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Group of Experts on Climate Change Impacts and Adaptation for Transport Networks and Nodes

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Climate Change and Transport Networks and Nodes: Presentations of initiatives at national and international levels

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

Submitted by United Nations Conference on Trade and Development

I. Introduction

1. This document contains case study on Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States (SIDS)". The Group of Experts is invited to consider this case study and decide whether to include in the Final Report.

II. Background and project scope

2. Coastal transport infrastructure vulnerability varies across regions, and depends on many factors, including the type of risks faced, the degree of exposure and the level of adaptive capacity. Small Island Developing States (SIDS) are among the most vulnerable, as they are both prone to being affected by climate change-related (and other) natural disasters and have low adaptive capacity. The significance of weather and climate-related threats has been underscored by the recent impacts of Hurricanes Irma and Maria that wreaked havoc in the Caribbean, including in some of the overseas territories of UNECE member States, during the 2017 hurricane season. SIDS share a number of socioeconomic and environmental vulnerabilities that challenge their growth and development aspirations. Their climate, geographical, and topographical features as well as their critical reliance on coastal transport infrastructure, in particular seaports and airports, exacerbate these vulnerabilities, including their susceptibility to climate change factors, such as sea-level rise and extreme weather events. Furthermore, in many SIDS, including the overseas territories of UNECE member States, international tourism, which is highly dependent on secure and reliable international

transport connections, is a major economic activity and a key purveyor of revenues, jobs and foreign exchange earnings. Enhanced climate resilience, climate change adaptation and disaster risk reduction for key coastal transport infrastructure is therefore critical for the overall sustainable development prospects of these vulnerable economies.

3. Against the above background, and drawing on UNCTAD's earlier related work since 2008, including a number of expert meetings as well as research and analysis[1], a technical assistance project on "*Climate change impacts on coastal transport infrastructure in the Caribbean: enhancing the adaptive capacity of SIDS*" was implemented by UNCTAD over the period 2015–2017, in collaboration with a range of partners, including UNECLAC, UNDP, UNEP, the Caribbean Community Climate Change Centre, OECS Commission, as well as the ECJRC and international and regional academic experts. Case studies focusing on ports and airports in two vulnerable SIDS in the Caribbean (Jamaica and Saint Lucia) were carried out to (a) enhance the knowledge and understanding at the national level and (b) to develop a transferable methodology for assessing climate-related impacts and adaptation options in SIDS. The case studies and methodology were reviewed and refined at a technical expert meeting and were presented and discussed at national and regional capacity-building workshops, bringing together seaports and airports authorities as well as a range of other stakeholders, experts, development partners, and organizations from 21 countries and territories in the Caribbean; full documentation, as well as guidance and training materials and additional resources are available on the project web-platform SIDSport-ClimateAdapt.unctad.org.

4. Key project outcomes include assessment of potential operational disruptions and marine inundation risk to 8 coastal international airports and seaports of Jamaica and Saint Lucia (Fig. 1), under different climatic scenarios. Relevant substantive findings and technical details of the methodology developed under the project were presented and discussed in a peer-reviewed scientific paper[2] and have informed the IPCC's recent assessment of "*Impacts of 1.5 ºC global warming on natural and human systems*",[3] highlighting substantial increases in risk to SIDS's critical coastal transportation infrastructure from climate changed-induced marine inundation as early as in the 2030s, when the AOSIS advocated temperature increase cap of 1.5 °C (SWL) will be reached, unless further climate change adaptation is undertaken.

