



Energia Ondas

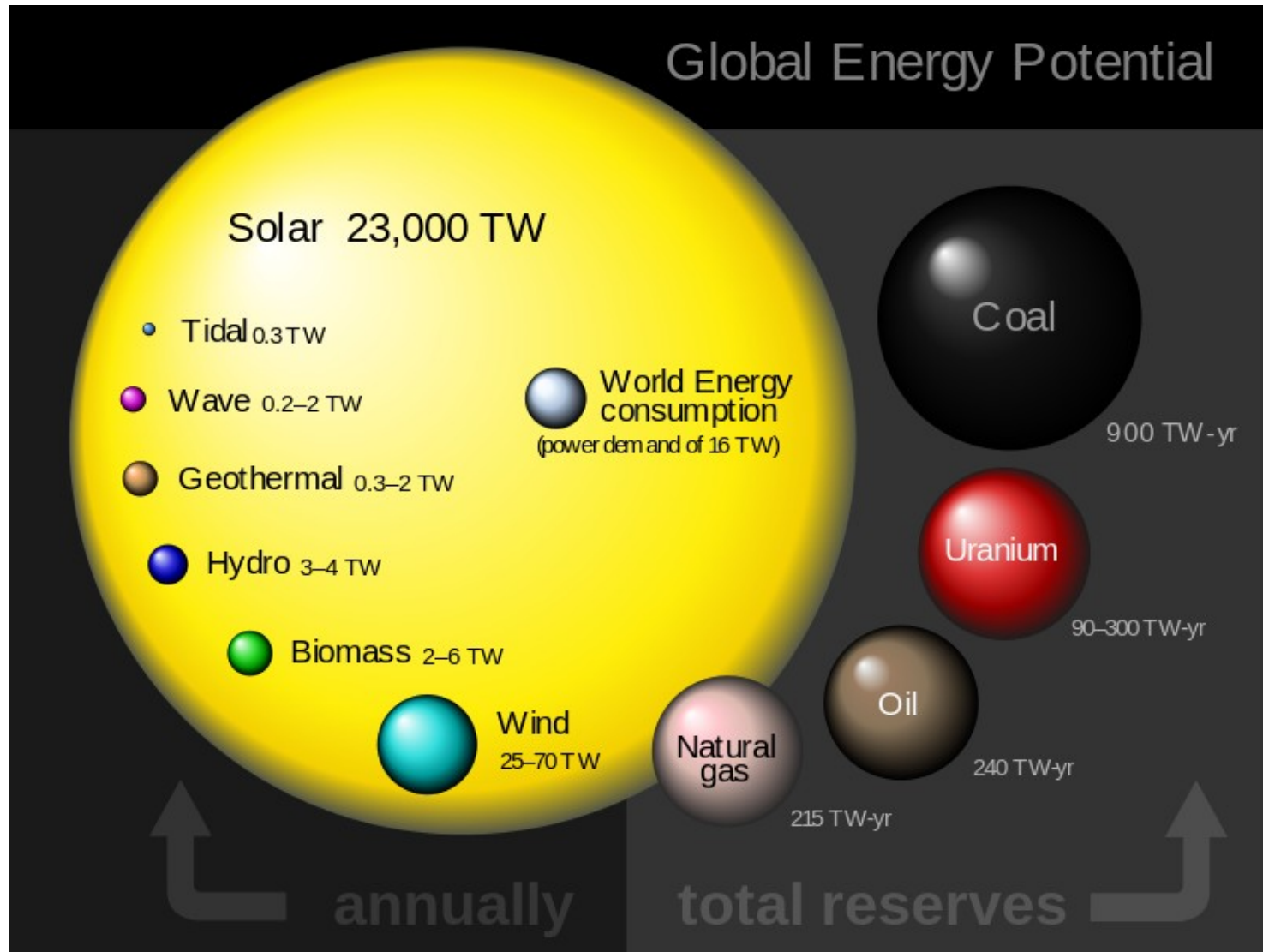
João Flesch Fortes



Energia Oceânica

- Ondas
- Correntes
- Maré
- Diferença de Temperatura
- Diferença de Salinidade
- VIV - Vibração induzida por Vortice

