



Parques eólicos offshore: Desafios ambientais, geológicos e geotécnicos

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Estrutura da apresentação

- Principais riscos geológicos marinhos
- Tecnologias convencionais e emergentes
- Estudos de desktop, integração de dados da costa brasileira e Rio Grande do Sul
- Considerações finais

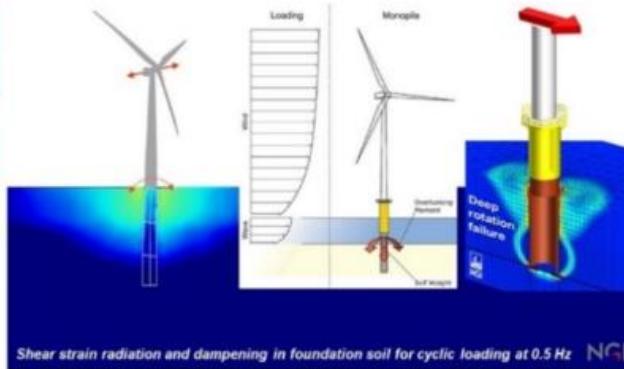


Figure 16. Monopile embedment depth adapted to sediment stratigraphy (illustration COWI/IMS). Soil dampening, transfer of loads and ULS deep rotation failure for monopoles (illustration NGI).



Figure 23. From left to right: SPAR, Semisub and TLP type of OWT floaters (Illustration: DNV-GL).

Geohazards marinhos

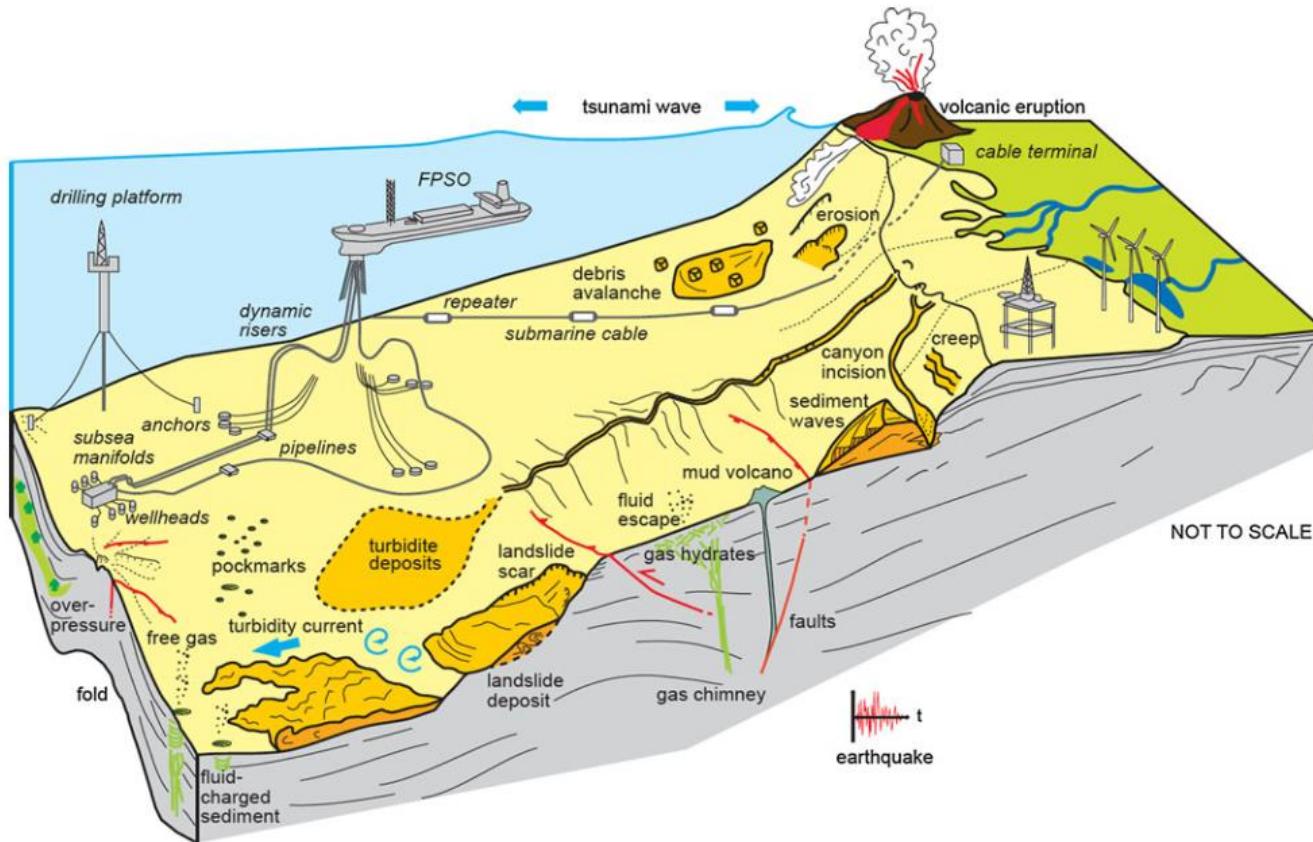
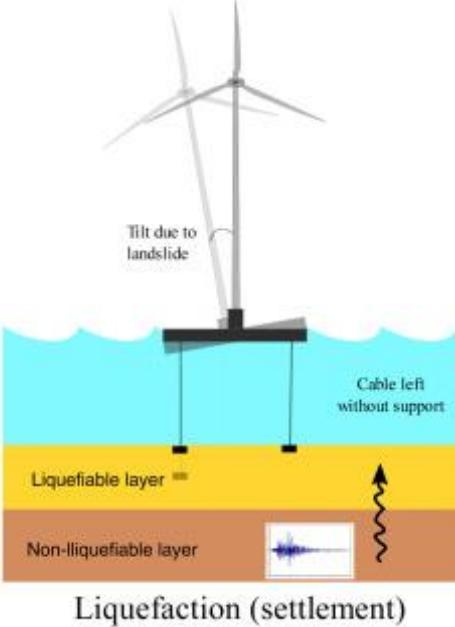