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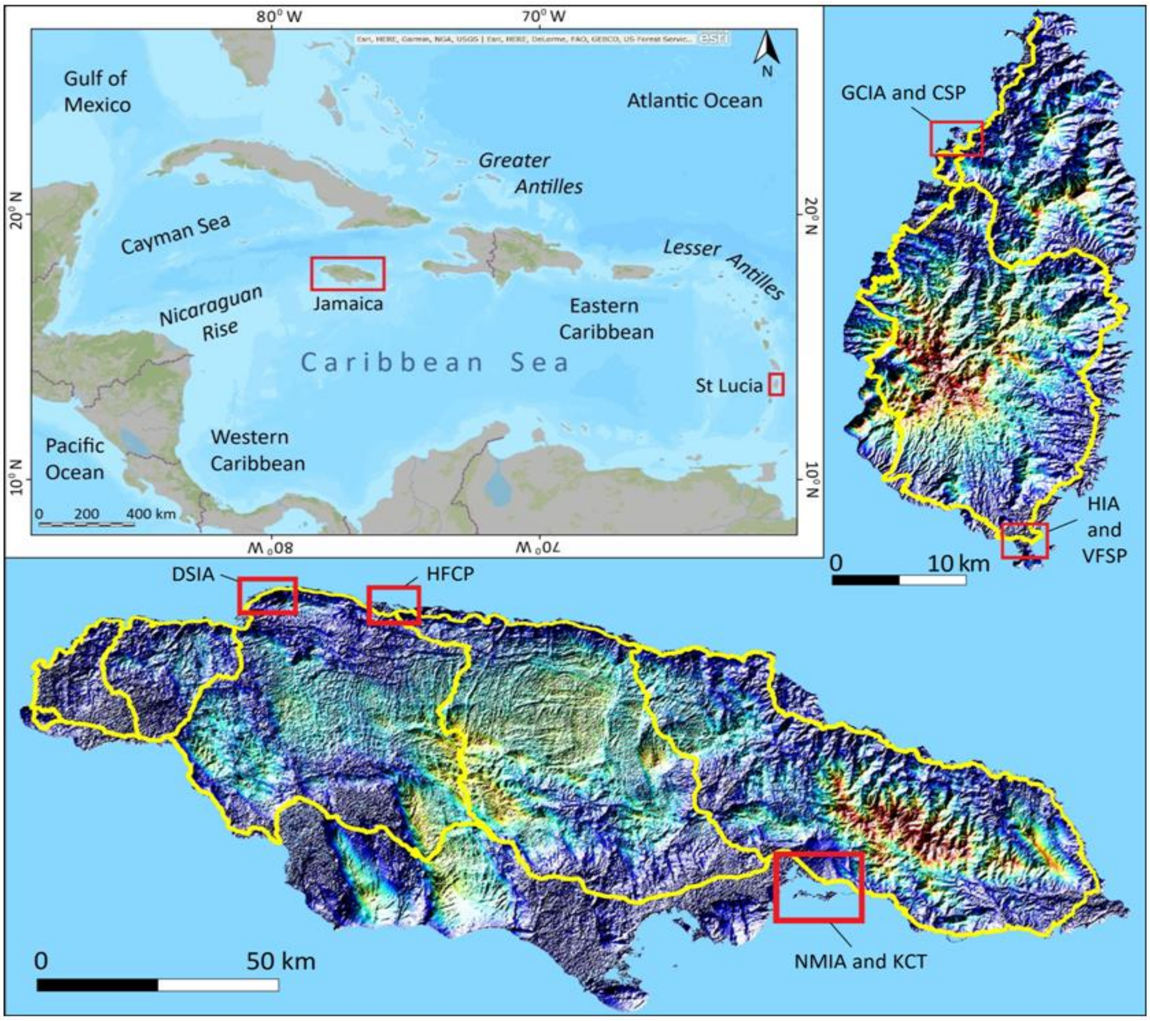
1 See unctad.org/en/Pages/DTL/TTL/Legal/Climate-Change-and-Maritime-Transport.aspx

2 Monioudi, I.N., Asariotis, R., Becker, A. et al. Reg Environ Change (2018) 18:2211–2225. Climate change impacts on critical international transportation assets of Caribbean Small Island Developing States (SIDS): The case of Jamaica and Saint Lucia. doi.org/10.1007/s10113-018-1360-4; rdcu.be/Q1OY.