Panorama Mundial e Nacional



Energia Oceânica

- Térmica - Havaí

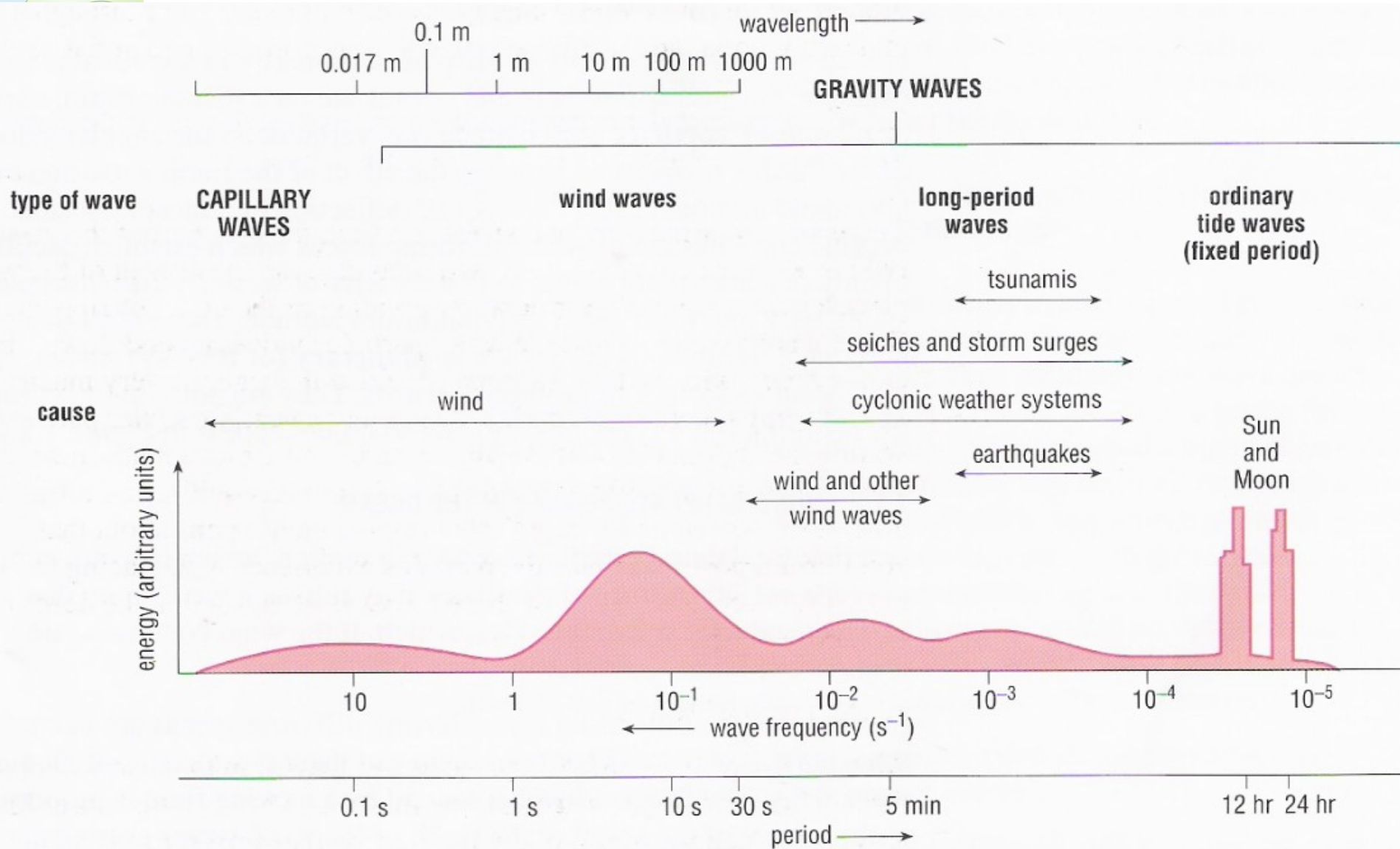




Energia de Ondas

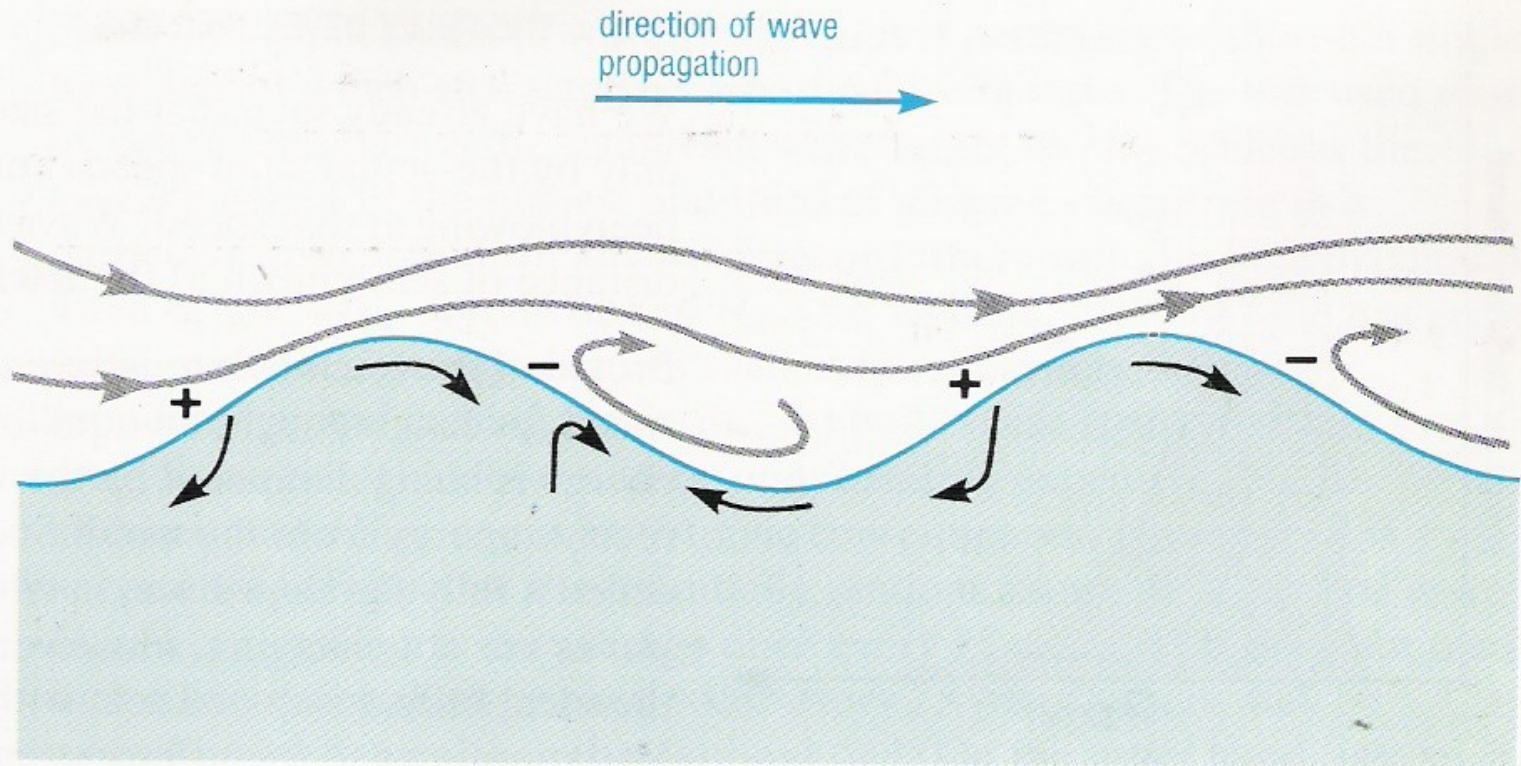
Energia de ondas de gravidade de superfície geradas pelo vento.

