

**Global Supply Chain Forum
(Bridgetown, Barbados, 21–24 May 2024)**

Parallel Session A7

**Climate change adaptation, resilience-
building and disaster risk reduction for
ports**

23 May 2024

**Changing Trends in Marine Infrastructure Design Wave
Criteria**

Presentation by

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Global Supply Chain
Forum

Barbados

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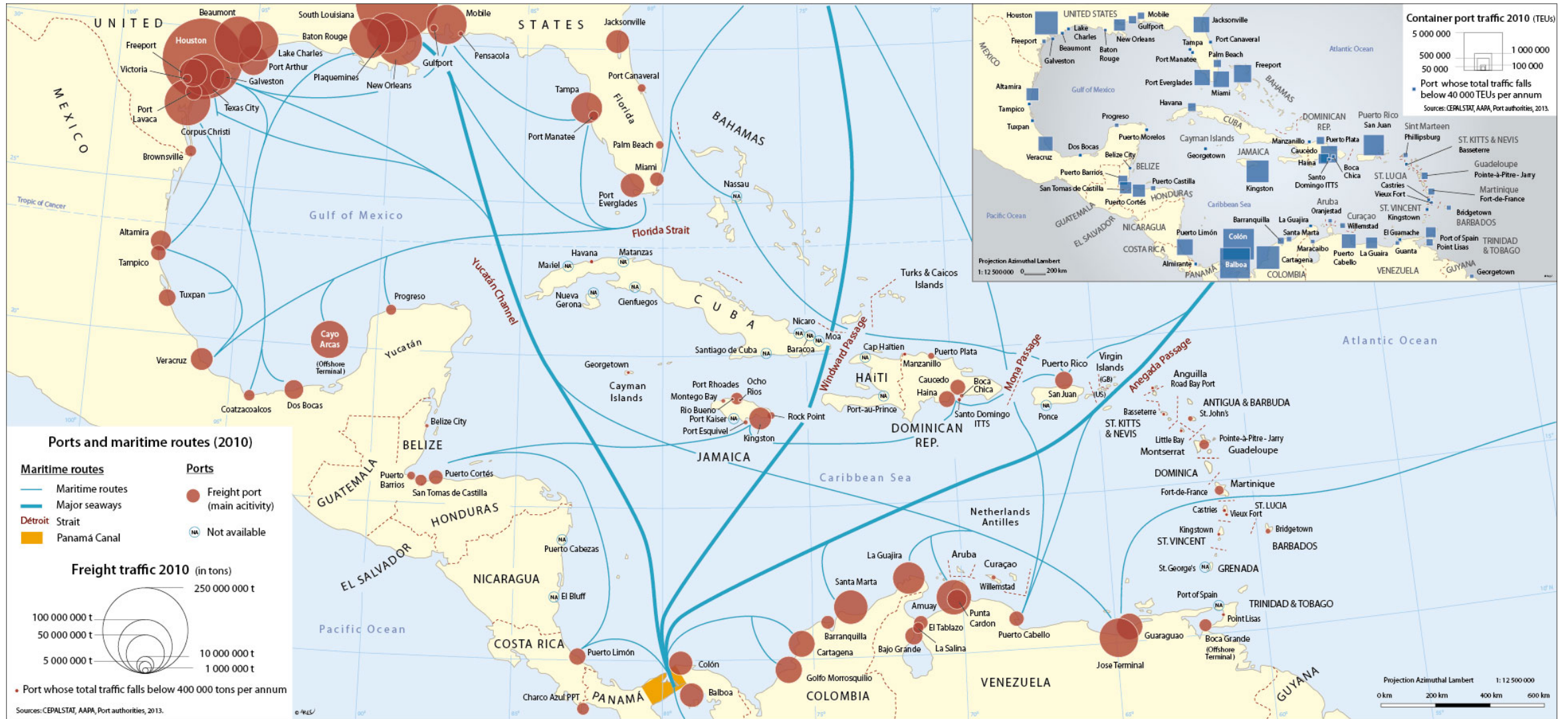
**Changing Trends in Marine Infrastructure
Design Wave Criteria**

By:

David A Y Smith & Miles Harris



An Archipelagic Region – With Many Ports

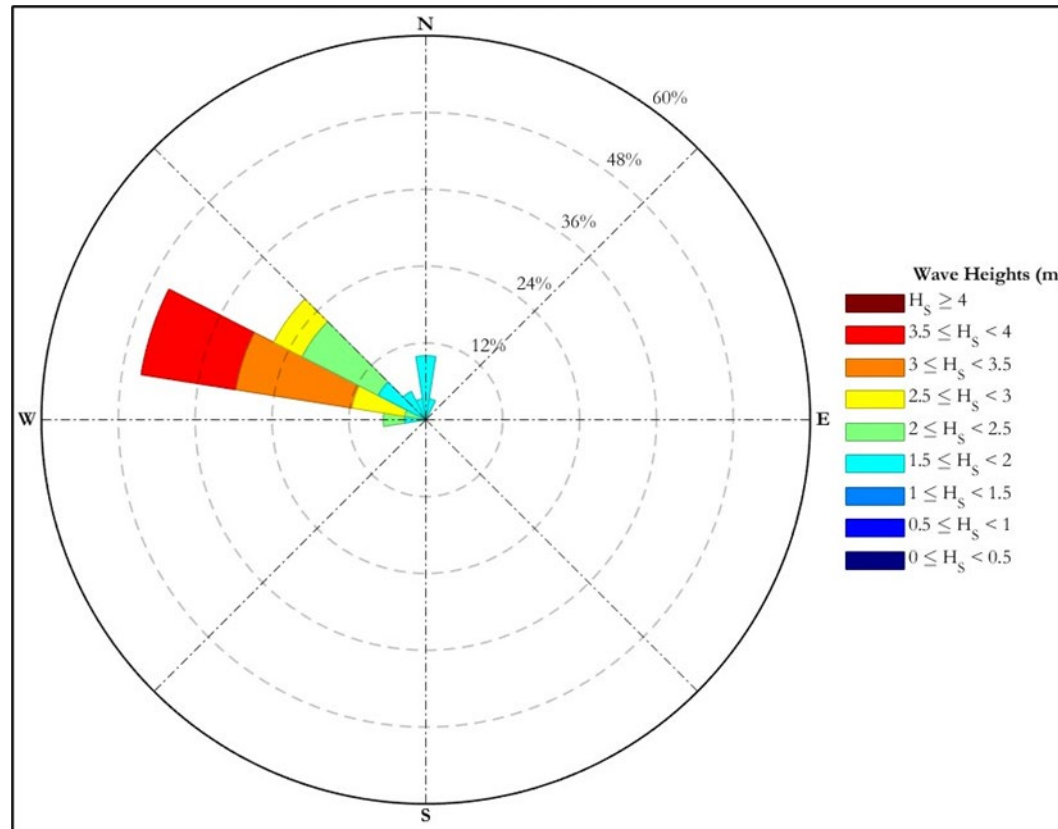


Many Providing Strategic, Economic and Social Importance

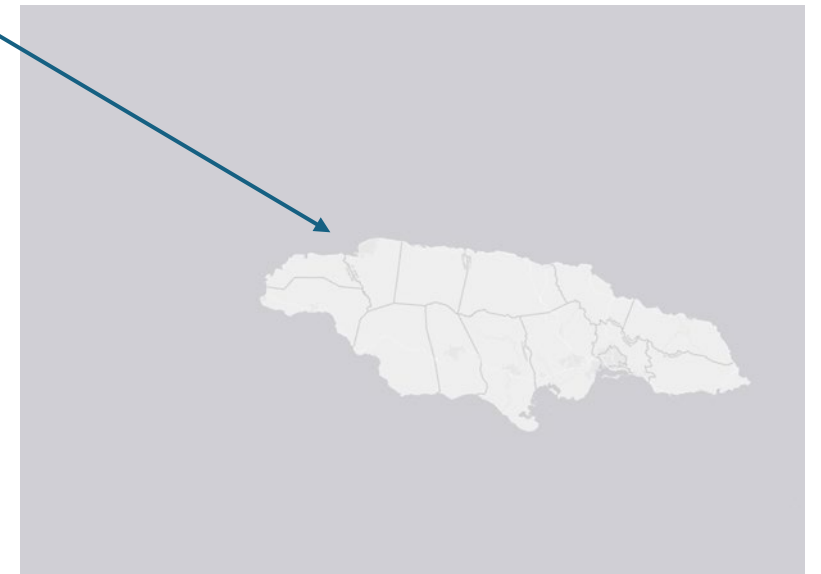
- Maritime transport, including cargo and cruise, is a key sector for the Caribbean economy.
- It creates jobs, reduces poverty, and helps the region transition to growth.
- In the upkeep of existing facilities, or the creation of new ports, hurricane wave forces provide design conditions.
- This has been a conventional wisdom for the Caribbean.