3 IPCC, 2018. Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. Chapter 3: Impacts of 1.5ºC global warming on natural and human systems. October 2018, available at: www.ipcc.ch/site/assets/uploads/sites/2/2019/02/SR15_Chapter3_Low_Res.pdf

Figure 1

Location of the transportation assets of Jamaica and St Lucia considered as part of the case studies. Key: DSIA, Sangster International Airport; HFCP, Historic Falmouth Cruise Port; NMIA, Norman Manley International Airport; KCT, Kingston Freeport and Container Terminal; HIA, Hewanorra International Airport; VFSP, Vieux Fort Seaport; GCIA, George Charles International Airport; and CSP, Port Castries. Digital Elevation Model data from SRTM DTM.



III. Results of the risk and vulnerability assessment of critical coastal transport infrastructure [4]

5. Projections showed that the critical transportation assets of both SIDS would face rapidly increasing marine inundation risks compared with the current situation, with those of Saint Lucia being at higher risk than those of Jamaica. The results also suggest that, even under the 1.5 °C temperature increase cap, some of the critical assets of the islands will face increased direct marine inundation under extreme events, which will deteriorate very significantly and involve other assets later in the century. The flood maps (Figs 2 and 3) illustrate the vulnerability to marine flooding of key international transport assets in both countries.

[4] For further details, see the case studies and methodology available at SIDSport-ClimateAdapt.unctad.org, as well as Monioudi et.al (2018).

Figure 2

Coastal flooding – Jamaica Inundation maps for: (a, e, i) DSIA, (b, f, j) KCT, (c, g, k) NMIA, and (d, h, l) HFCP under a 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).

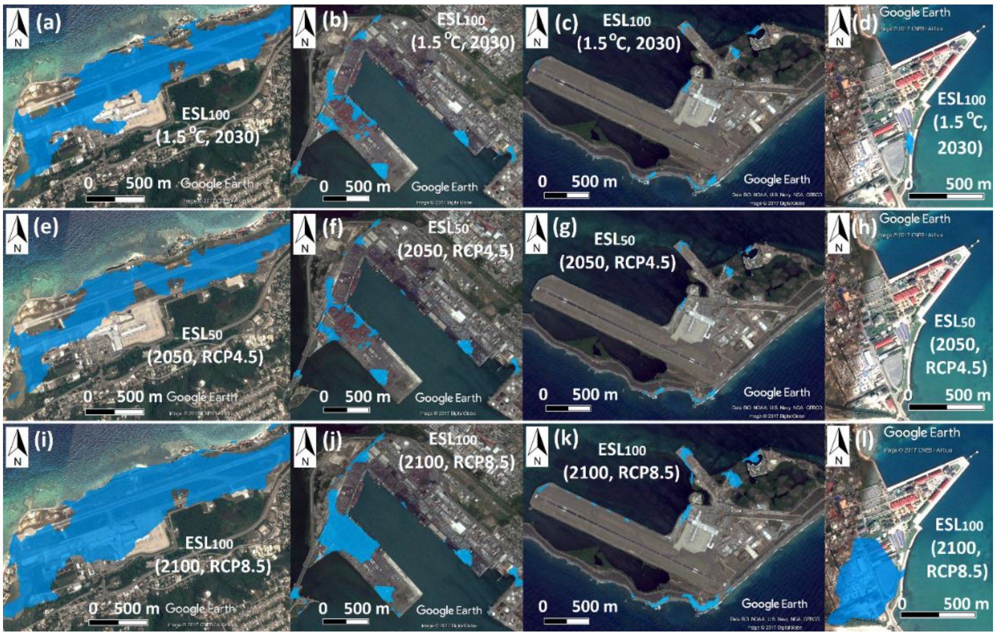
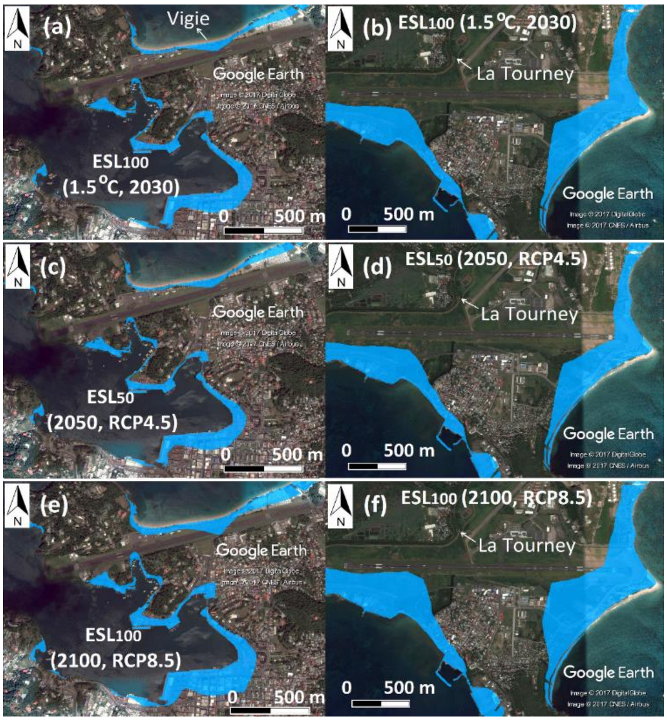