Ondas de Gravidade de Superfície



Geração de Ondas

11

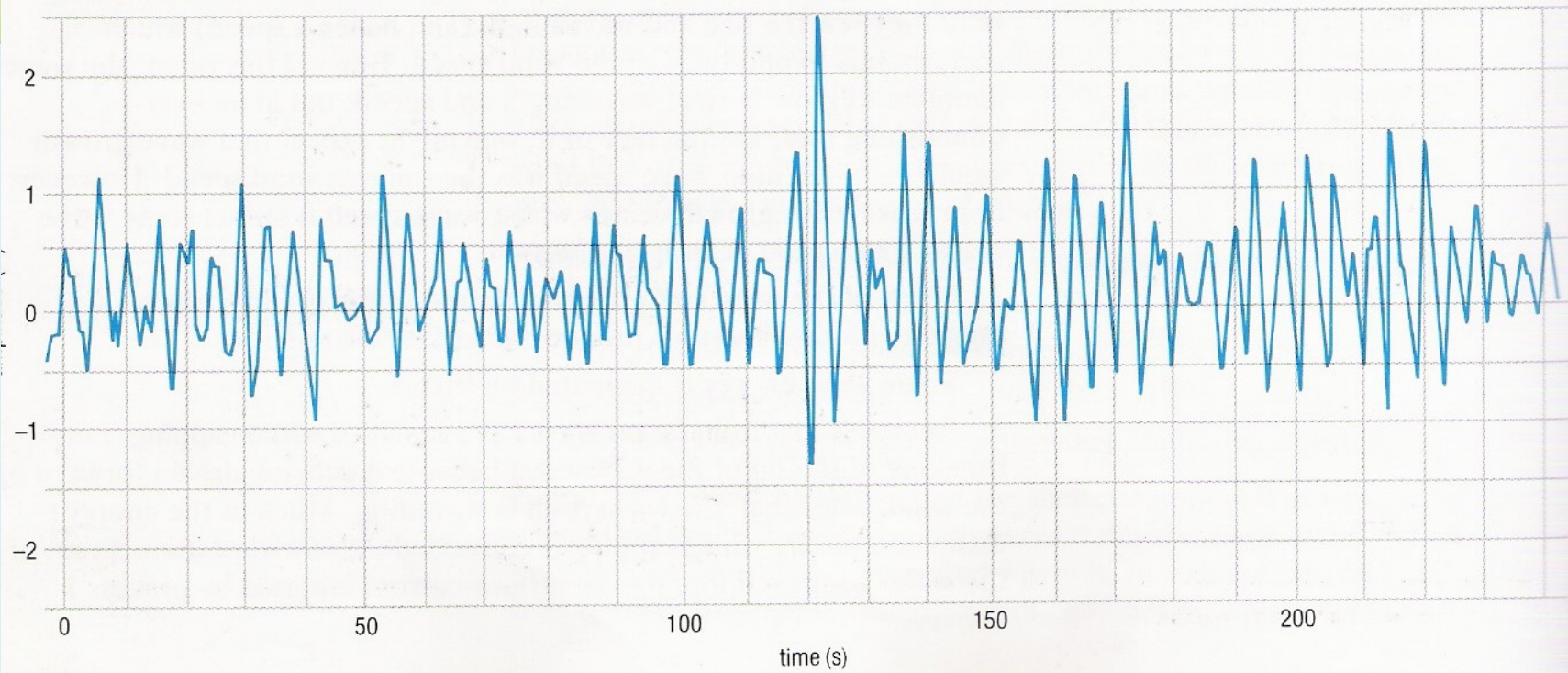




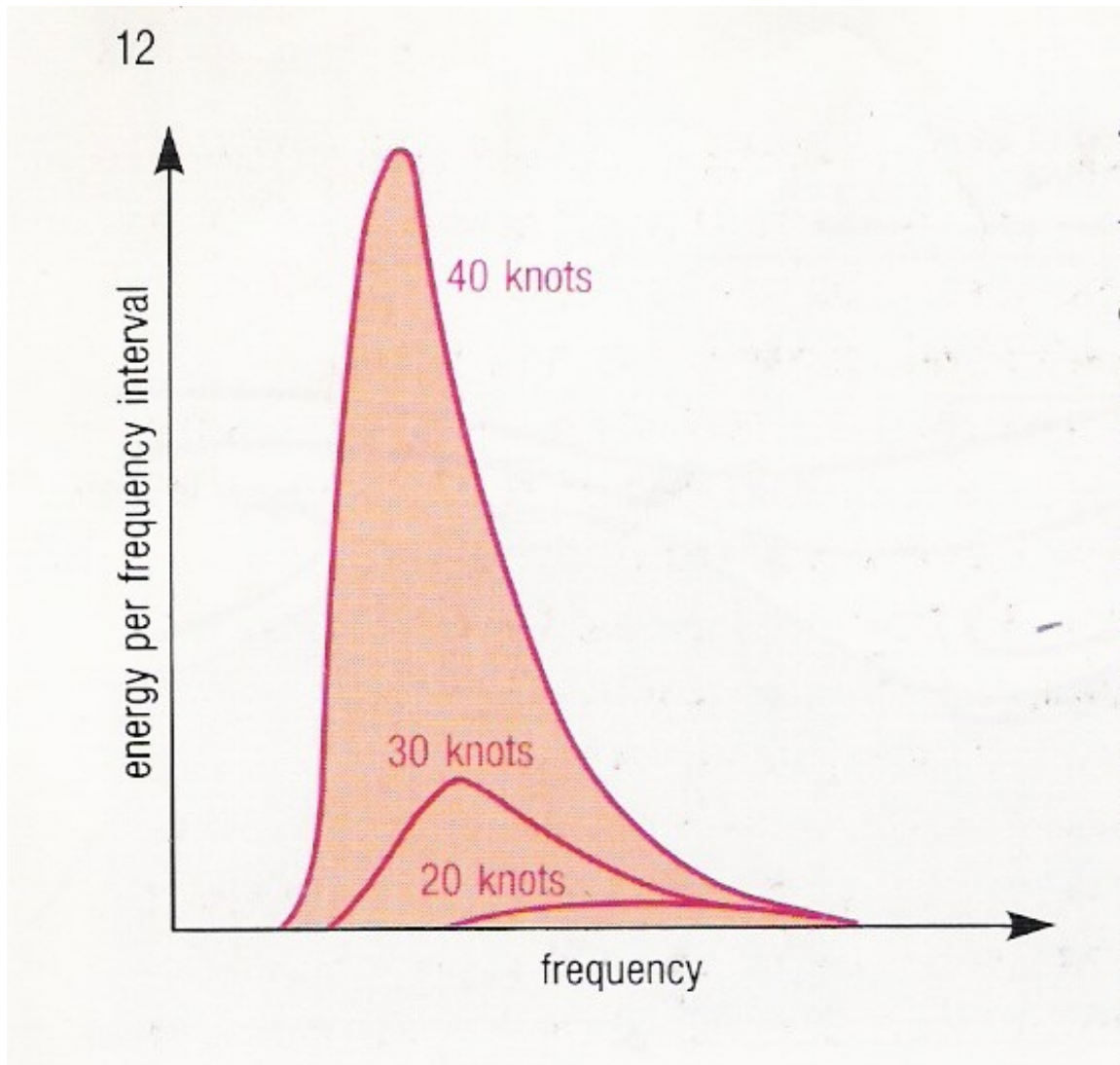
Geração de Ondas

- Intensidade do vento
- Persistência do vento (duração)
- Pista (área de ação do vento)

