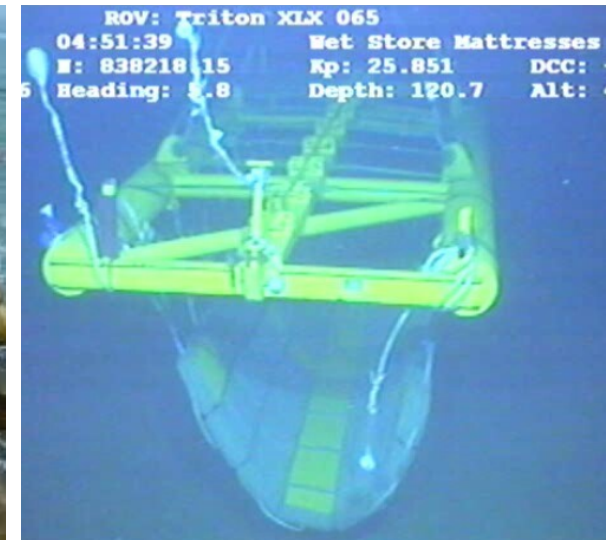


Advances on risk and reliability analysis of coastal, maritime and offshore structures

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Summary

- The beginning of risk and reliability analysis in ME;
- Former applications of risk and reliability in ME;
- Key trends in application to ME;
- Example of scour protections;
- Spin-off research;
- Conclusions



The beginning of risk and reliability analysis in ME



P - 36 explosion, flooding and capsizing, Brazil, 2001



Piper Alpha fire and explosion, NorthSea, 1988



Severe damage caused by hurricane Lilli in the Gulf of Mexico



Deepwater Horizon (2010)

Former applications of risk and reliability in ME

- Structural elements design;
- Fatigue phenomena;
- Corrosion;
- Structural reliability;
- Explosions;
- Vessels collision;
- Risk and safety plans;
- ROI of offshore investment;
- ...



Former applications of risk and reliability in ME

Slowly we started to move towards a more general application to other structures and phenomena related to hydraulics and environment:

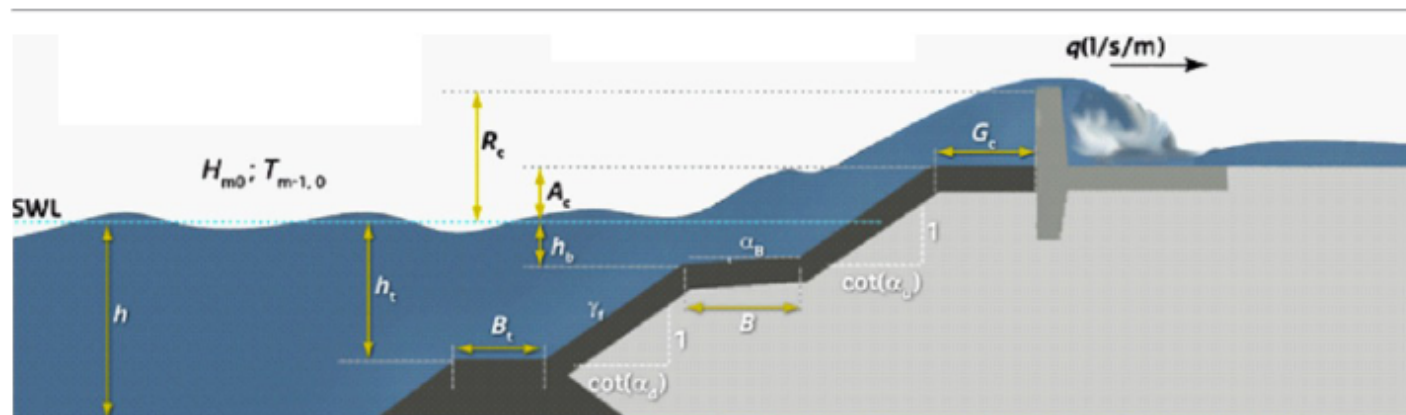
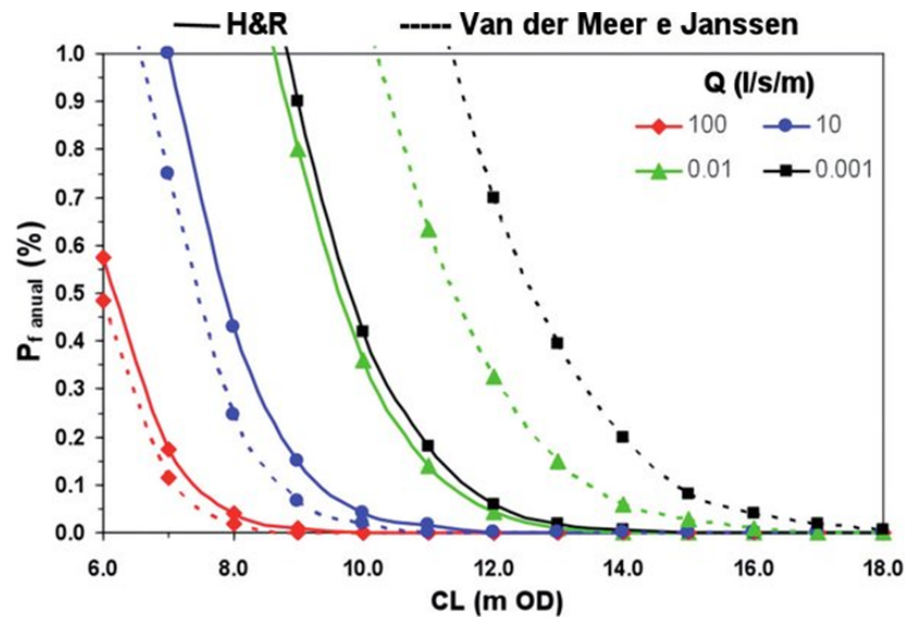