A Recent Winter Storm

Between February 4 – 6, 2024 a winter swell event affected the north coast of Jamaica. [It also affected Cayman].



Wave Direction: NW
Wave Height (Peak): 3.8m
Wind Speed: 14. m/s
Event Duration: ≥ 48 hours



Focus on Ocho Rios Cruise Terminal



When the coast is the question, we are the answer.

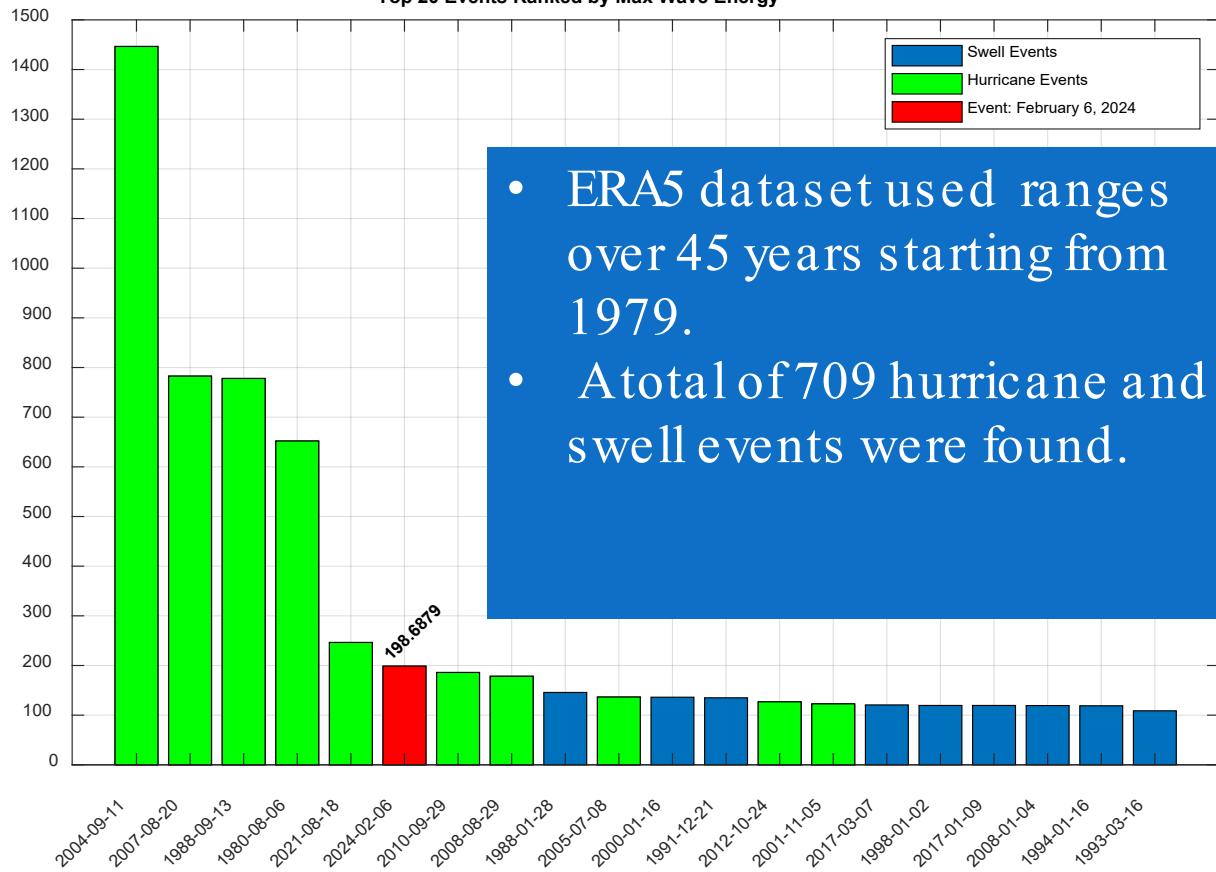
Terminal Damage Observations – Ocho Rios