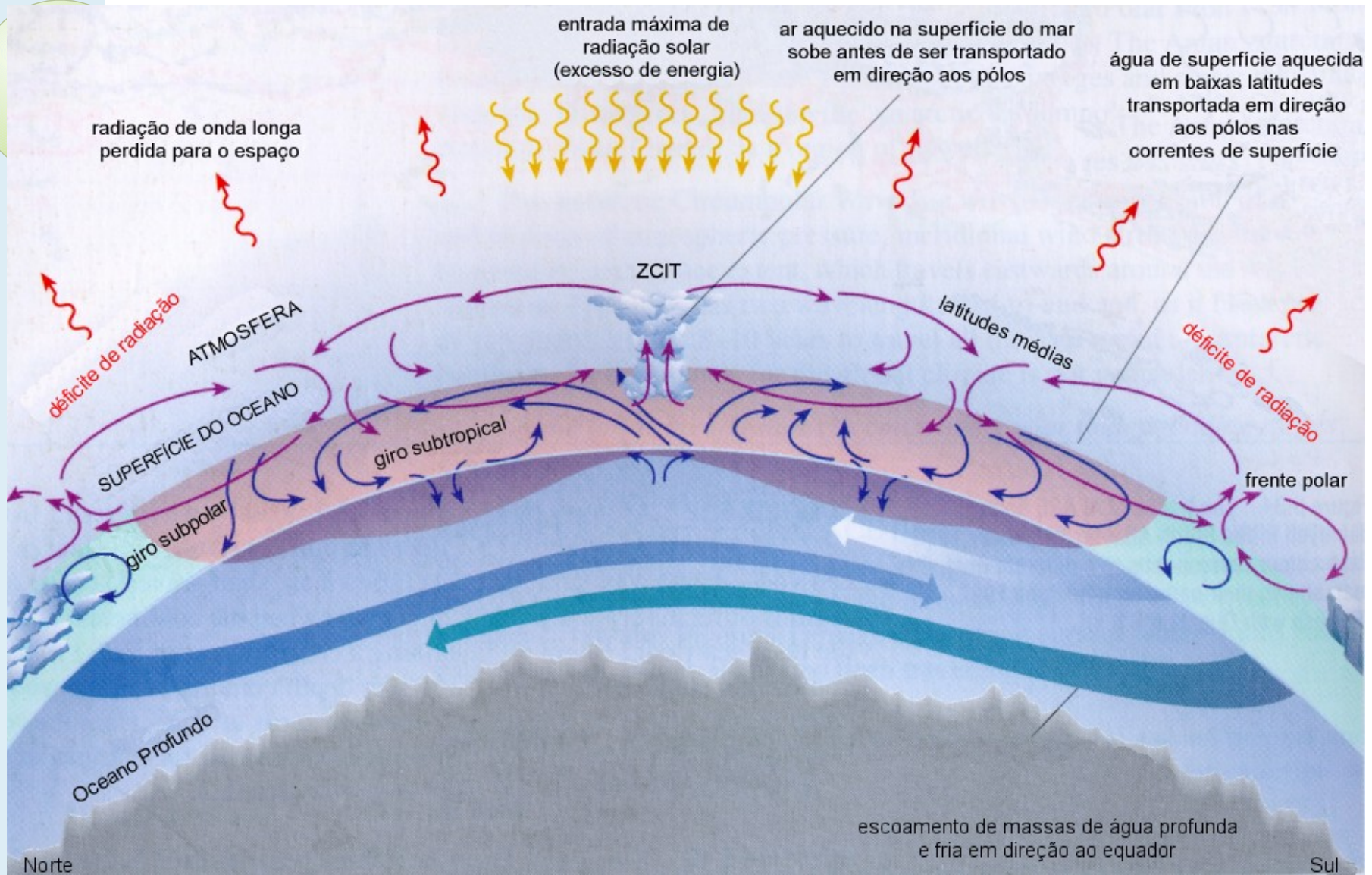
Geração de Ondas



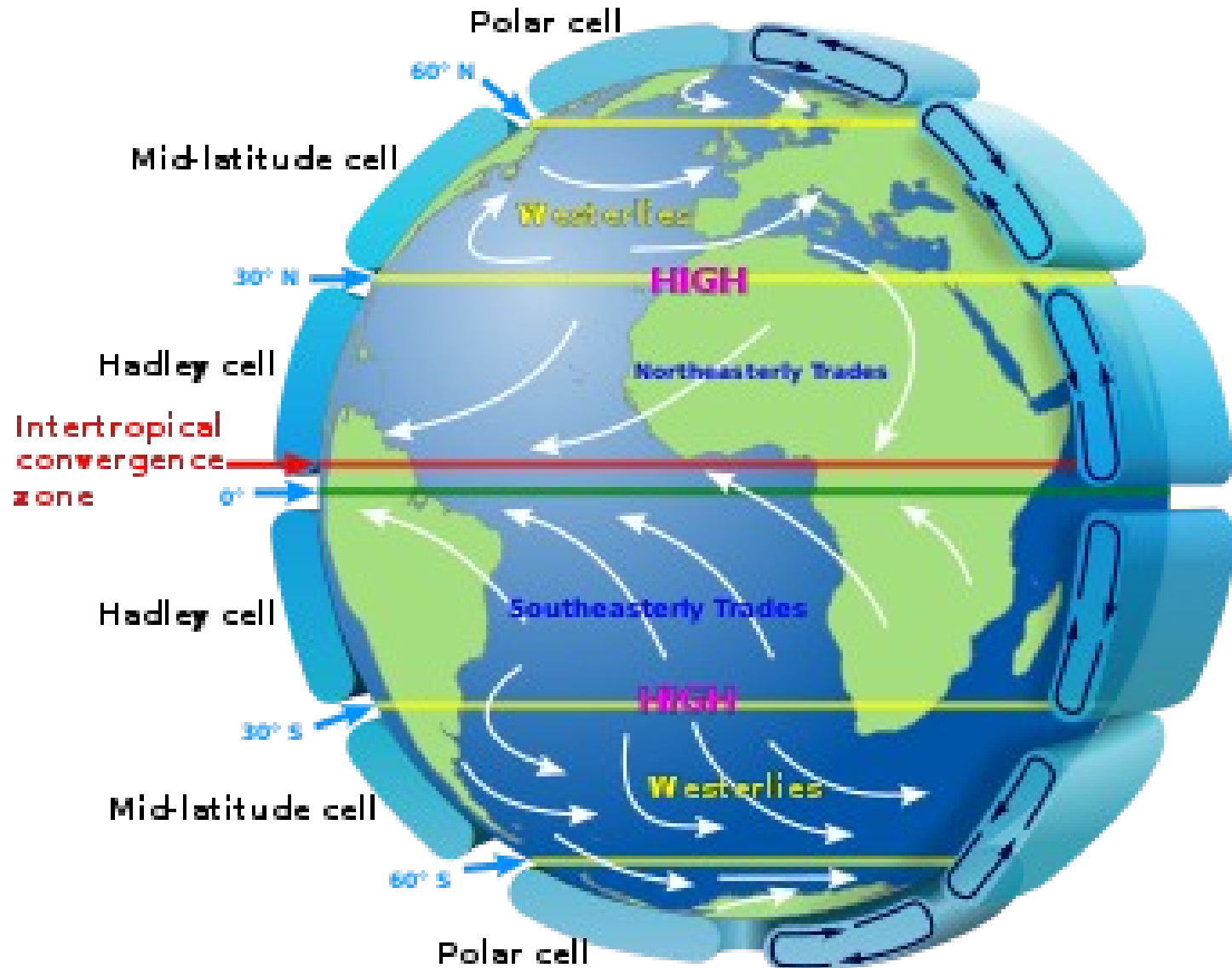
Geração de Ondas



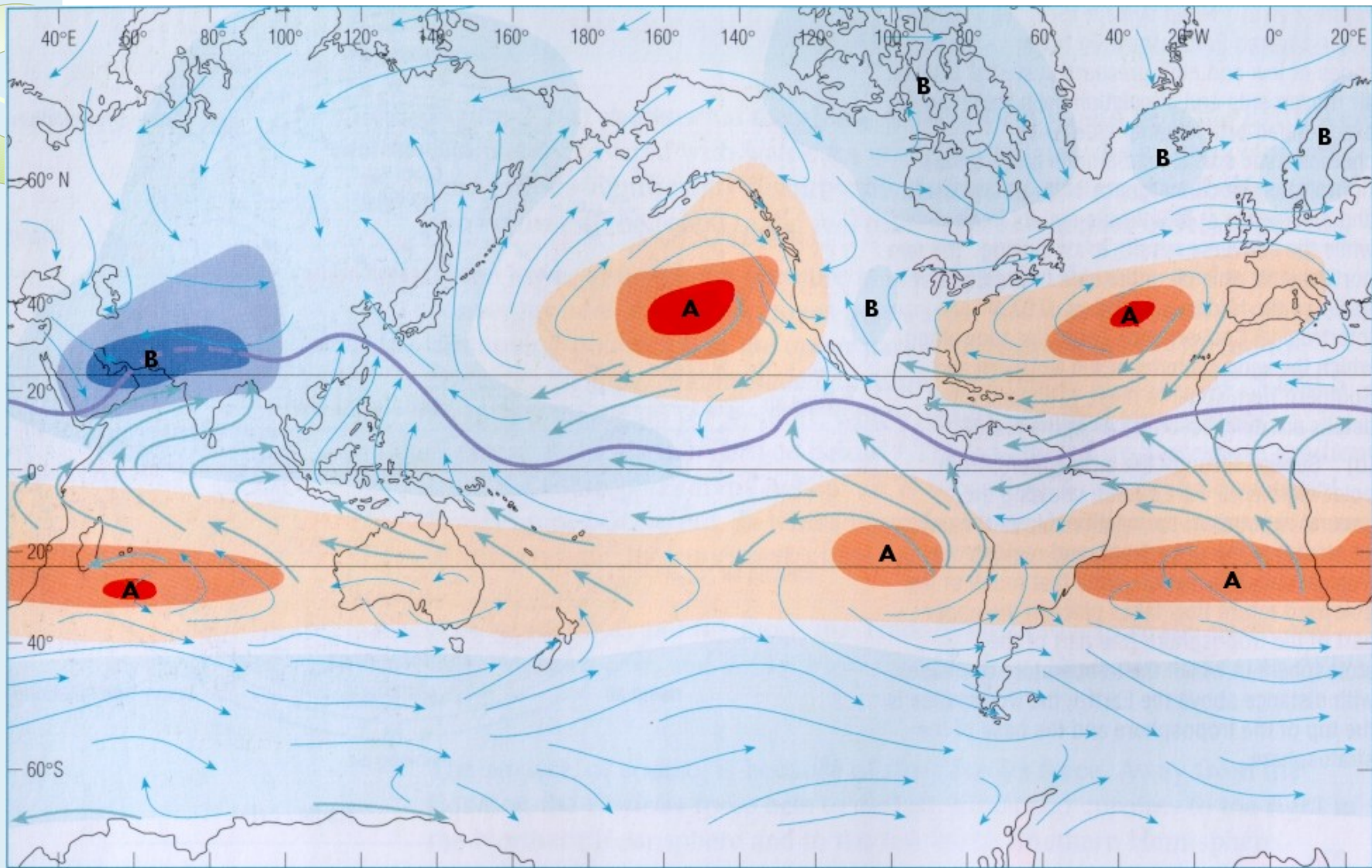
Vento



Vento



Circulação Básica



JULHO

— posição média da
Zona de Convergência Inter-Tropical (ZCIT)

← direção de ventos
mais frequentes

← direção de ventos prevalentes
(≥ 50% das observações)