Risk assessment and management of coastal erosion.

- Harbour's safety and risk management;
- Harbour's design;



Former applications of risk and reliability in ME



Key trends in application to ME

RECOMENDACIONES PARA OBRAS MARÍTIMAS



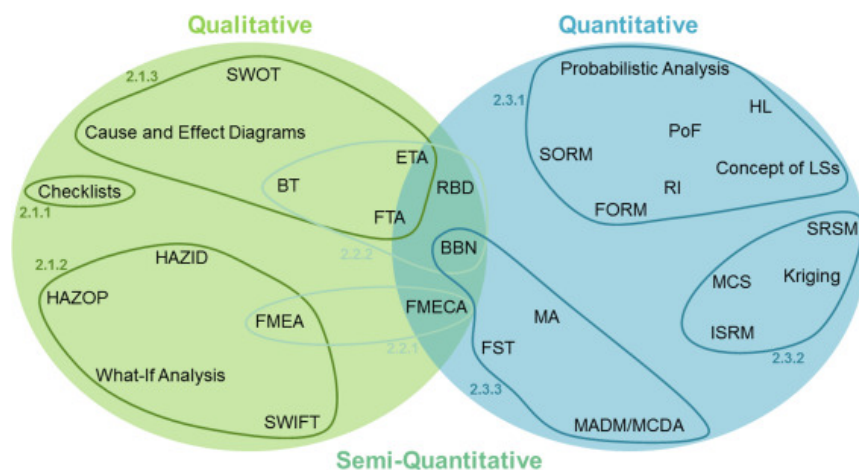
Procedimiento general y bases de cálculo en el proyecto de obras marítimas y portuarias. PARTE I