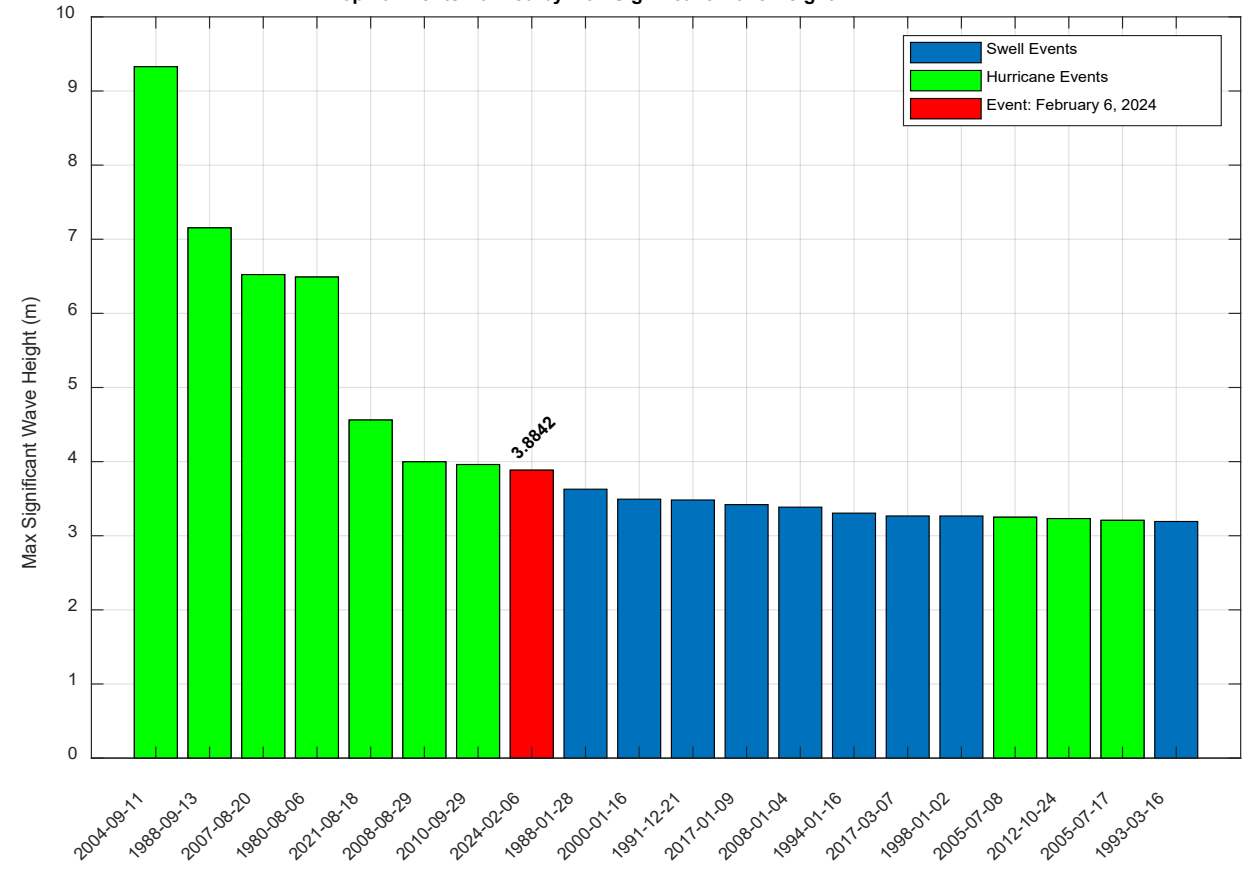
Event Significance – Historical Perspective

