shipping/ports and of transport across supply chains

Seaborne trade: 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. Climatic Variability and Change, CV&C)

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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Relevance in the context of the 2030 Sustainable Development Agenda

2030 Agenda adopted in September 2015, effective as of 1st January 2016

Consensus by international community on a 'plan of action' involving 17 sustainable development goals with 169 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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Climate Variability and Change (CV & C)

A global challenge and "*a defining issue of our era*" (UN SG Ban Ki Moon, 2008)

- Compelling scientific evidence of increasing impacts (IPCC, 2013; 2018)
- Huge potential costs associated with inaction (5-20 % of GDP, annually; STERN, 2006)
  - WEF 2019 Global Risks Report: top 3 economic risks are extreme weather events, failure of CC mitigation and adaptation, natural disasters
  - By 2100, global flood damages due to sea-level rise (and related extreme events) might amount to up to US$ 27 trillion/year – about 2.8% of global GDP in 2100 (S Jevrejeva et al 2018 Environ. Res. Lett)
- A serious development threat, particularly for the Least Developed Countries (LDCs) and the Small Island Developing States (SIDS)
- UNSG – Climate Action Summit 2019; Update of NDCs under Paris Agreement by 2020

- Since 2008, integration of CV & C considerations into UNCTAD's work on transportation

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IPCC Report on Global warming of 1.5° (2018)

Limiting global warming to 1.5° above pre-industrial levels by 2100 is included as an aspirational target in 2015 Paris Agreement, Art. 2 (a) (advocated by AOSIS)

Some key messages from IPCC (2018) regarding impacts and adaptation:

- Severe impacts are expected at 1.5 degrees warming, as early as in the 2030s
- Impacts expected to be much worse at 2 degrees warming than at 1.5 degrees
- "Much of the published research on the risks of climate change for the transportation sector has been qualitative"
- For SIDS – substantial increases in the risk to critical transportation infrastructure from marine inundation at 1.5° , as early as in the 2030s, unless further climate change adaptation is undertaken

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UNCTAD's work on climate change impacts and adaptation for ports and other coastal transport infrastructure and follow-up

(see further http://unctad.org/en/Pages/DTL/TTL/Legal/Climate-Change-and-Maritime-Transport.aspx)

2009	**UNCTAD Multiyear Expert Meeting: "*Maritime Transport and the Climate Change Challenge*"**
Follow-up	UNCTAD edited multidisciplinary book: **Maritime Transport and the Climate Change Challenge** UN-Earthscan (Routledge/Taylor&Francis) (2012) 327 pp
2010	**Joint UNECE-UNCTAD Workshop: "*Climate change impacts and adaptation for international transport networks*"**
Follow-up	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	**UNCTAD Ad Hoc Expert Meeting: "*Climate Change Impacts and Adaptation: a Challenge for Global Ports*"**
Follow-up	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)"***

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CV & C implications for Transport

Two sides of the "coin": causes - effects

- **Mitigation**: action directed at addressing causes (long-term)
- **Adaptation**: action directed at coping with impacts (short- and long- term); requires assessment of impacts that can vary considerably by physical setting, type of forcing, sector, mode, region etc.

In Transport:

- much of the international debate/policy action focuses on 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

Direct and *indirect* impacts on transport infrastructure and services:

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

- affect coastal transport infrastructure, hinterland/connecting transport infrastructure, and transport throughout global network of supply-chains
  - potential for *damage, disruption and delay* – economic/trade related losses
- affect demand for transport
- exacerbate other transport-related challenges
- open new arctic sea-lanes due to polar ice melting

Enhanced climate resilience / adaptation for ports and other key transport infrastructure is of strategic economic importance

How prepared are we?

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UNCTAD Port Industry Survey on Climate Change Impacts and Adaptation

Online survey to

- **improve the understanding of weather and climate-related impacts on ports**
- **identify data availability and information needs; and**
- **determine current levels of resilience and preparedness among ports**

Respondent port sample collectively handle more than **16 % of global seaborne trade** and can be considered as **representative**

- **The majority of respondents had been impacted by weather/climate related events**, including by extremes;
- The survey revealed **important gaps in terms of relevant information available to seaports of all sizes and across regions** with implications for effective climate risk assessment and adaptation planning.