CLASSIFICATION NOTES
NO. 30.6

STRUCTURAL RELIABILITY ANALYSIS OF MARINE STRUCTURES

JULY 1992



DNV·GL

SERVICE SPECIFICATION

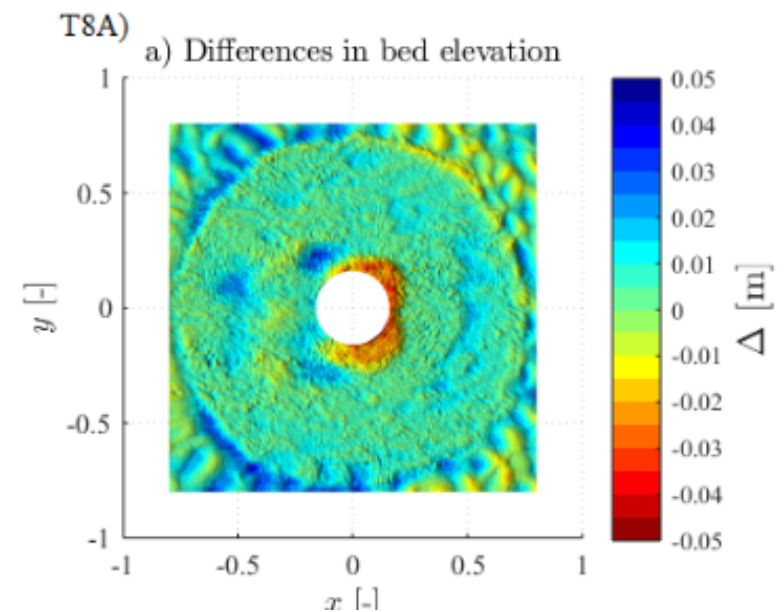
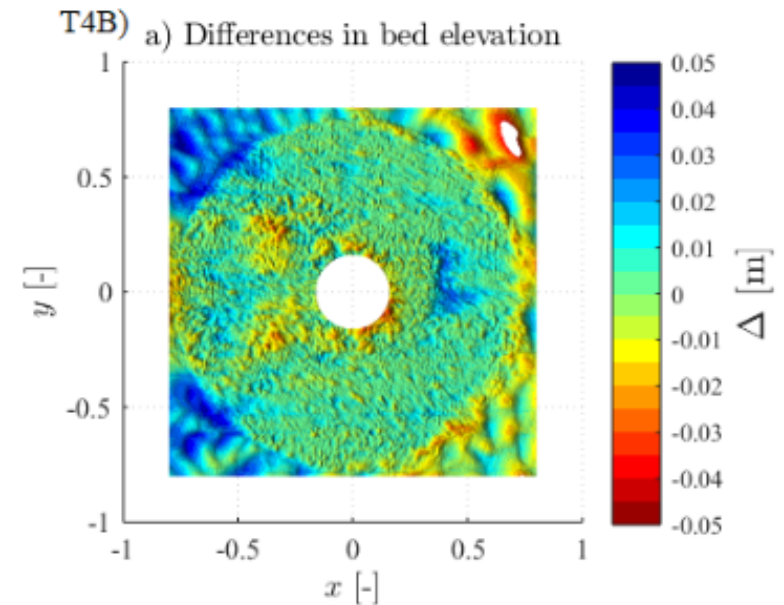
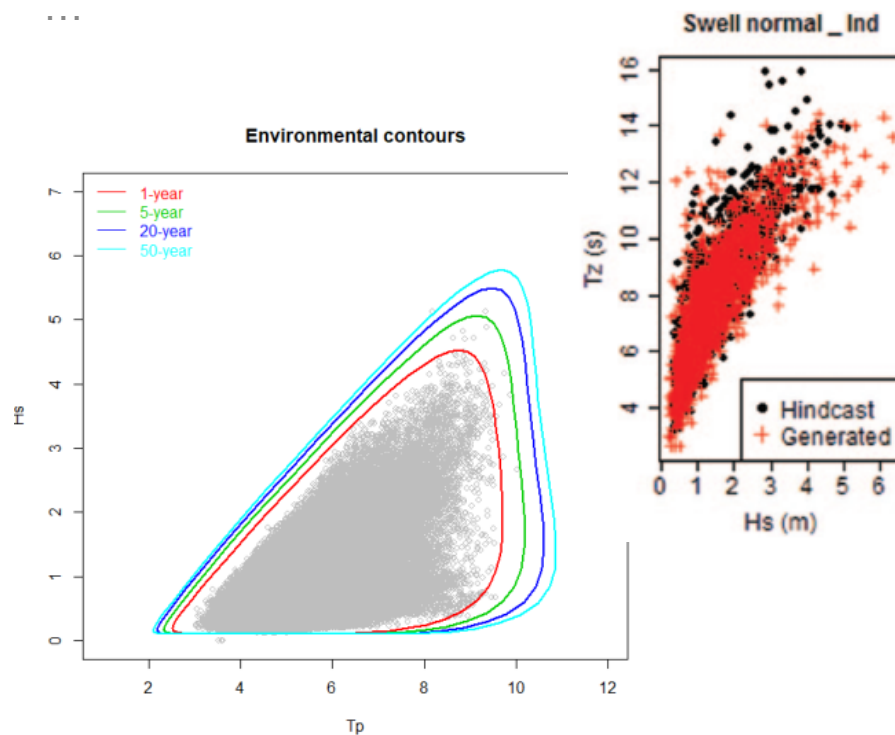
DNVGL-SE-0263

