Global perspectives on the impact of climate change and its relevance to the Sustainable Development Agenda

Regina Asariotis
Chief, Policy and Legislation Section, TLB/DTL
UNCTAD

unctad.org/ttl/legal
Global trade is dependent on Maritime Transport

- Over 80% of the volume of world merchandise trade (70% by value) is carried by sea – from port to port

- Maritime transport provides access to global markets: crucial for all countries - developed and developing - including those that are landlocked

  *Key factors for developing countries: connectivity, transport costs*

- Globalization: strong interconnectedness / interdependence of shipping/ports – over 60% loaded and unloaded in developing countries

- Shipping and ports are key-nodes in global supply-chains and therefore vital for global trade

- Seaborne trade is a derived demand – reflecting developments in global economy and merchandise trade
Economic growth, trade and demand for shipping services closely interlinked

Source: UNCTAD Review of Maritime Transport, various issues
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 international supply chains.

Globalization: interconnectedness/interdependence of shipping/ports

60% of goods loaded and 63% of goods unloaded in developing countries (UNCTAD RMT 2018)

Environmental challenges: two sides of the coin

- Effects of maritime transport on the environment (e.g. pollution, CO2 emissions)
- Environmental impacts on maritime 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.
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**
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) – even at 1.5 degrees, as early as in the 2030s
- Huge potential costs associated with inaction (5-20 % of global GDP, annually (STERN Review 2006)
- A serious development threat particularly for the Least Developed Countries (LDCs) and the Small Island Developing States (SIDS)
- Since 2008, integration of CV & C considerations into UNCTAD's work on Transport Policy and Legislation. See unctad.org/ttl/legal for further information
Temperature difference between 2018 and 1981-2010
A global challenge and “a defining issue of our era” (UN SG Ban Ki Moon, 2008)

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


<table>
<thead>
<tr>
<th>Year</th>
<th>UNCTAD Multiyear Expert Meeting: “<em>Maritime Transport and the Climate Change Challenge</em>”</th>
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| 2009 | **Follow-up** 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)  
| 2014 | **Follow-up** 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*” |
| 2015-2017 | **Follow-up** UNCTAD DA Project "*Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States (SIDS)*" |
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 [Maritime] 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:* Maritime transport is not (just) a ‘culprit’, it is (also) a victim
Direct and indirect impacts on maritime transport infrastructure and services:

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

- affect seaports and hinterland/connecting transport infrastructure as well as the global network of supply-chains
  - potential for damage, disruption and delay – economic/trade related losses
- affect demand for shipping/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
Flood risk at US Gulf coast under sea level rise 0-6 -1.2 m.

Mean sea level rise of about 1.2 m (4 feet) could permanently inundate:
- over 70% of existing port facilities
- 3 airports
- 9% of railway lines
- more than 2400 miles of roads

Temporary flooding from storms can also be devastating.
Impacts of extreme events (hurricanes): air transport

**2017 Hurricane season**
- At the disruption peak, revenue losses for the industry of US$75-85m per day
- MIA and ATL handle 14% of total US trade by air (by weight), approx. US$89.2bln of goods; disruptions could have affected about US$245m worth of cargo per day (IATA, 2017)

**2018 Hurricane season**
- 1,300 flights canceled due to Florence (09/13, CNN)
- Total damage from Florence in N. Carolina expected to exceed $10.6 billion (NOAA).
- 300 + flights canceled at Charlotte Douglas International Airport (N. Carolina) due to Michael (10/11 USA Today)

And these were *no direct hits*
Direct and indirect impacts on maritime transport infrastructure and services:

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Enhanced climate resilience / adaptation for ports and other key transport infrastructure is of strategic economic importance: but are we prepared?
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

Although 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 into planning and operations; ‘piggyback’ climate resilience when upgrading
### Major climate change impacts on coastal transport infrastructure

<table>
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<tr>
<th>Factor</th>
<th>Impacts</th>
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<tr>
<td><strong>Sea level (mean and extreme)</strong></td>
<td>Coastal transport infrastructure (open sea ports, estuarine ports and inland waterway ports; airports; roads; railroads; bridges)</td>
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<td>• Mean sea level changes</td>
<td>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</td>
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<tr>
<td>• Increased destructiveness of storms/storm surges</td>
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<td>• Changes in the wave energy and direction</td>
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<td><strong>Precipitation</strong></td>
<td>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</td>
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<tr>
<td>• Changes in the intensity and frequency of extremes</td>
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<td>• (floods and droughts)</td>
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<tr>
<td><strong>Temperature</strong></td>
<td>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</td>
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<tr>
<td>• Higher mean temperatures,</td>
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<td>• Heat waves and droughts</td>
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<td>• Increased spatio-temporal variability in temperature extremes</td>
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<td><strong>Permafrost degradation</strong></td>
<td>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</td>
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<td>• Reduced arctic ice coverage</td>
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Enhanced climate resilience / 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.

- California Bill (Assembly Bill No. 2800 CHAPTER 580) that modified the Public Resources Code (2016) effective Jan 2017
- ICAO Resolution A 39-2
The special case of the SIDS

- Small (land mass, economies, population), remote & highly vulnerable to external shocks
- Large dependency on international transport, but high transport costs; transport costs in Caribbean trade at least 30% higher than the world average (Pinnock & 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)**
- These assets are threatened by sea level rise and extreme events (storms)
- At the same time: Strong nexus between transport and tourism: “Sun-Sea-Sand (3S) tourism”, often a very significant SIDS industry, is threatened by climate-driven coastal and beach erosion, together with its facilitating infrastructure (i.e. seaports, airports, coastal access roads)
SIDS are vulnerable to storms


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

Past Losses
Very large (for its economy) and disproportionate (uninsured) losses for the Caribbean

Adaptation makes sense
Every US dollar spent on weather and climate services could yield US$ 2 - US$ 14 in revenues as a result of avoided damages (according to the World Bank)

Losses from hurricanes in N. America since 1980
MunichRe, World Meteorological Organization
2017 hurricanes: impacts in the Caribbean and US Gulf Coast

- Most costly hurricane season on record (WMO 2018):
- responsible for more than 320 deaths and assessed as ranking in the top five for hurricane-related economic losses in the USA (with Katrina (2005) and Sandy (2012))
- estimated losses of US$ 125 billion (Harvey), US$ 90 billion (Maria) and US$ 50 billion (Irma) (WMO, 2018).

Transport infrastructure damages from the 2017 hurricanes.

(a) Harvey: highway flooding in downtown Houston (USA);
(b) Harvey: Houston highways;
(c) Maria: Bridge at Puerto Rico;
(d) Irma: Destruction of the St Maarten Princess Juliana international airport (September 2017).

Source: UNECE (2019). Informal document WP.5/GE.3 (2019) No. 2. (Fig. 14)
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
- 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)

September 2018

Rains from tail end of Tropical Storm Kirk cause massive flooding in Barbados ...

https://www.sott.net/article/397419-Tropical-Storm-Kirk-causes-flooding-damage-in-eastern-Caribbean-countries

https://pressroom.oecs.org/oecs-member-states-discuss-the-impact-of-natural-disasters-on-trade#
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) 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](http://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 climatic scenarios*

Innovative methodological approaches, validated by scientific peer-review
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

See also:

Cited in IPCC Special Report on Global Warming of 1.5°C (Ch. 3)
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)
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)
Thank you!