Figure 3

Coastal flooding – Saint Lucia Inundation maps for (a, c, e) GCIA and CSP and (b, d, f) HIA and VFSP under ESL100 (1.5 °C, 2030), ESL50 (2050, RCP4.5) and ESL100 (2100, RCP8.5)



6. Results of the study also suggest that transport operations will be affected in Jamaica and St. Lucia due to future Climate Variability and Change (CV & C). The projected increases in the frequency of hot days will likely affect the ability of staff to work safely outdoors, require reductions in aircraft payloads and increase energy costs. Inter alia, the following operational disruptions are projected:

- Outside working conditions: By the early 2030s, staff working outdoors at the Jamaican and Saint Lucian international transportation assets could be at “high” risk for 5 and 2 days per year, respectively. By 2081-2100, such days could increase to 30 and 55 days per year, respectively.
- Aircraft take-off: By 2030, Boeing 737-800 aircraft that serve all studied airports, will have to decrease their take-off load for 65 days per year at Sangster International Airport-SIA and 24 days per year at Norman Manley International Airport- NMIA (both in Jamaica), whereas by the 2070s such days could increase at least twofold for SIA and fourfold for NMIA, assuming no targeted aircraft design changes.
- Energy needs: a 1.5 °C temperature rise will increase energy requirements by 4 % for 214 days per year for Jamaican seaports, whereas a 3.7 °C rise (2081-2100) will increase energy requirements by 15 % for 215 days per year. Saint Lucia seaports are projected to experience similar trends.

7. Finally, the dominant 3S (‘Sea-Sand-Sun’) tourism model of Saint Lucia (and other Caribbean island destinations) is projected to be challenged by increasing beach erosion, which, by 2040, may overwhelm between 11 and 73 % of its beaches[5], with negative ramifications for tourism, the main driver of many Caribbean SIDS’ economy, accounting for between 11% and 79% of their GDP[6]. Due to the strong nexus between tourism and the facilitating transport infrastructure, this will also have negative impacts on transportation demand.