Fig. 2 Cartoon summarizing the seafloor features linked to potentially hazardous geological processes. This figure depicts an idealized continental margin with both natural geohazard-bearing features and main anthropogenic structures lying on the seafloor

Chiocci et al. (2011)

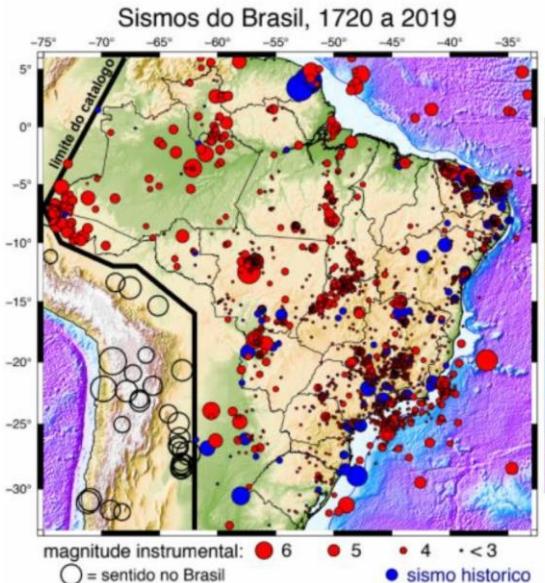


Fault rupture



Liquefaction (settlement)

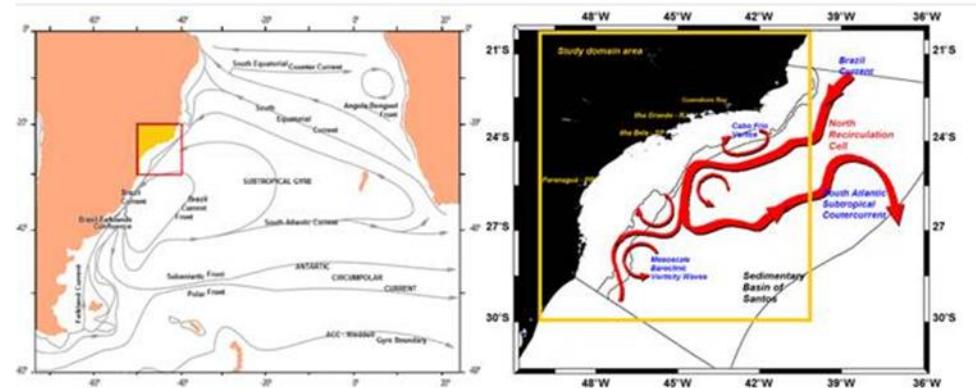
Amani et al. (2023)