Edition March 2016

Certification of lifetime extension of wind turbines

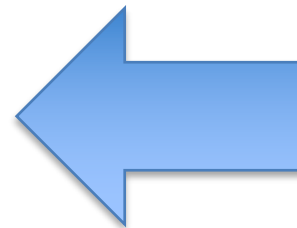
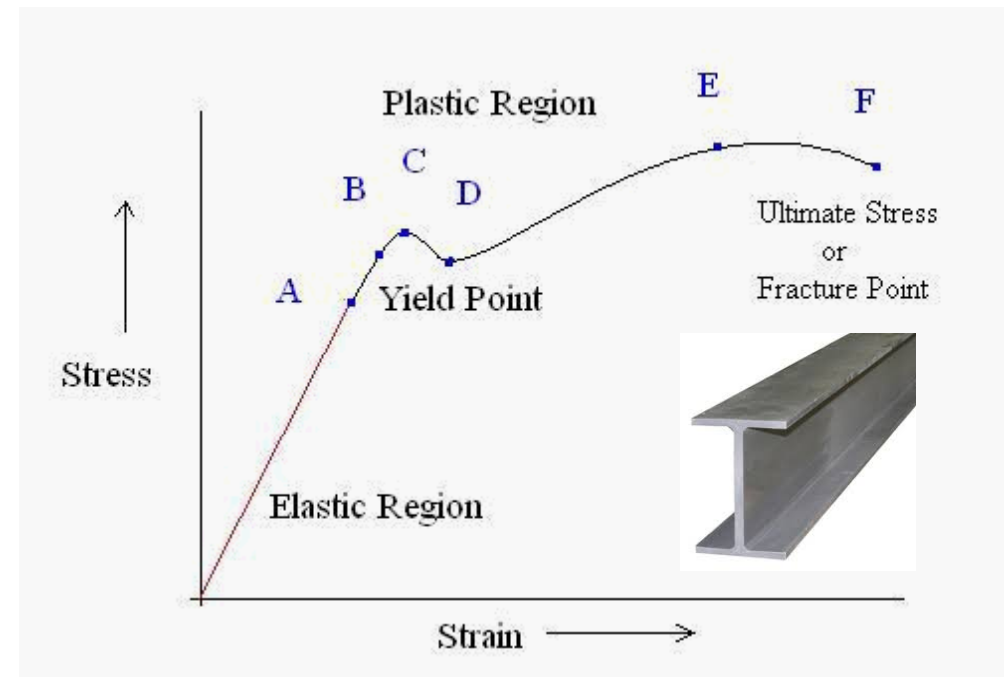
Key trends in application to ME

- Climate change and lifetime extension;
- Met-ocean data analysis;
- Extreme phenomena;
- Marine renewable energy structures and foundations;
- Reliability of rubble-mound structures;
- ...