Top 20 Events Ranked by Max Wave Energy

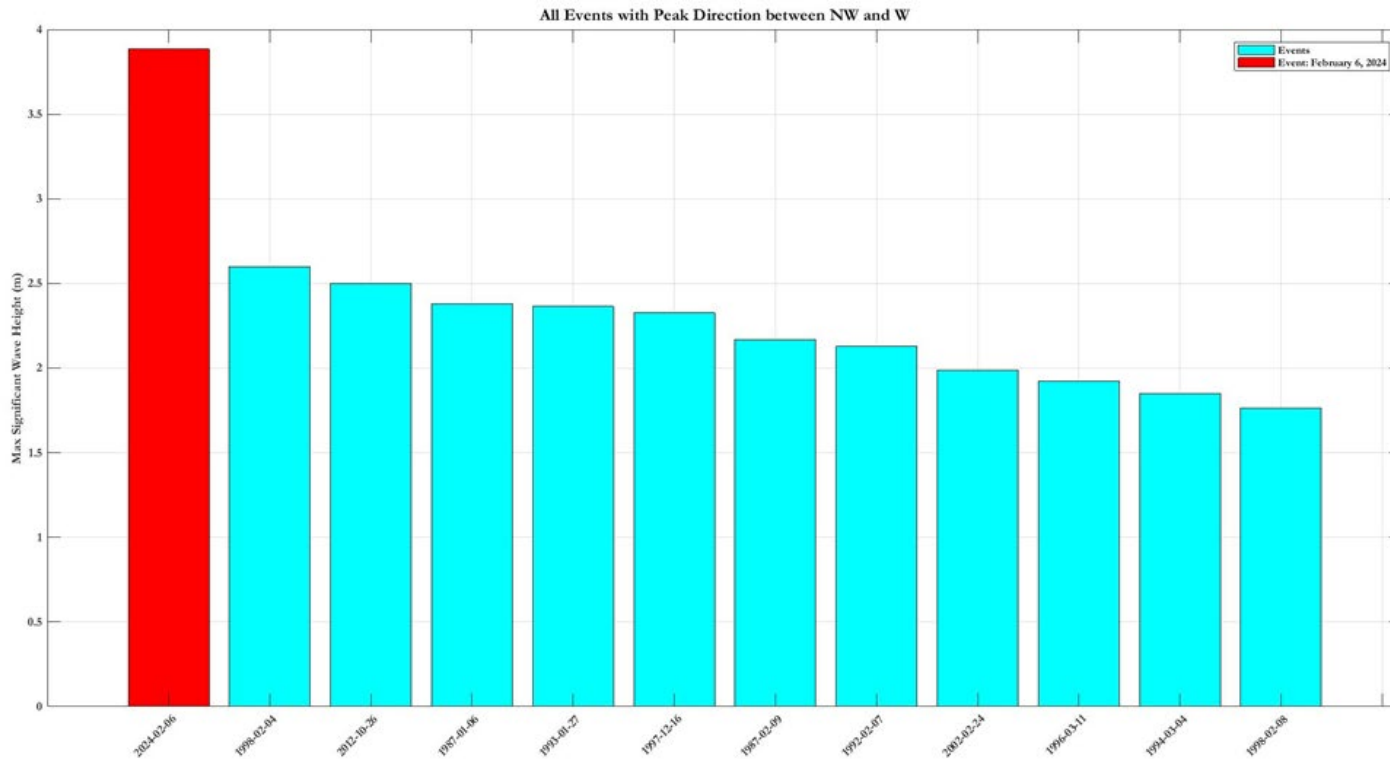


- ERA5 dataset used ranges over 45 years starting from 1979.
- A total of 709 hurricane and swell events were found.

Top 20 Events Ranked by Max Significant Wave Height



Event Significance – Future Implications



Directional Context:

- Strongest recorded storm from the Northwest (NW) direction since 1979 (45 years).

Event Characteristics:

- Storm was active for more than 48 hours.
- Wave heights exceeded 2.5 meters for over 24 hours.