IV. Methodology: A climate risk and vulnerability assessment framework for Caribbean coastal transport infrastructure

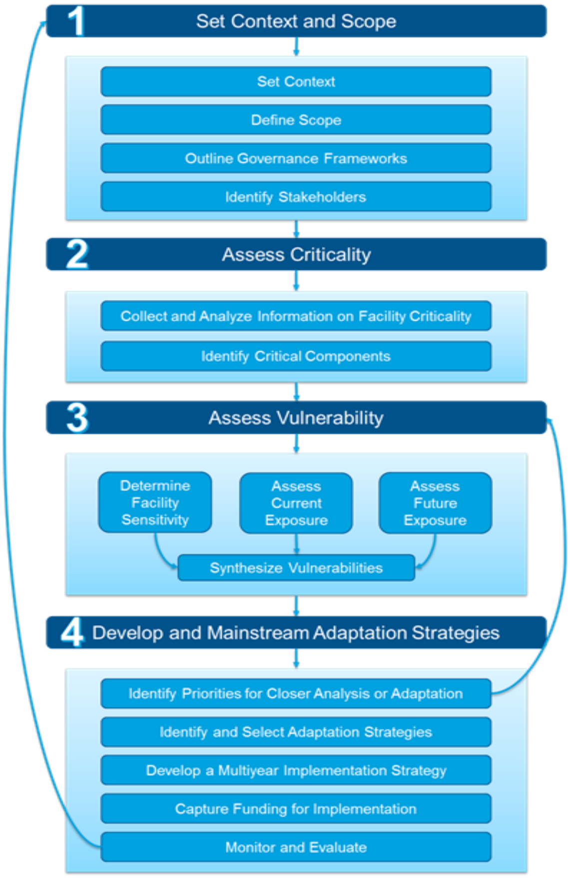
8. A methodology was developed under the project to assist transport infrastructure managers and other relevant entities in SIDS in assessing climate-related impacts and adaptation options in relation to coastal transport infrastructure (‘*Climate Risk and Vulnerability Assessment Framework for Caribbean Costal Transport Infrastructure*’). The methodology provides a structured framework for the assessment of climate-related impacts with a view to identifying priorities for adaptation and effective adaptation planning for critical coastal transport infrastructure (Figure 4); it takes a practical approach that uses available data to inform decision-making at a facility, local, and national level. Technical elements include an ‘operational thresholds’ method, to determine the climatic conditions under which facility operations might be impeded, as well as marine inundation modelling (see Section II, above). The methodology is transferable, subject to location specific modification, for use in other SIDS within the Caribbean and beyond.

[5] UNCTAD, 2017. Climate Change Impacts on Coastal Transportation Infrastructure in the Caribbean: Enhancing the Adaptive Capacity of Small Island Developing States (SIDS). SAINT LUCIA: A Case study. UNDA 1415O, available at: https://SIDSport-climateadapt.unctad.org.

[6] UNECLAC, 2011. An assessment of the economic impact of climate change on the transportation sector in Barbados.

Figure 4

Schematic overview of 'Climate Risk and Vulnerability Assessment Framework for Caribbean Costal Transport Infrastructure'



V. Key findings and main lessons learnt

9. As already noted, the study results show high and increasing potential vulnerabilities to climatic changes of the critical international transportation assets (airports and seaports) of Jamaica and Saint Lucia involving both operational disruptions and coastal inundation from extreme events. Flooding is projected for the airport runways of some of the examined airports and for most seaports, from as early as the 2030s and the exposure of these assets to coastal flooding is projected to deteriorate as the century progresses. In the absence of timely planning and implementation of requisite adaptation measures, the projected impacts on critical transport infrastructure may have serious implications for the connectivity of SIDS to the international community and global markets, as well as broad economic and trade-related repercussions, which may severely compromise the sustainable development prospects of these vulnerable nations. Against this background, better and more targeted data, further research, including detailed technical studies, as well as collaborative concerted action at all levels are urgently required.

10. Some of the other major lessons learnt as part of the project fall into the following three categories:

(a) Data:

- Data collection efforts take time; many SIDS lack baseline data; better Digital Elevation Models (DEMs) are required
- Site visits and interviews with local stakeholders are essential ('the map is not the terrain')
- Steps to validate stakeholder input from facility managers can ensure high-quality inputs

- Identifying facility specific sensitivity thresholds can help streamline and improve the vulnerability assessment process

(b) Awareness and coordination:

- Communication and collaboration among public and private sector stakeholders is key
- Ports/airports already taking action to increase resilience should share their success stories
- There is a need for regional cooperation, and to build a knowledge base and community of practice around vulnerabilities

(c) Implementation:

- Organizational "best practices" can increase resilience, and vice-versa.
- "Mainstream" adaptation activities into existing planning and decision-making processes
- Climate change adaptation often comes down to a policy decision related to risk tolerance
- Financing for capital projects remains a major hurdle

11. Ecosystem enhancements can play a significant role in reducing natural hazard risks, including coastal hazards and inland flooding