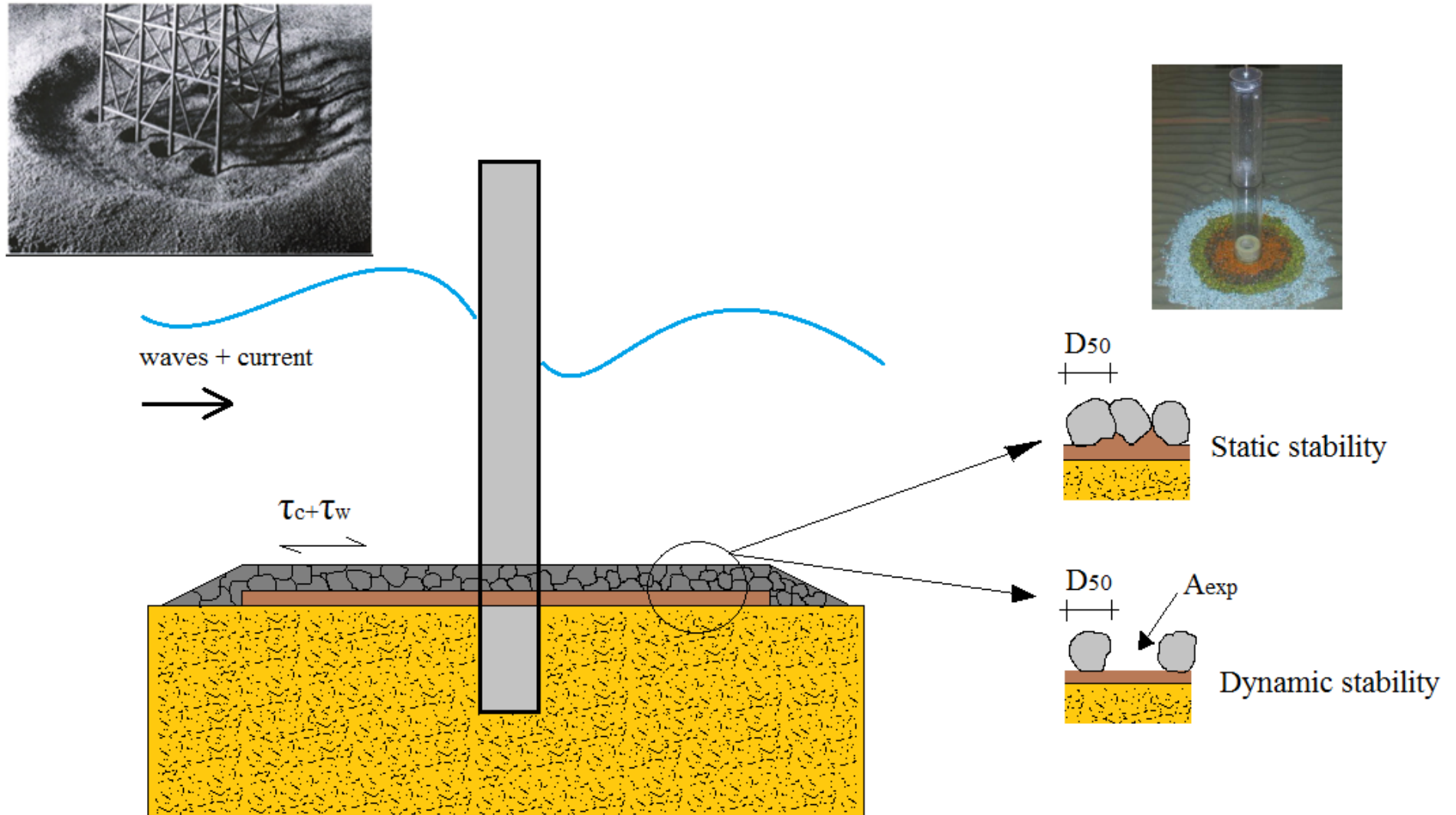


Application to scour protections

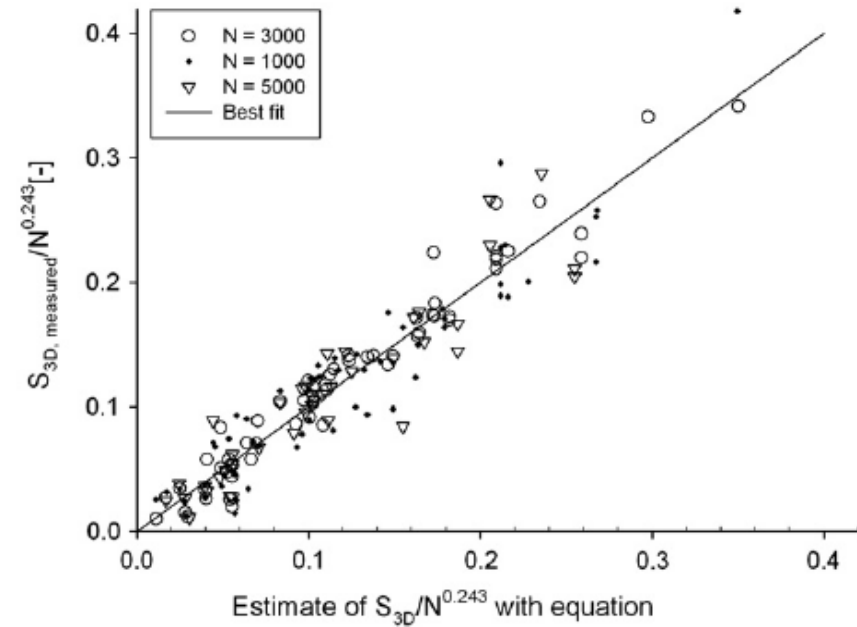
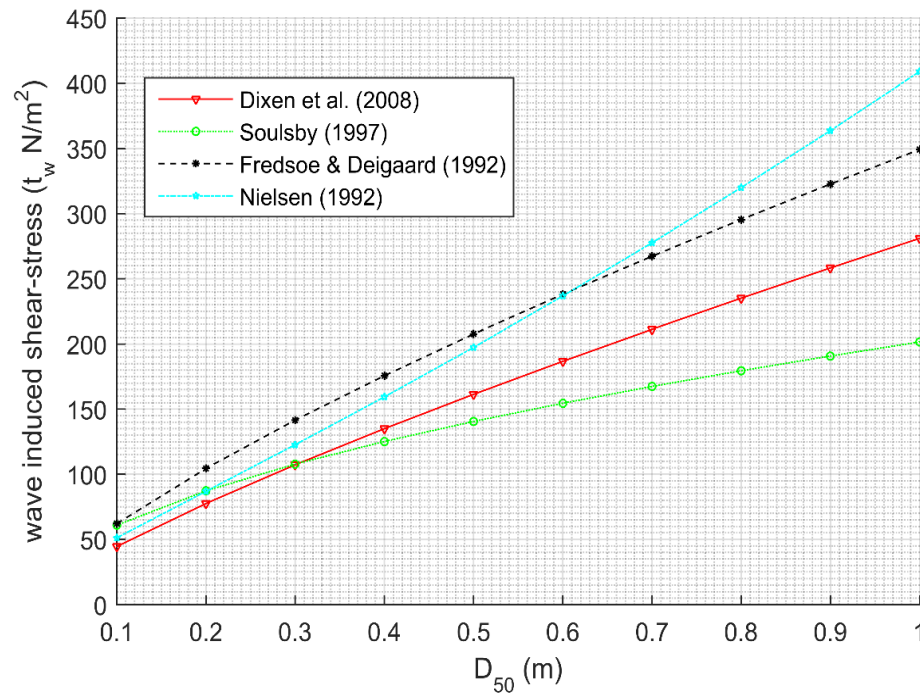
- How do we define failure?
- How do we analyze the reliability of something we do not see?
- How do we define the probability of failure?
- What is the acceptable probability of failure?
- How do you model the physics of the phenomena?
 - Entrainment of the armour stones;
 - Critical shear-stress (resistance);
 - Sea-state (loads)...