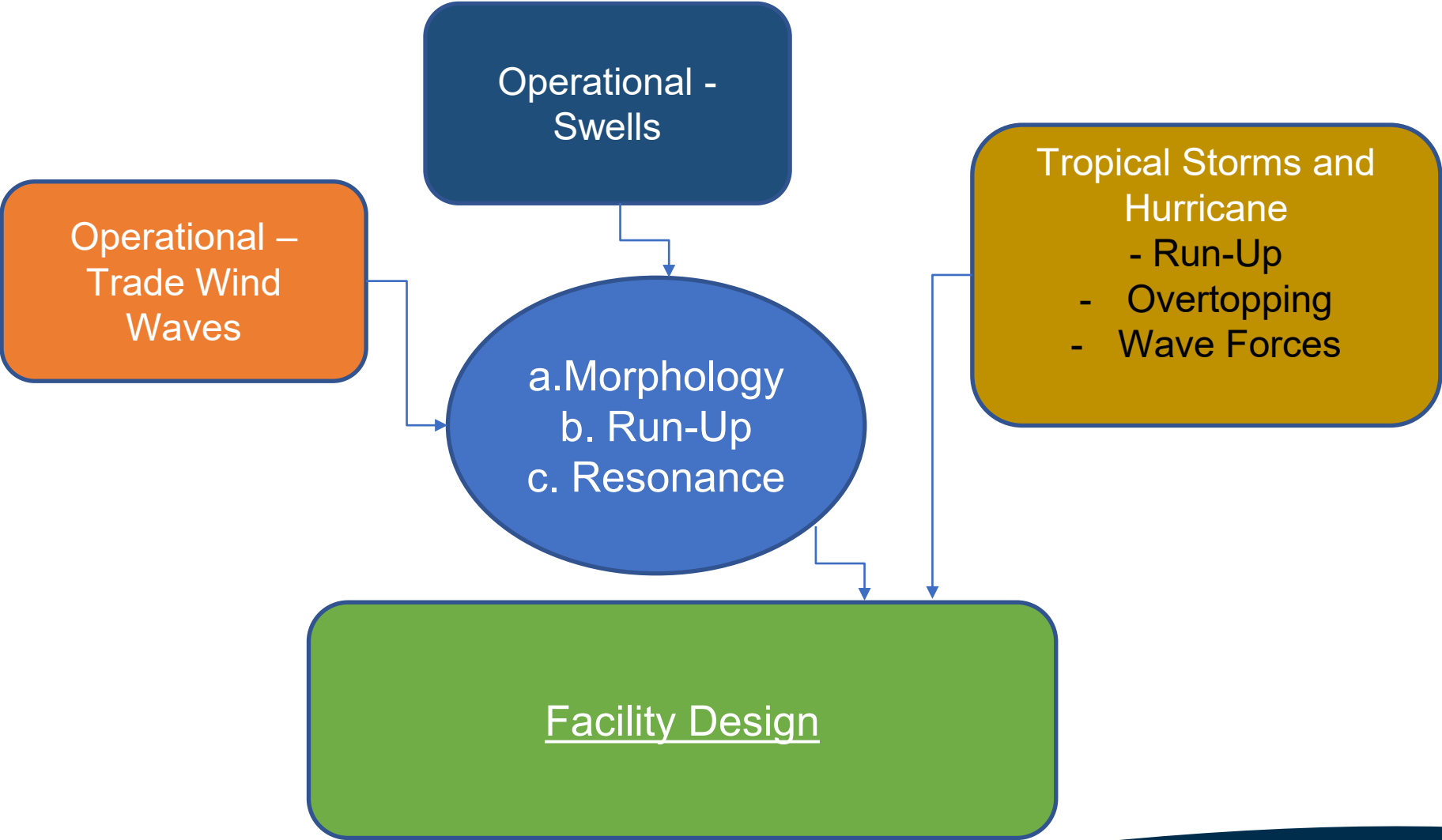
Impact Analysis:

- Significant damage was caused to marine infrastructure in Montego Bay and Ocho Rios.

Implications:

- A changing climate forces us to include winter Swells in the design criteria.

Present Design Approach



Summary of Accepted Approach

Wave forces & run up calculations for extreme conditions

Wave run up /overtopping calculations for operational conditions

**Recommendation:
set back and
elevation for
walkway**

**Recommendation:
Size of protective
structure to
minimize
structural failure**

Facility Design

Operational (Daily Waves)
Extreme (Hurricane)

Some Key Take-Aways

- In the design of structural protective elements of a port, research into swell wave records should be done, in addition to hurricane records.
- These may be obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF) as an ERA5 product. Hurricane data are obtainable from the NHC.
- Extreme swells could be as destructive as hurricanes, and their uni-directionality makes them particularly troubling for some port layouts.



Thank You!



When the coast is the question, we are the answer.