Visualização

- Earth Null School
<https://earth.nullschool.net/pt/>

Fluxo de Energia

$$FE = \frac{1}{16}g \times \rho \times H_s^2 \times C_g$$

Fluxo de Energia

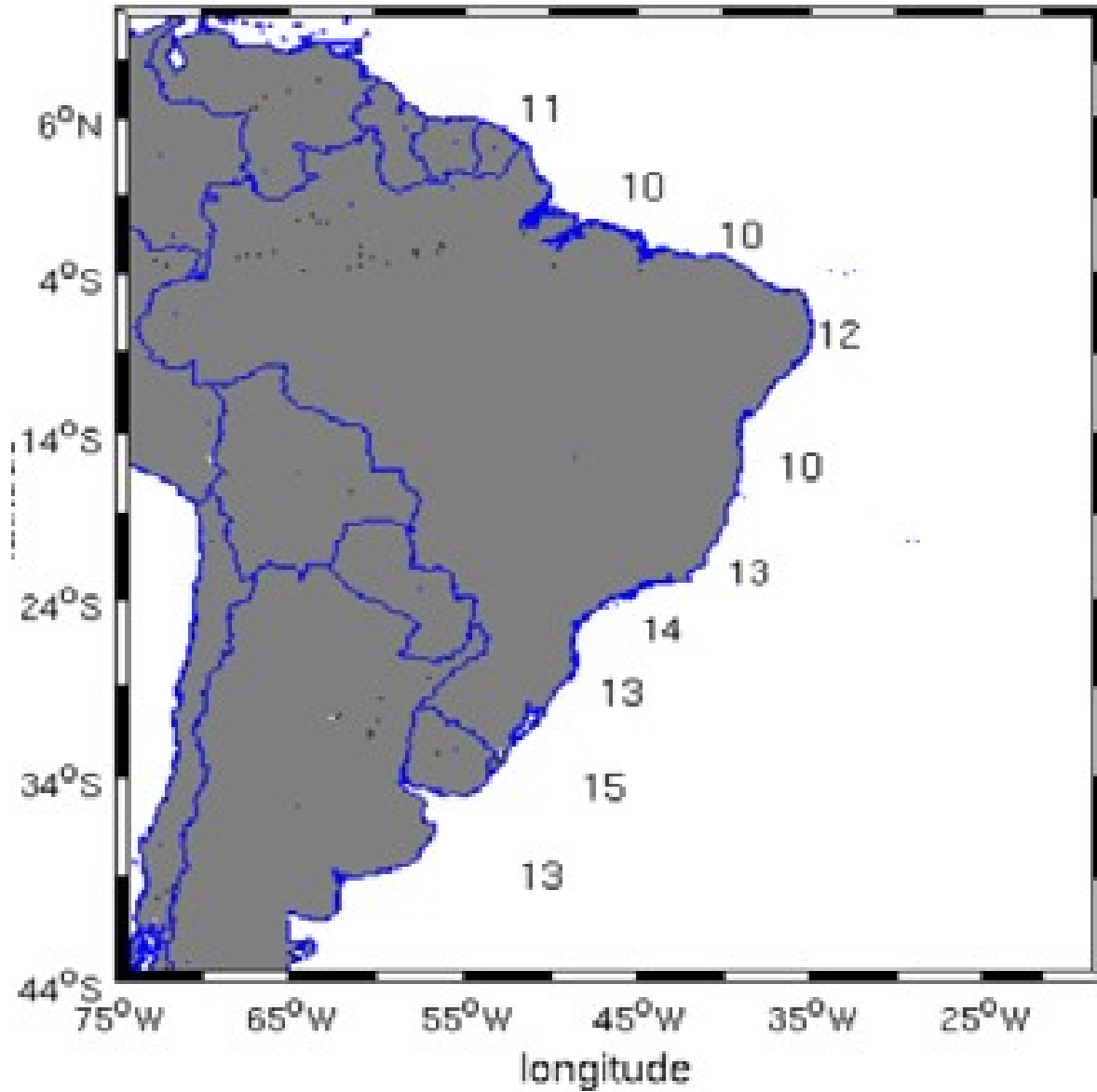
$$FE = k \times H_s^2 \times T$$

$$k = \frac{\rho g^2}{64\pi}$$

Panorama Mundial



Panorama Nacional



Dados Nacionais

- PNBOIA
<https://www.marinha.mil.br/chm/dados-do-goos-brasil/pnboia-mapa>



Dados Nacionais

- SimCosta
<http://www.simcosta.furg.br/>

Dados Nacionais

- Avaliação do potencial de energias marinhas na região de São Sebastião

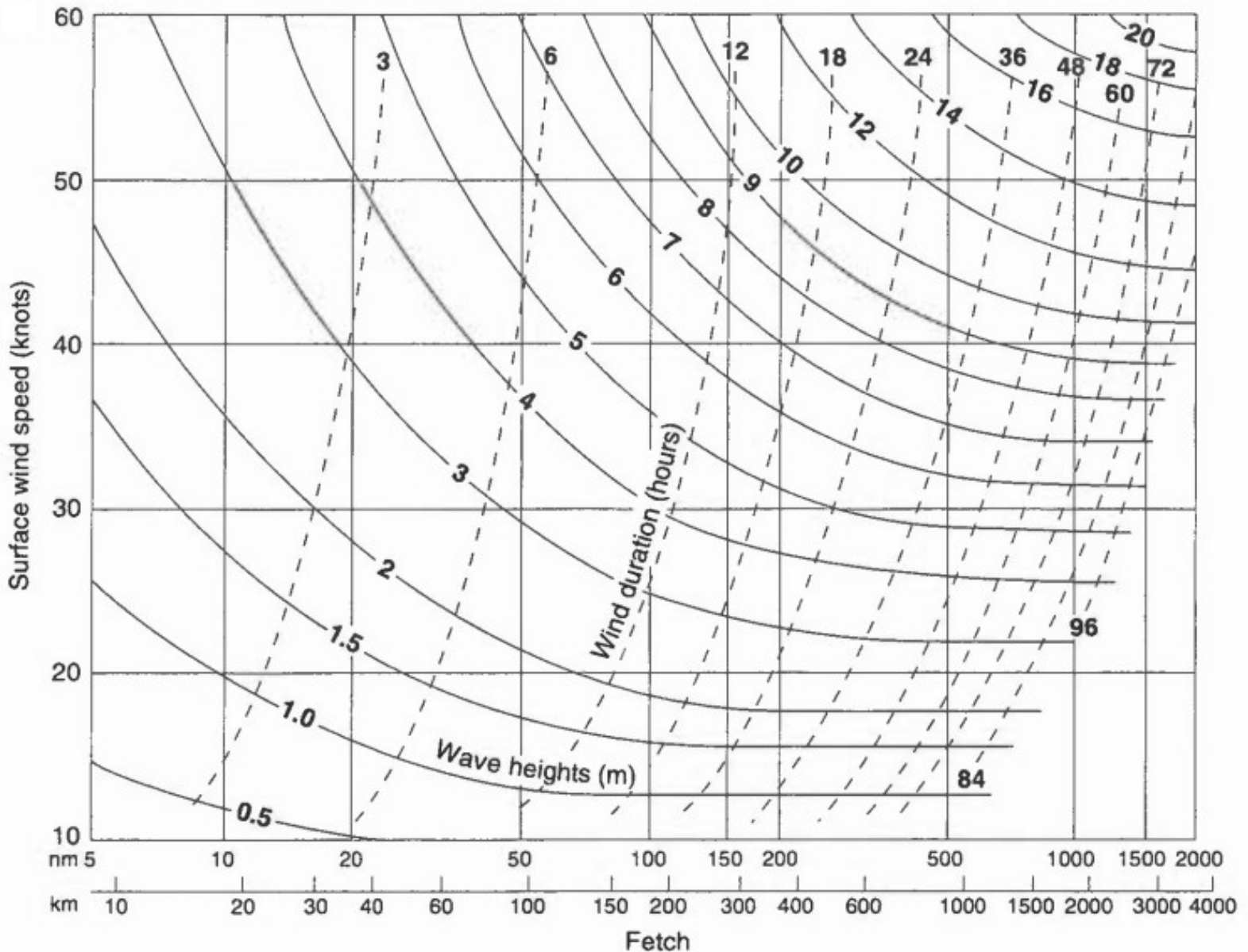


<https://teses.usp.br/teses/disponiveis/21/21135/tde-09012019-135013/pt-br.php>

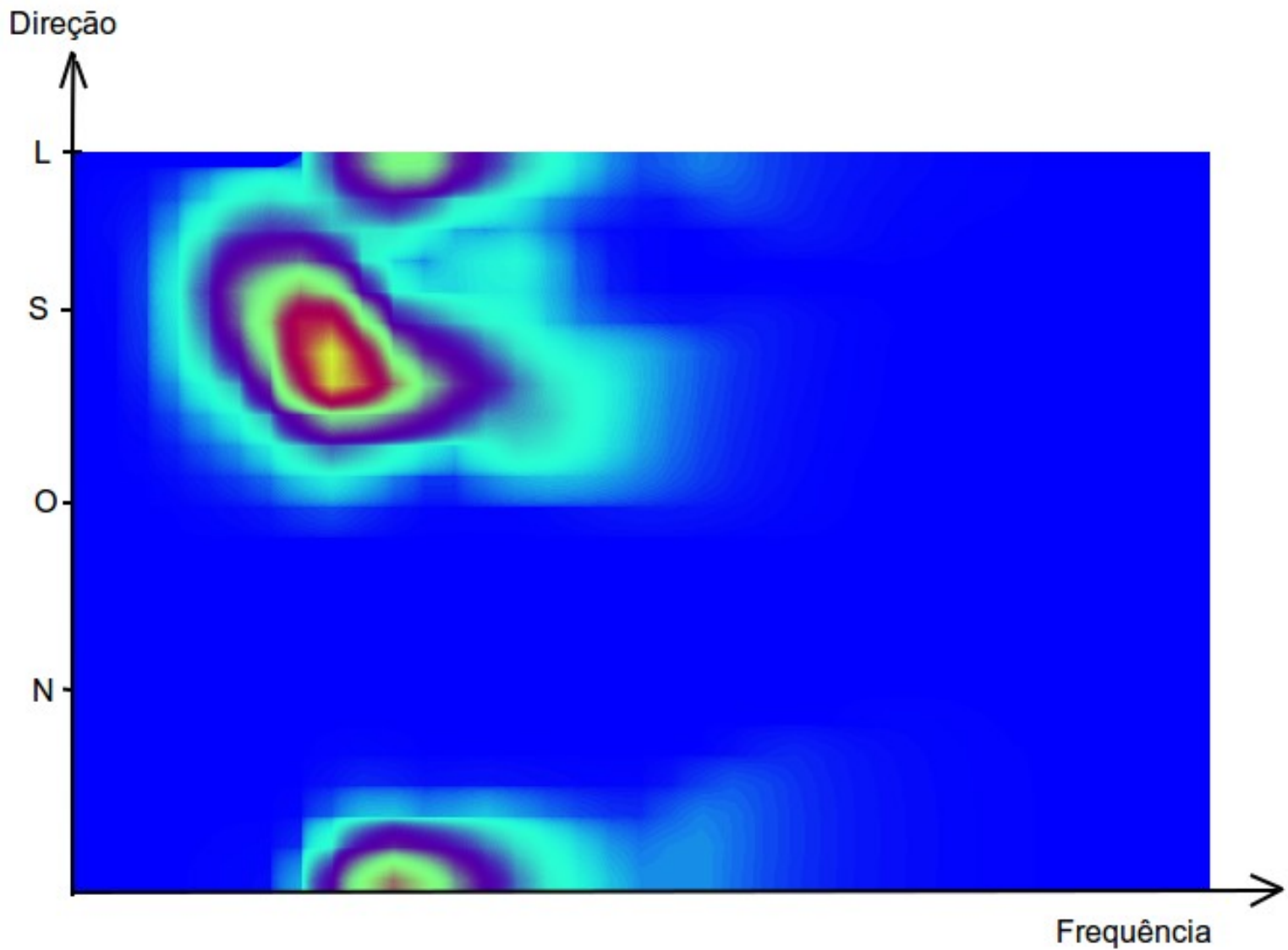
Modelos

- Wavewatch III (WW3)
- WAM
- SWAM
- UMWM
- ...