Key messages: better data/information needed; **mainstream CC considerations**; 'piggyback' climate resilience when upgrading infrastructure and operations

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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	Damage to 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; increased health risks for staff and passengers; rail buckling and restrictions in railway operational speed; asphalt softening/rutting
• Permafrost degradation • Reduced arctic ice coverage	Major damage to 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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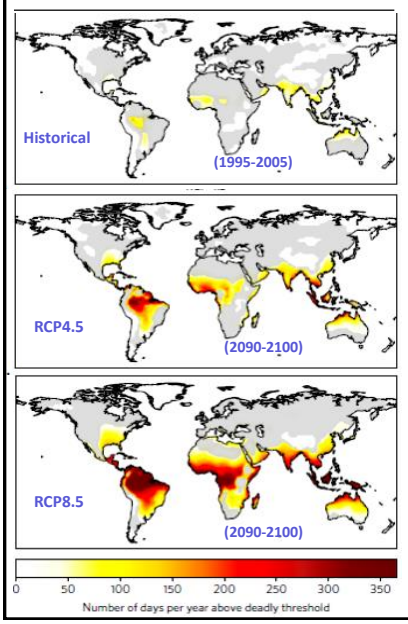

Impacts of temperature and humidity increases

The projected temperature (and humidity) increases will affect the human thermoregulatory system and may create difficult ambient conditions for transport due to

- direct impacts on transport operations/costs and
- changes in demand

Geographical distribution of past (1995-2005)and projected (2090 - 2100) deadly climatic conditions (from temperature and humidity increases) under a moderate (RCP4.5) and 'business as usual' (RCP8.5) emission scenario (Mora et al., 2017, Nature Climate Change)

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The special case of the SIDS

- Small (land mass, economies, population), remote & highly vulnerable to external shocks
- Large dependency on imports (i.e. international transport)
- Key concerns: connectivity and transport costs (accessibility and affordability)
- High transport costs (e.g. transport costs in Caribbean trade at least 30 % higher than the world average, see Pinnock and Ajagunna, 2012)
- High exposure to natural disasters and CV&C; low adaptive capacity
- **Coastal transport infrastructure (seaports/airports): critical lifelines for external trade, food, energy, tourism (cruise-ships and air transport) and DRR**
- These assets are threatened by sea level rise and extreme events (storms)
- Strong nexus between transport and tourism: "Sun-Sea-Sand (3S) tourism", often a most significant SIDS industry, is threatened by climate - driven beach erosion / coastal inundation, as is its facilitating transport infrastructure

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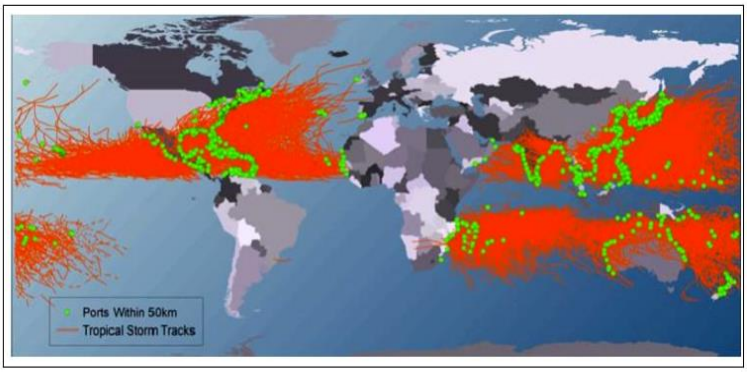
SIDS are vulnerable to storms



Ports within 50 km of tropical sea storm tracks (1960–2010) Data: 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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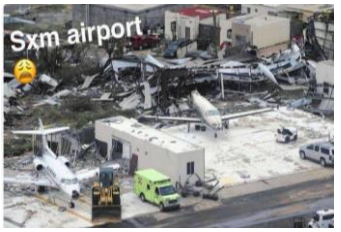
2017 hurricanes: impacts in the Caribbean

- Major impacts in Dominica, Dominican Republic, Guadeloupe, Montserrat, Antigua & Barbuda, Saint Kitts & Nevis, Puerto Rico, Turks & Caicos, Virgin Islands
- Most costly hurricane season on record (WMO 2018)
- Estimated losses: Dominica, US$ 1.3 billion or 224% of GDP; BVI, about 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 airport