RSBR (2019)

Avanço no Brasil: Senior Seismic Hazard Analysis Committee – Projeto SSHAC Nível 2

Correntes superficiais do Brasil (linhas cinza) e sistemas de recirculação subsuperficial (setas vermelhas)



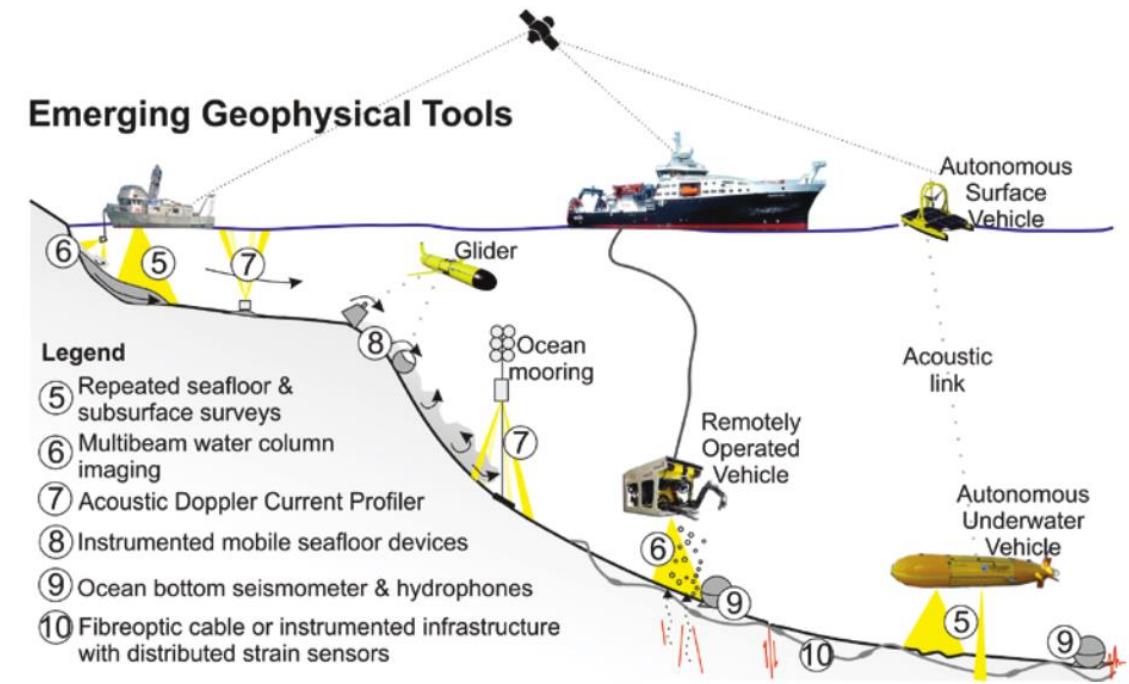
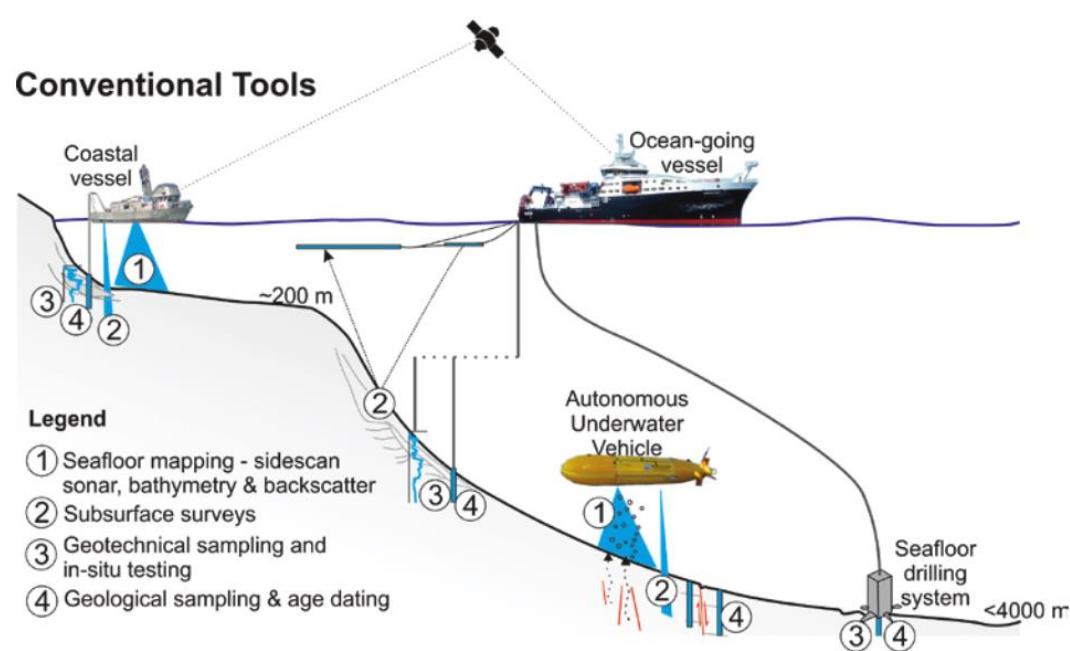
Peterson & Stramma (1991), Mattos (2006), Soares (2014) apud Zacharias & Fornaro (2020)