Modelos 1ª geração



Modelos 3ª geração

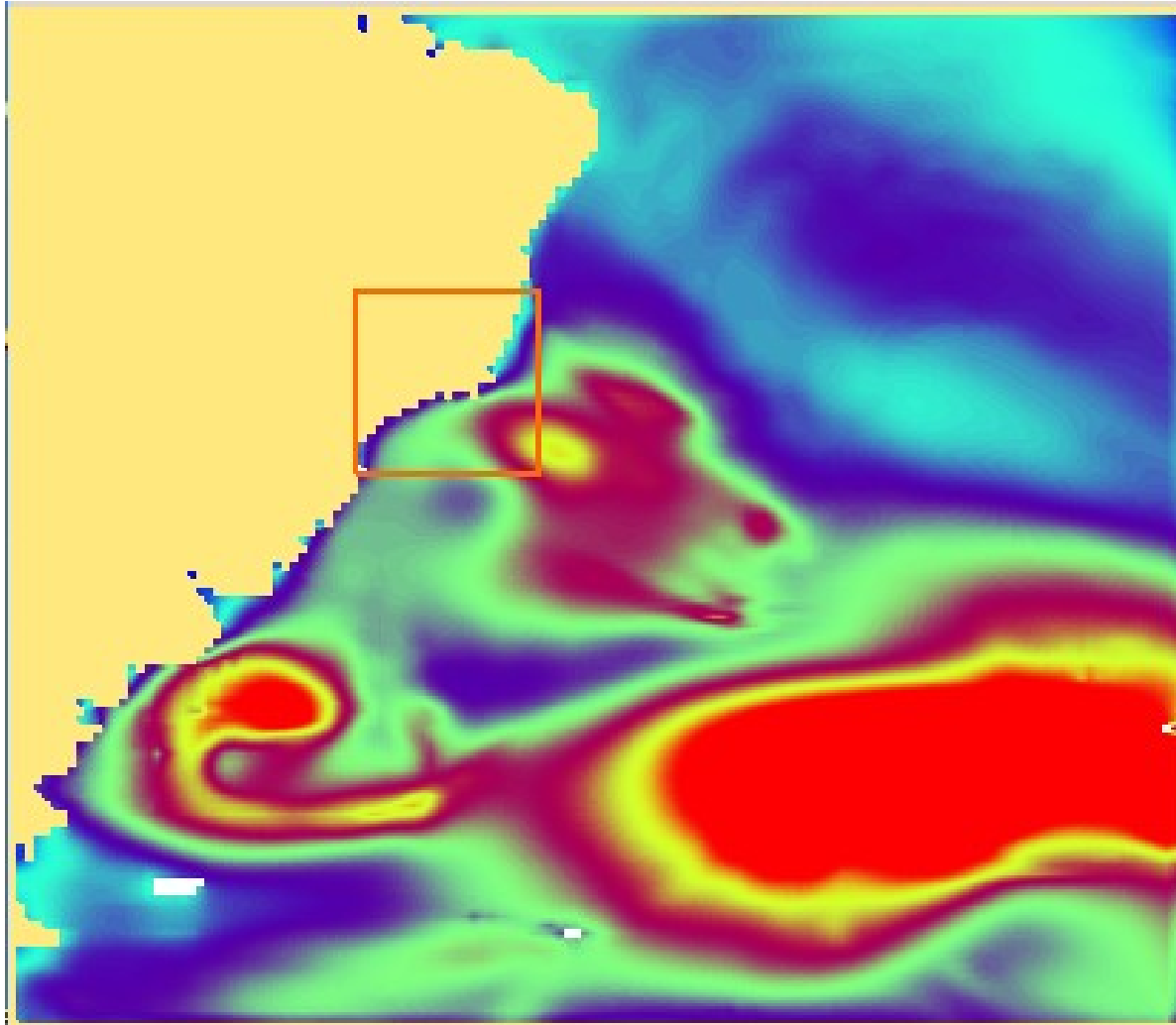




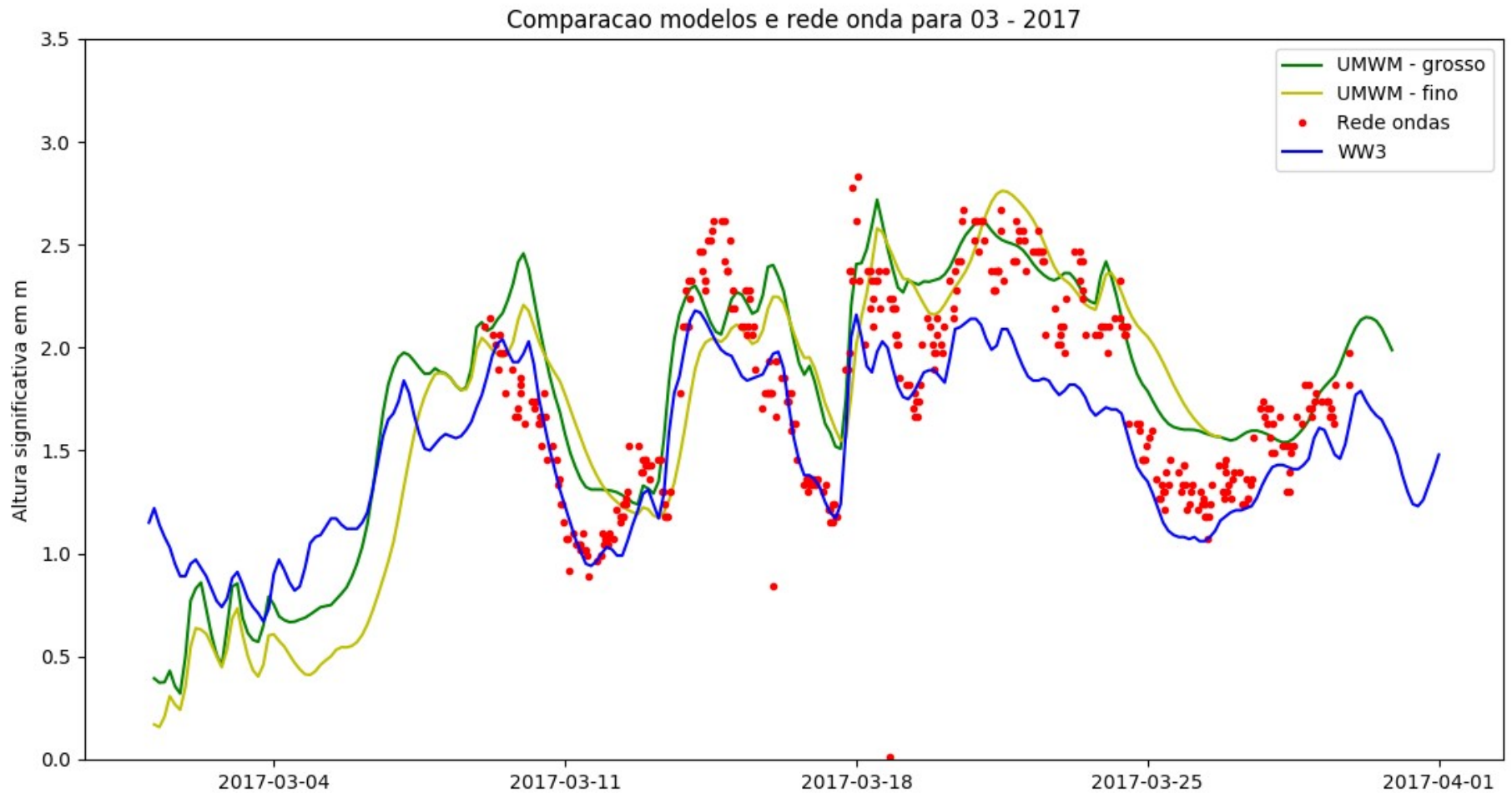
Resultado de Modelos

- CPTEC (<https://www.cptec.inpe.br>)
- NOAA (<https://polar.ncep.noaa.gov/waves/>)