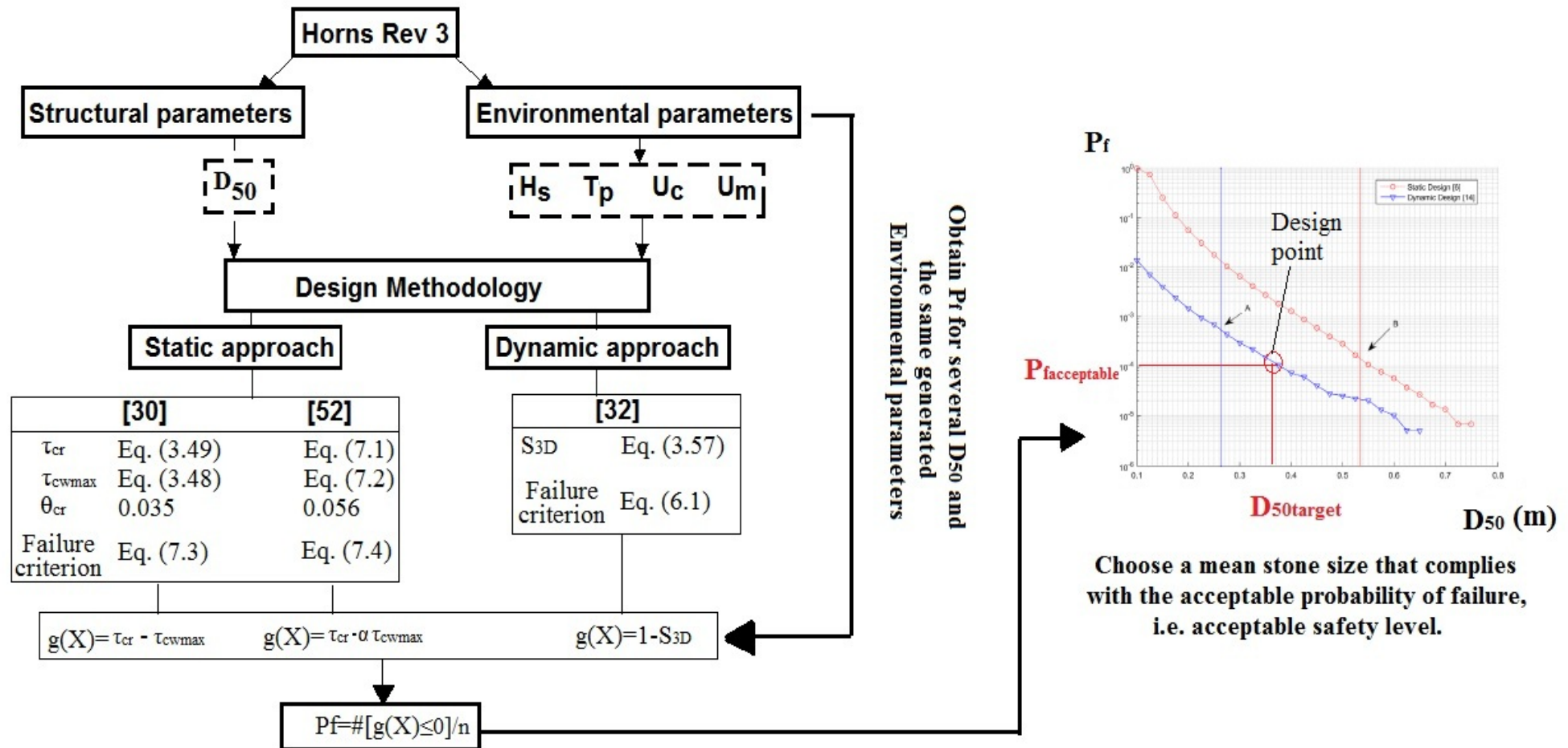
Application to scour protections



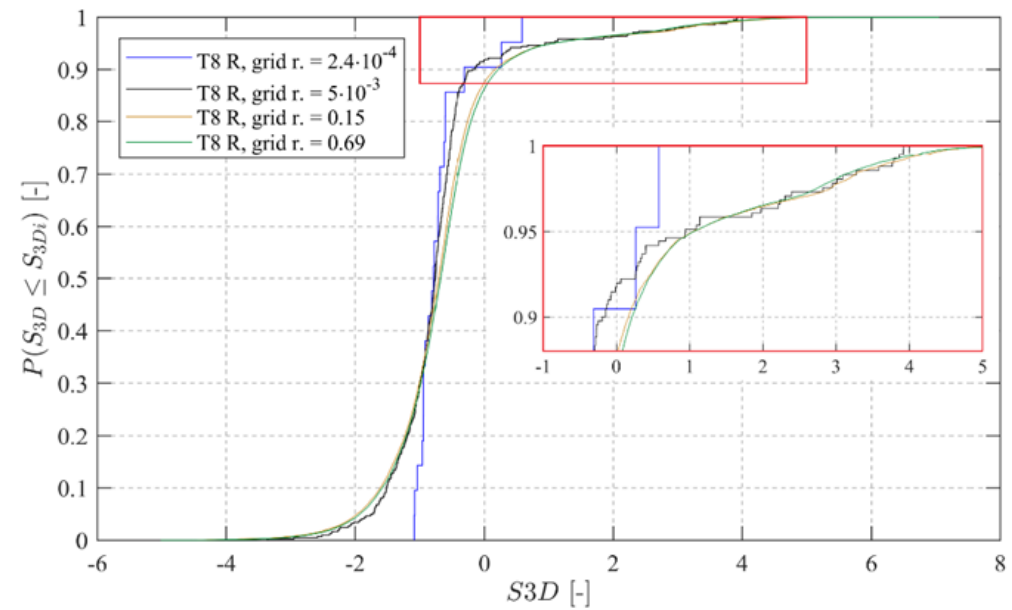
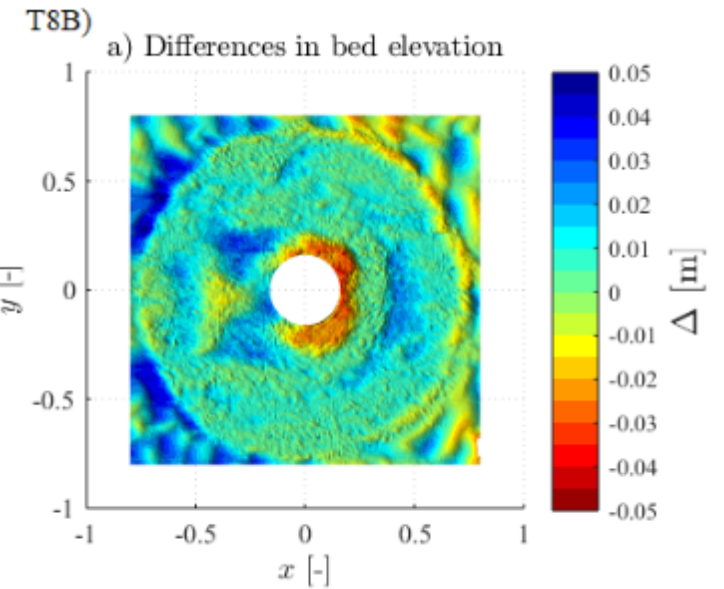
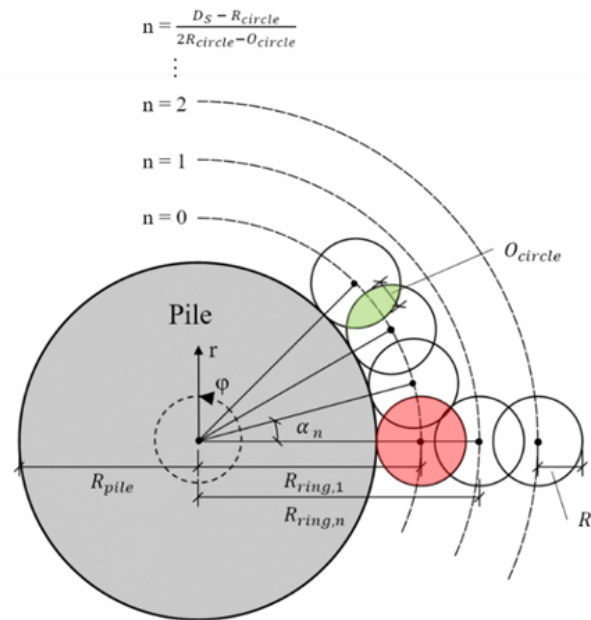
Application to scour protections



Application to scour protections



Spin-off Research



Conclusions

- Risk and reliability analysis remain as key tool to develop the design of maritime, coastal and offshore structures;
- It is crucial to optimize resources and money saving;
- Despite the random behaviour of the materials and the difficulty in modelling the physics of the underlying phenomena, the community is moving towards a successful combination between qualitative and quantitative methods;
- Reliability-based design of maritime, coastal and offshore has registered a considerable development over the last 30 to 40 years and has direct impact on other research topics that ultimately contribute to the advance of maritime engineering.

Maritime Engineering

ice Publishing

A review of reliability analysis of offshore scour protections

Thank you!

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