Figure 12. Scour development around a monopile foundation (illustrations: EIWA).

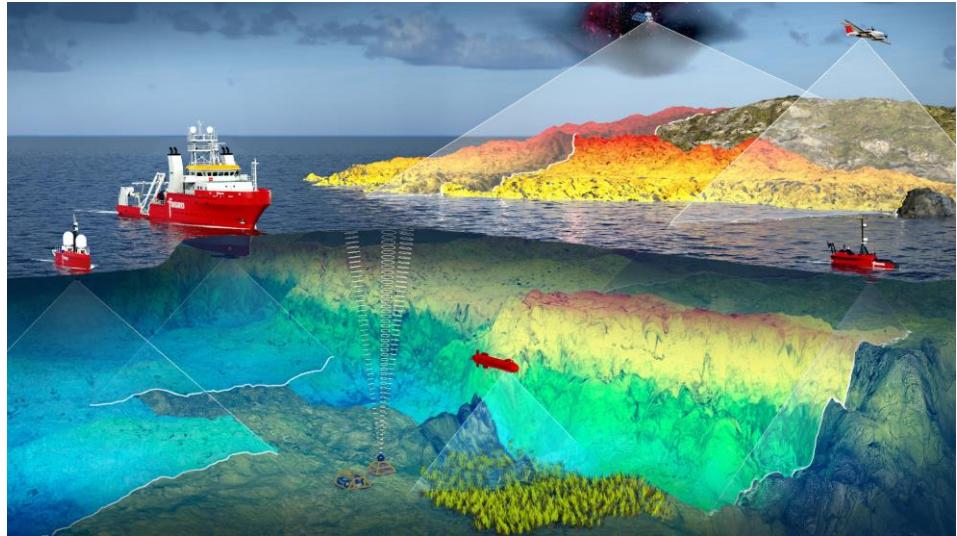
Sparrevik (2019)

Exemplos de tecnologias



Clare et al. (2017)