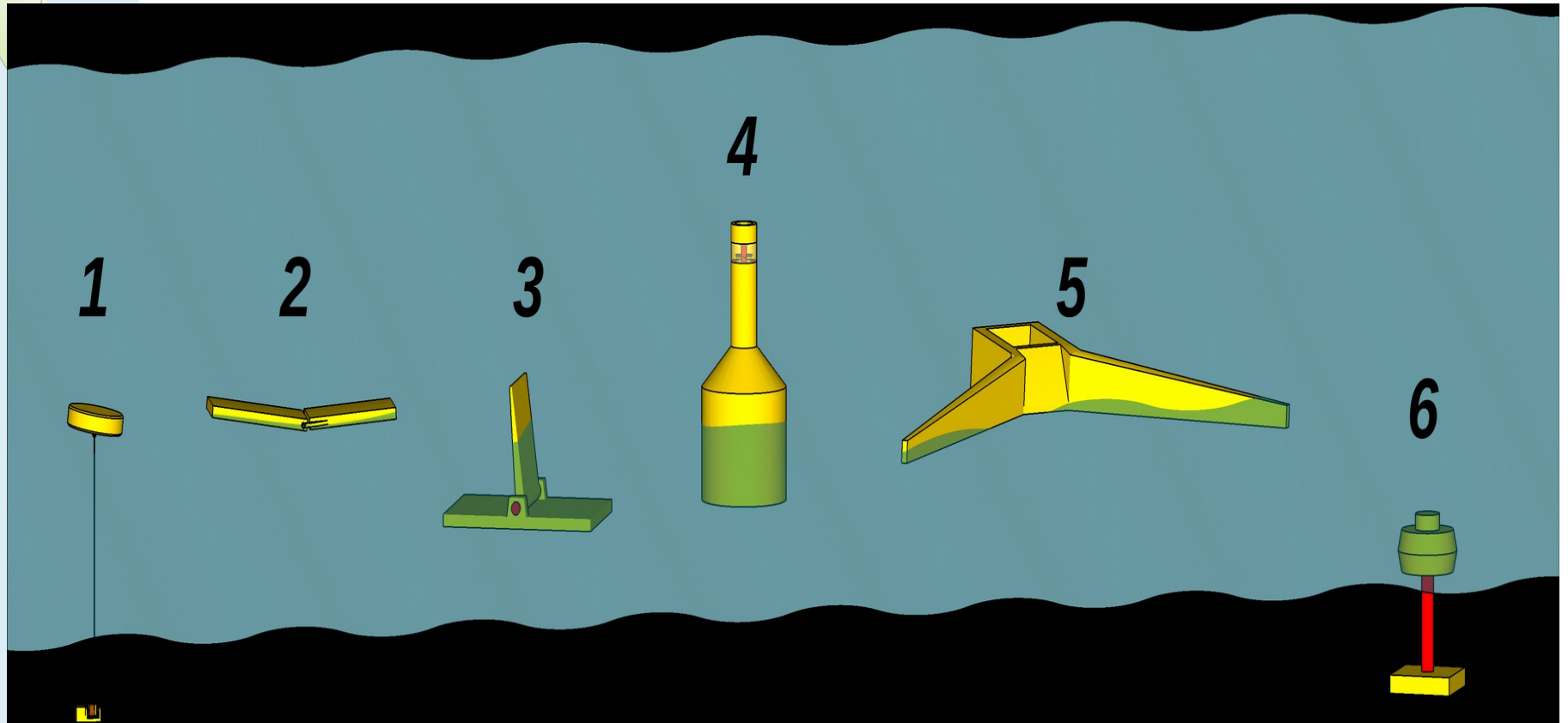
Potencial em SSB - Ondas



Potencial em SSB - Ondas

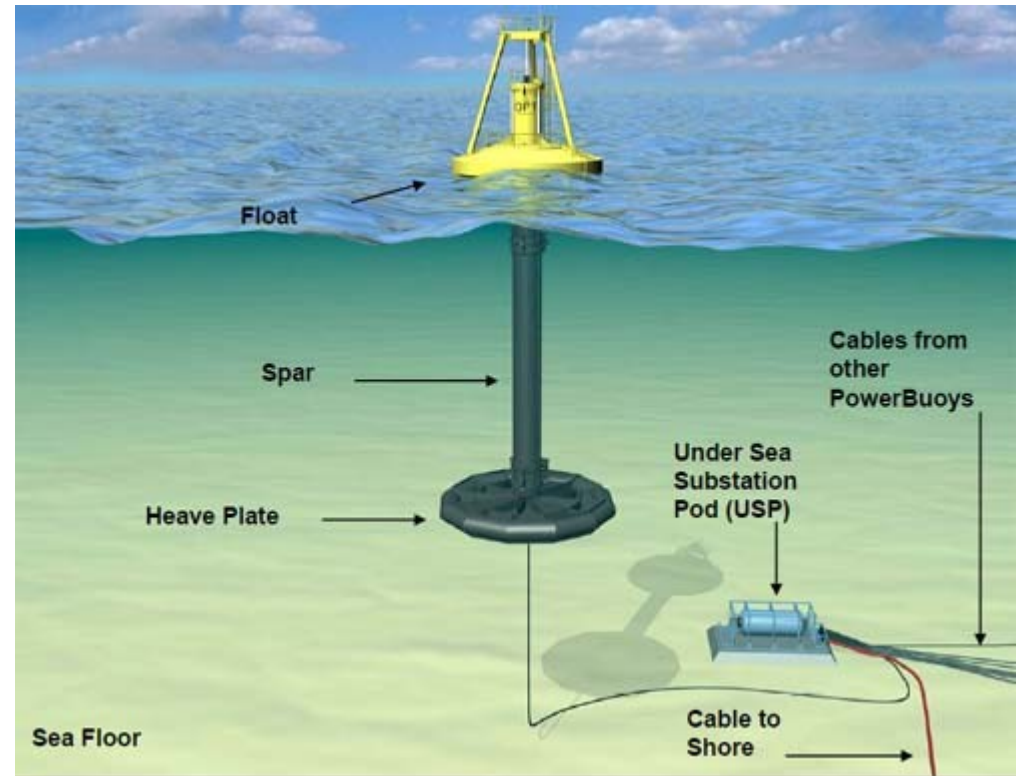
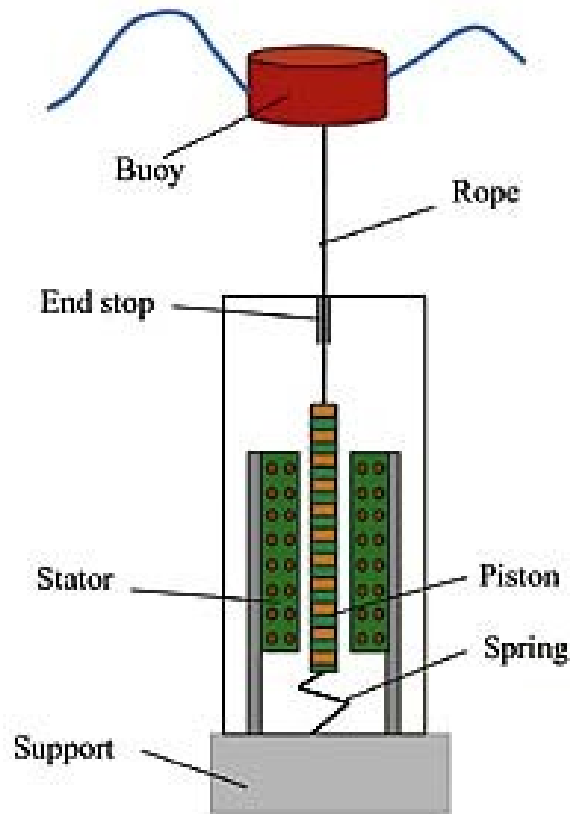


Conversores Ondas



Conversores Ondas

Point Absorber Buoy



Conversores Ondas

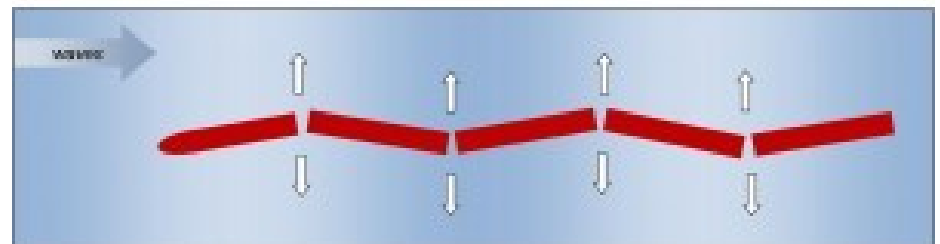
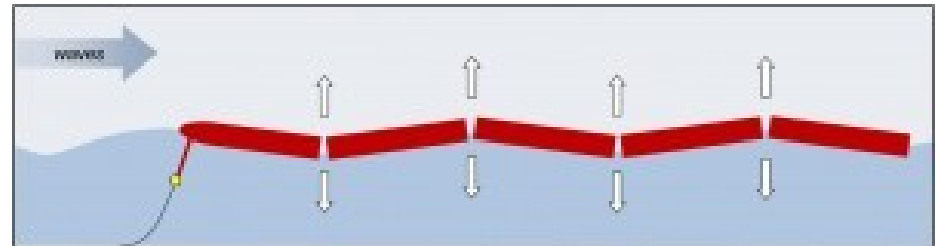