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

- Focus on key coastal transport infrastructure (i.e. airports and ports)
- 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); 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 operational disruptions and marine inundation risk* to coastal international airports and seaports of Jamaica and Saint Lucia, under different climatic scenarios;
  - Innovative methodological approaches, validated by scientific peer-review

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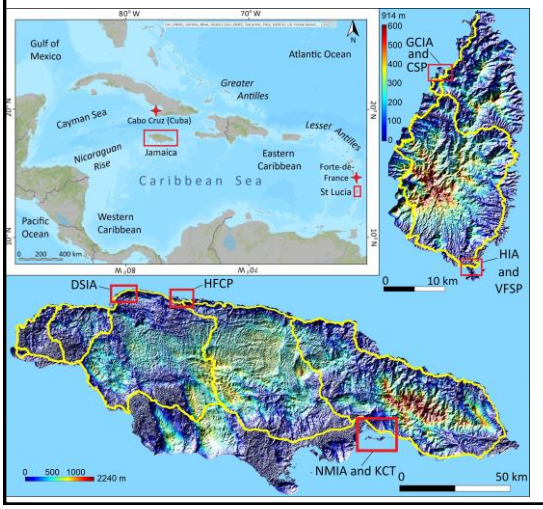
Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States



Some findings:

High risk of marine flooding for key assets under extreme events and different CV & C scenarios

Operational disruptions also identified, using an operational thresholds method

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

See also **IPCC Special Report on Global Warming of 1.5ºC** (Ch. 3)

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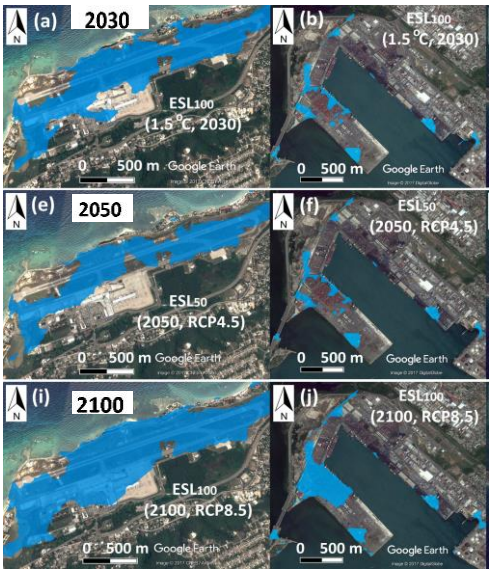
Marine flooding projections for ports/airports under CV & C: **Jamaica**



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

Flood maps for: (a, e, i) Sangster International Airport (SIA, Montego Bay, Jamaica); (b, f, and i) Kingston Container Terminal (KFTL, 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)

Monioudi et. al. (2018)

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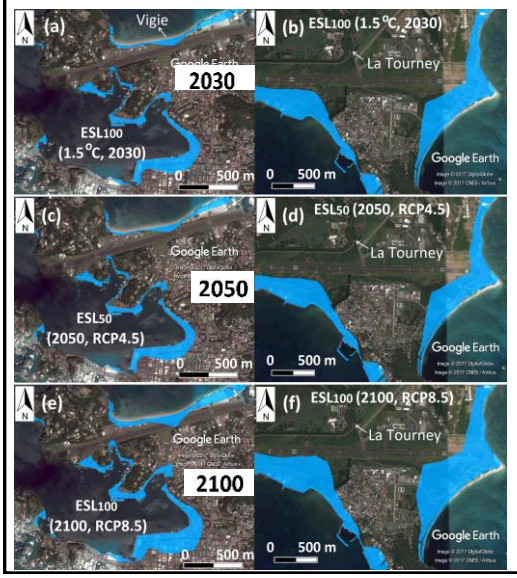
Marine flooding projections for ports/airports under CV & C: **Saint Lucia**



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

Flood maps:
(a, c, e) George Charles International Airport and Castries seaport and (b, d, f) Hewanorra International Airport and Vieux Fort seaport for the:

- *1-100 year extreme sea level event, ESL100 (1.5 ° C SWL, 2030),*
- *1-50 year extreme sea level event, ESL50 (2050, RCP4.5) and*
- *ESL100 (2100, RCP8.5)*

Monioudi et. al. (2018)

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Thank you!