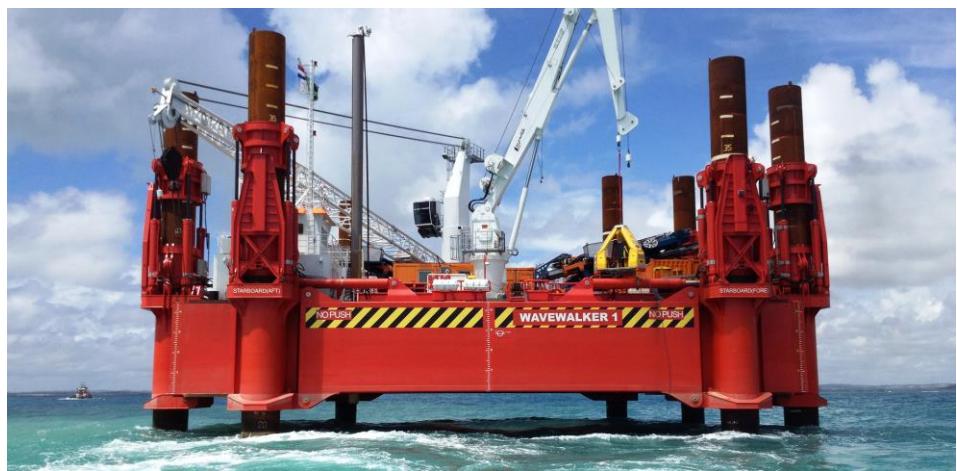
Exemplos de tecnologias



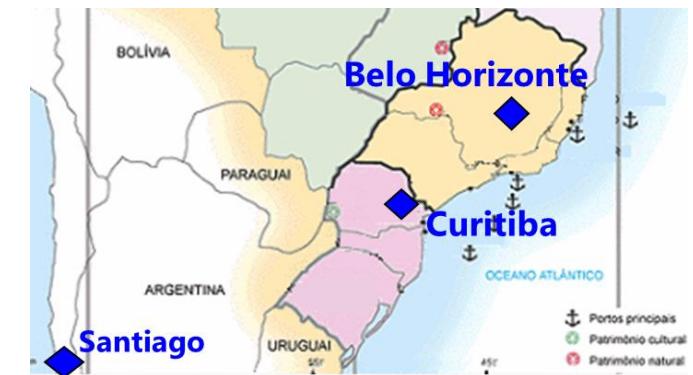
Modular SEACALF® system



FUGRO SMARTPIPE®

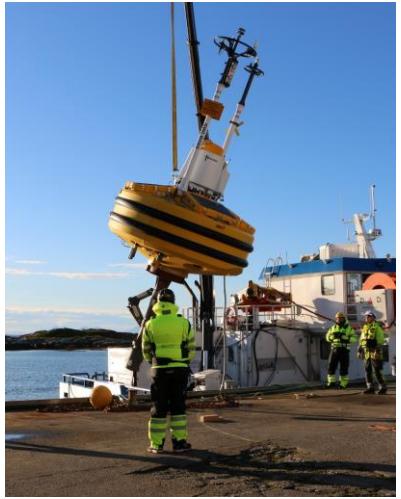


SEASCOPE 10

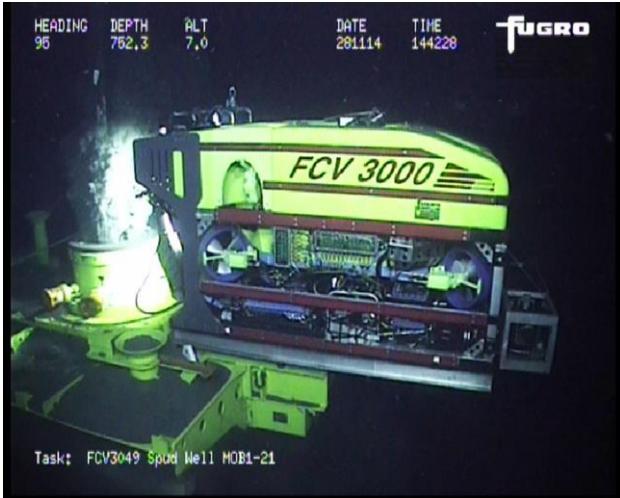


Portos principais
Patrimônio cultural
Patrimônio natural

