VULNERABILITY OF PORT AREAS OF OPERATIONAL INTEREST: SENSITIVITY TO CLIMATE CHANGE

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INTRODUCTION

Often, in port planning of new facilities, extension of existing ones or alternatives facing climate change (CC), infrastructural aspects take precedence over operational ones. Although risk assessments developed to support Port Authorities in the decision-making process are applicable to both aspects, this work has focused on those considered least developed: operational risks; more precisely, in the second term included in the calculation of risk: Probability, VULNERABILITY and Costs (see Gómez & Molina et al., 2018).

Some key concepts used in the present work are operational risk and Area of Operational Interest (AOI).

To assess the sensitivity of the vulnerability of AOIs to changes in magnitude, duration and direction of met-ocean agents derived from CC, a methodology has been developed and applied to the Port of Gijón (Spain).

METHODOLOGY

The methodology (see Campos et al., 2019) comprises the following steps:

- Identification of operational vulnerabilities against met-ocean agents. Through a survey to Port Authorities, the main factors conditioning port operability were identified and analyzed.
- Selection of strategies to evaluate the operability. Although it is a multidimensional problem, for the sake of simplicity, the present example shows a threshold approach for a single parameter.
- Definition of AOIs. Either terrestrial or maritime, they are port spaces with the same functional activity, sharing infrastructural typologies, means of manipulation, land uses, etc., and subjected homogeneously by met-ocean agents. This is the operational equivalent to the subset of a structure defined in ROM 0.0-0.1 (Puertos del Estado, 2001).
- Selection of Global Climate Models (GCM), concentration scenarios (CS) and time horizons (TH). Selected GCM were MRI-CGCM3, MIROC5 and CNRM-CM5; RCP4.5 and RCP 8.5 as CS and 1986-2005 (control), 2026-2045 (short term) and 2081-2100(long term) for TH.
- Identification and prediction of met-ocean variables at global level for the scenarios.
- Propagation to AOIs. The downscaling methodology was based on Camus et al. (2011) allowing the calculation of the vulnerability at all AOIs.

RESULTS

Figures 1 and 2 show some results in the Port of Gijón (northern Spain) with the location of the AOIs and the CDFs of the propagated values of Hs at deep water for control and long term time horizons, respectively.

Figure 1 - Areas of Operational Interest. Port of Gijón

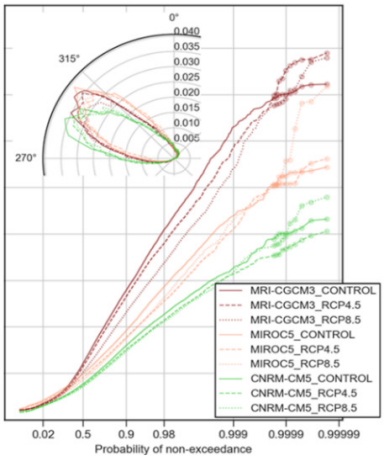

Figure 2-CDFs of Hs: deep water for control and long term

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REFERENCES

Campos et al. (2019). Addressing Long-Term Operational Risk Management in Port Docks under Climate Change Scenarios–A Spanish Case Study. Water 11(10), 2153.

Camus et al. (2011). A hybrid efficient method to downscale wave climate to coastal areas. Coastal Eng., vol. 58, no. 9, pp. 851-862

Gómez & Molina et al. (2018) Conceptos y herramientas probabilísticas para el cálculo del riesgo en el ámbito portuario, Puertos del Estado. (In Spanish)

Puertos del Estado, (2001). ROM 0.0-01. General procedure and requirements in the design of harbor and maritime structures. PART I.