Exemplos de tecnologias



Bóia Lidar



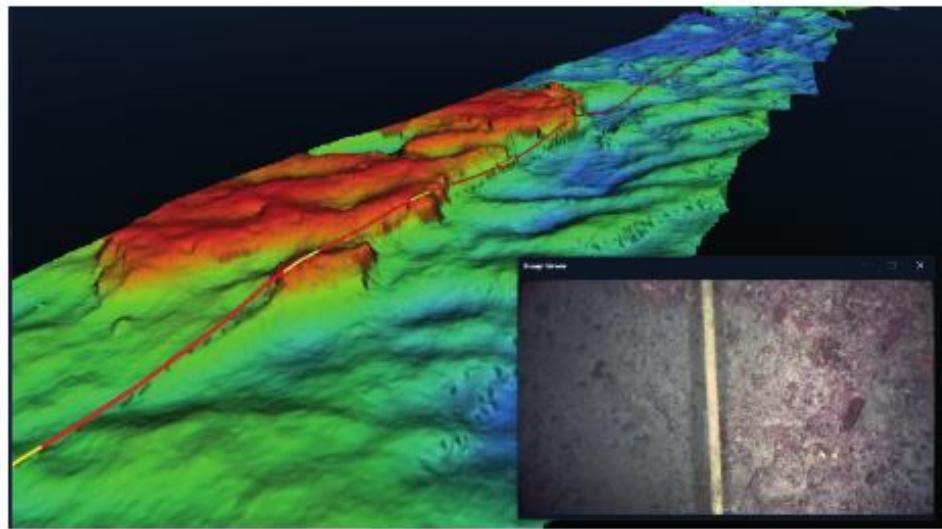
ROV & eROV



USV



Centro operação remota

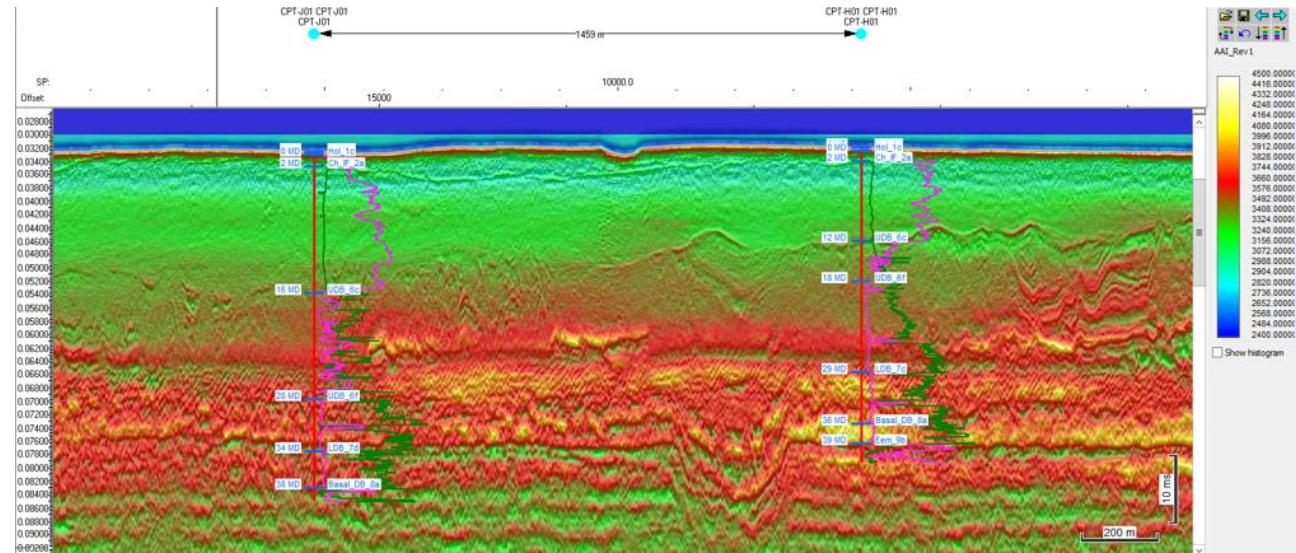


Near real-time visual display of cable asset

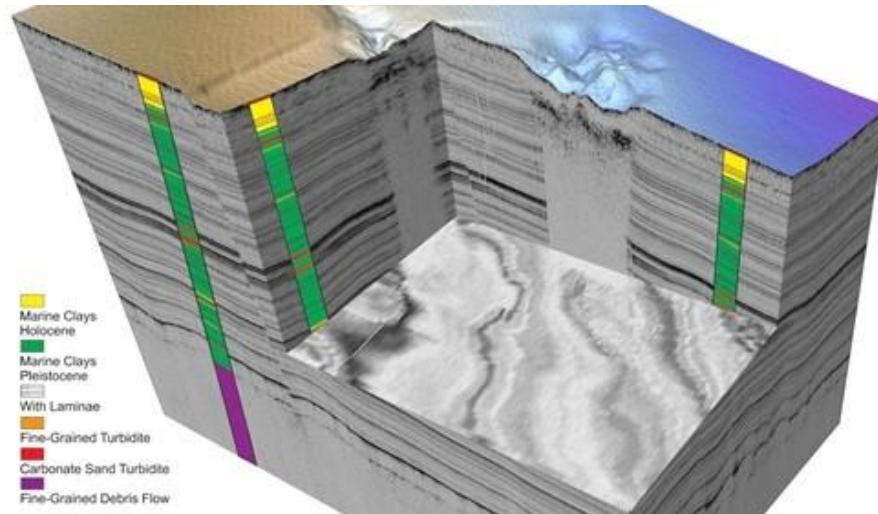
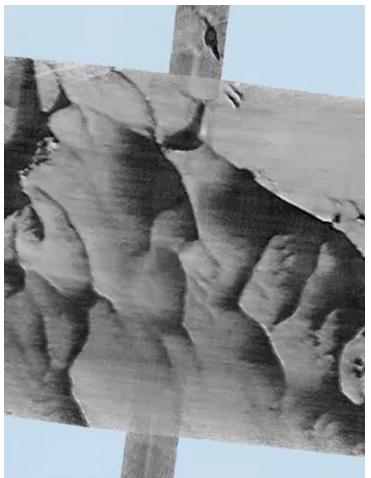
FUGRO

Batimetria georreferenciada

Integração de dados e inteligência artificial



Perfis de correlação litológica



Confidencial

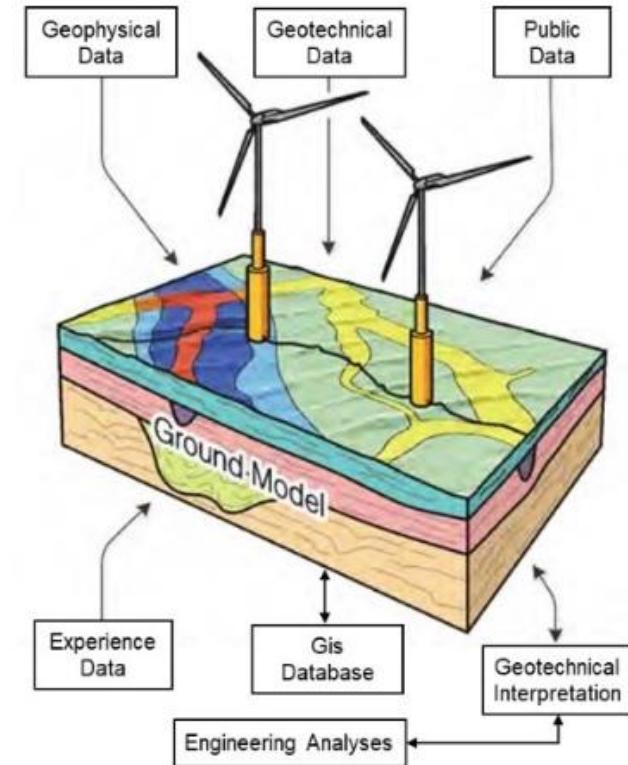
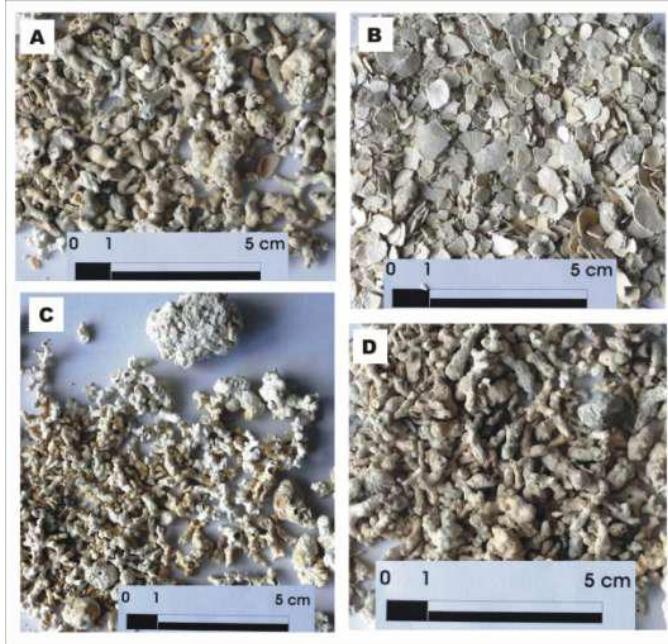


Figure 11. The evolutionary ground model [4].

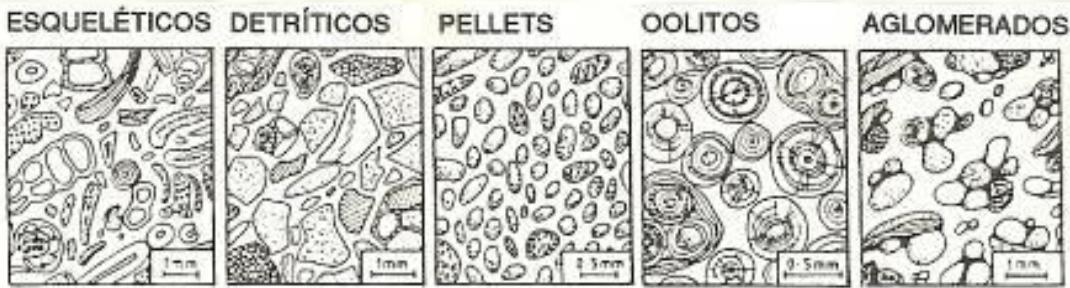
Sparrevik (2019)

FUGRO

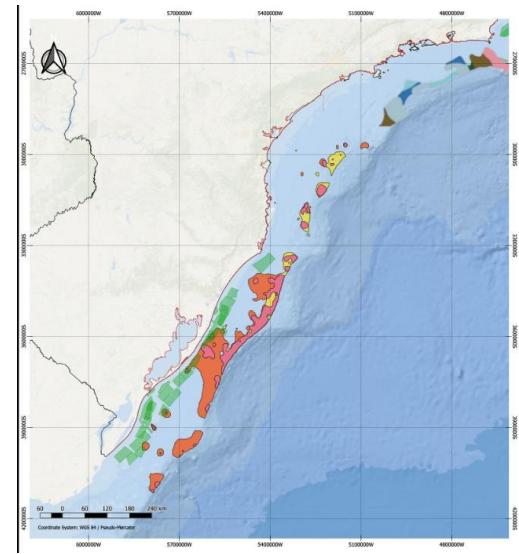
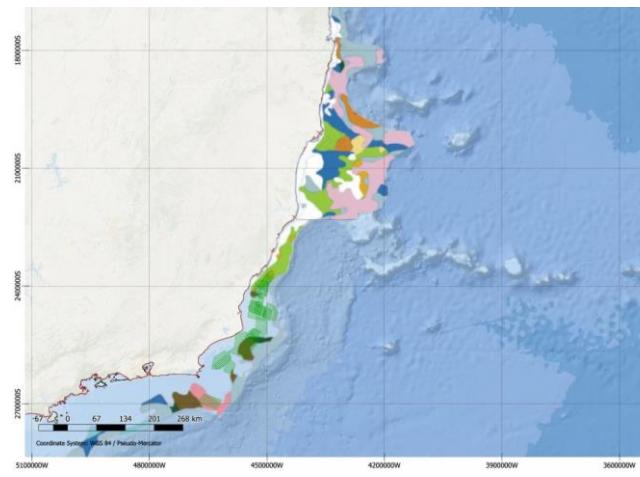
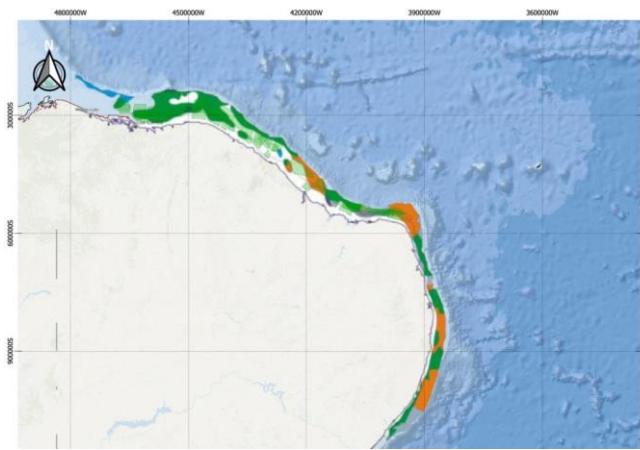
Brasil: areias calcárias



DNPM (2010)



Kormann (1993)



Kormann et al (2025)

Integração de dados

Dados ambientais



Dados antrópicos



Dados geológicos



Dados geotécnicos



Dados meteoceanográficos



Dados geofísicos



Documentos



Considerações finais

- Estado da prática de parques eólicos offshore → informações valiosas sobre riscos geológicos marinhos e ambientais.
- Desejável abordagem multidisciplinar para mapeamento, observações, análise e modelagem multiescala.
- Compreensão de processos antrópicos, geológicos e ambientais → levantamentos de alta resolução permitem mapear feições ativas e sua evolução temporal (4D).
- Integração de dados / visualização em tempo real / IA → novas fronteiras na compreensão de processos e riscos.
- Integração de dados georreferenciados ambientais, antrópicos, meteoceanográficos, geológicos, geofísicos e geotécnicos → tomada de decisão informada e monitoramento → suporte ao desenvolvimento de infraestrutura de reduzido impacto ambiental e com impactos sociais positivos.

Obrigado!

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