Conversores Ondas



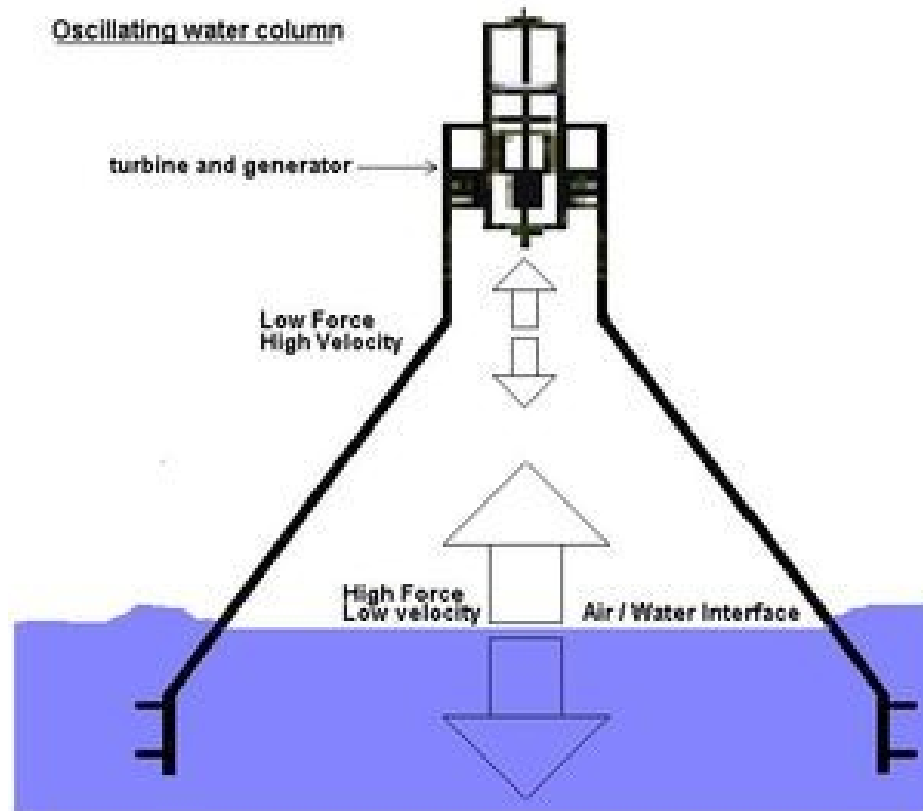
Conversores Ondas

□ Pelamis



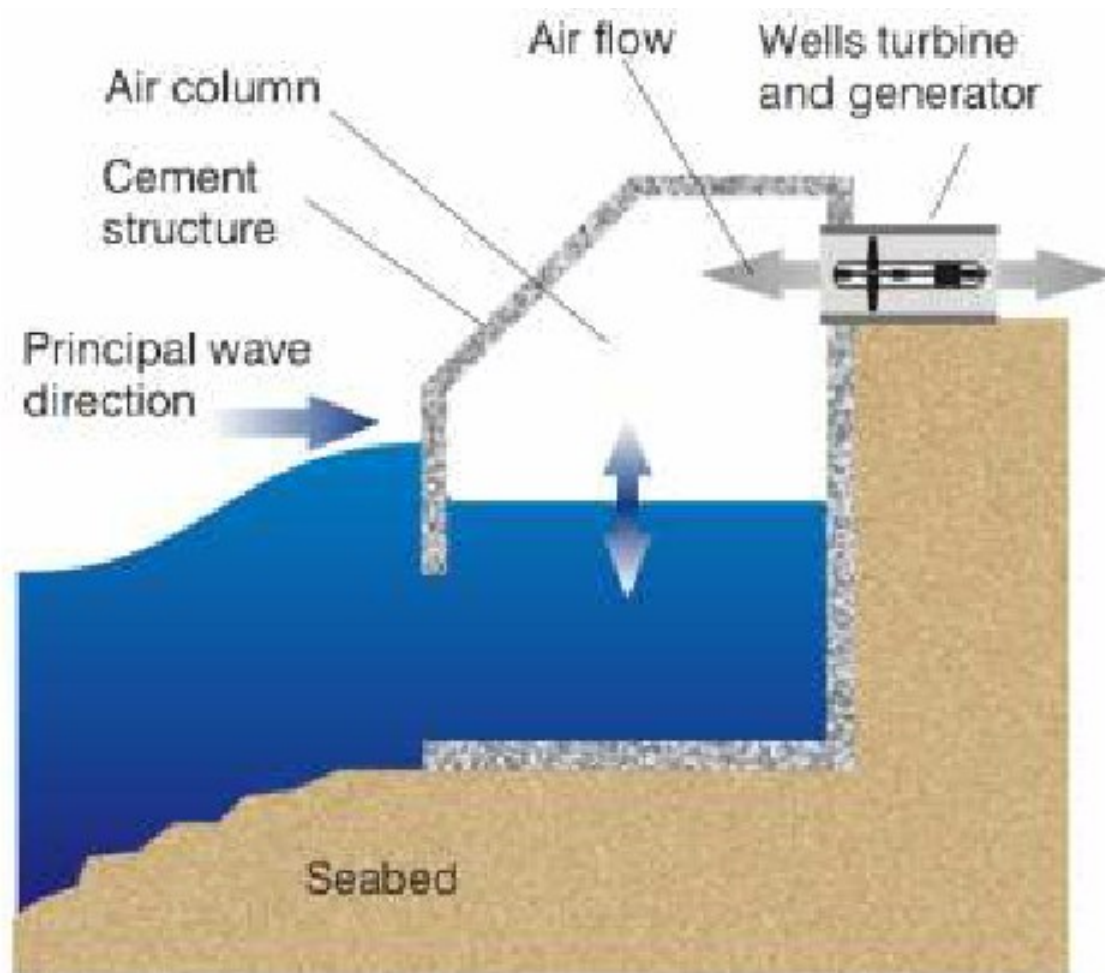
Conversores Ondas

□ Oscillating Water Column



Conversores Ondas

□ Oscillating Water Column



Conversores Ondas

□ OWC – Usina de Pico, Açores



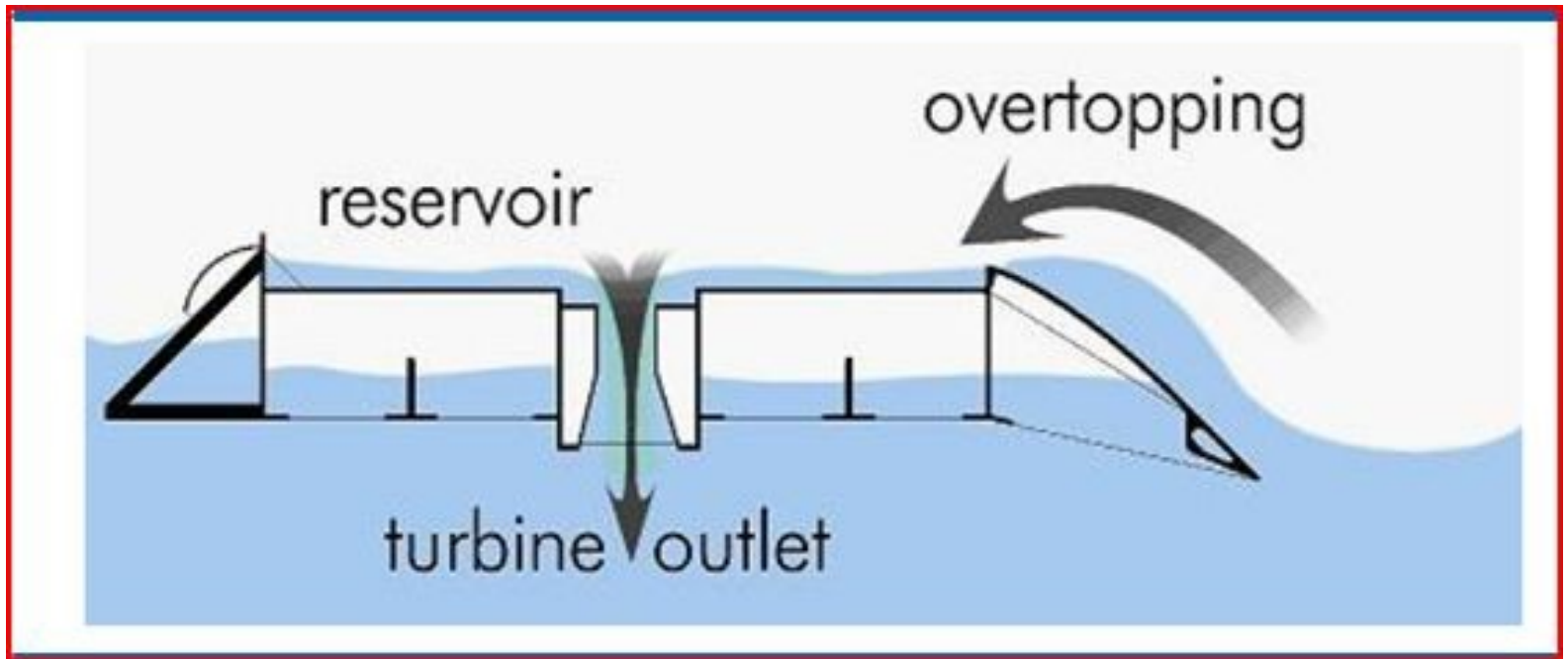
Conversores Ondas

□ OWC - Oceanlinx



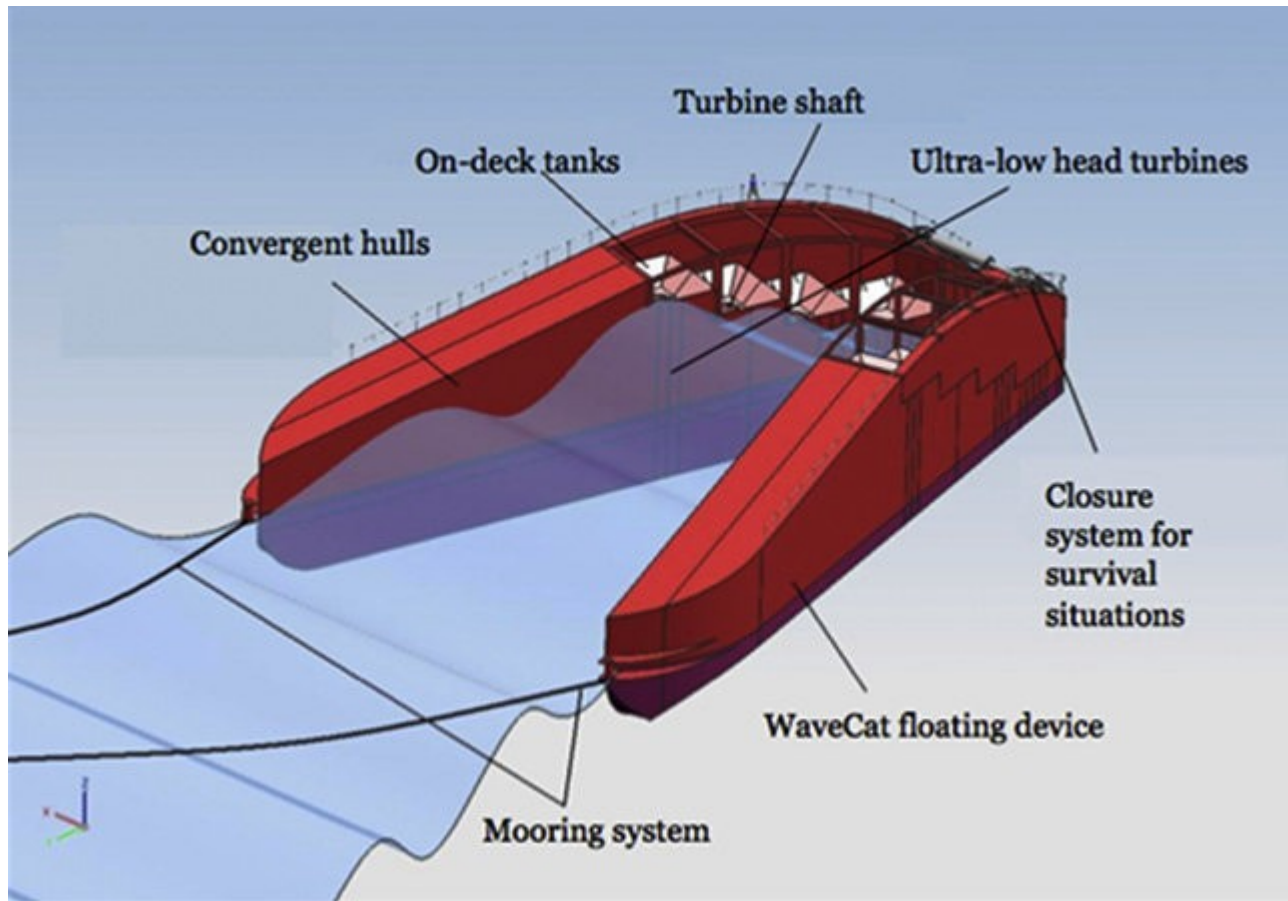
Conversores Ondas

□ Overtopping Device



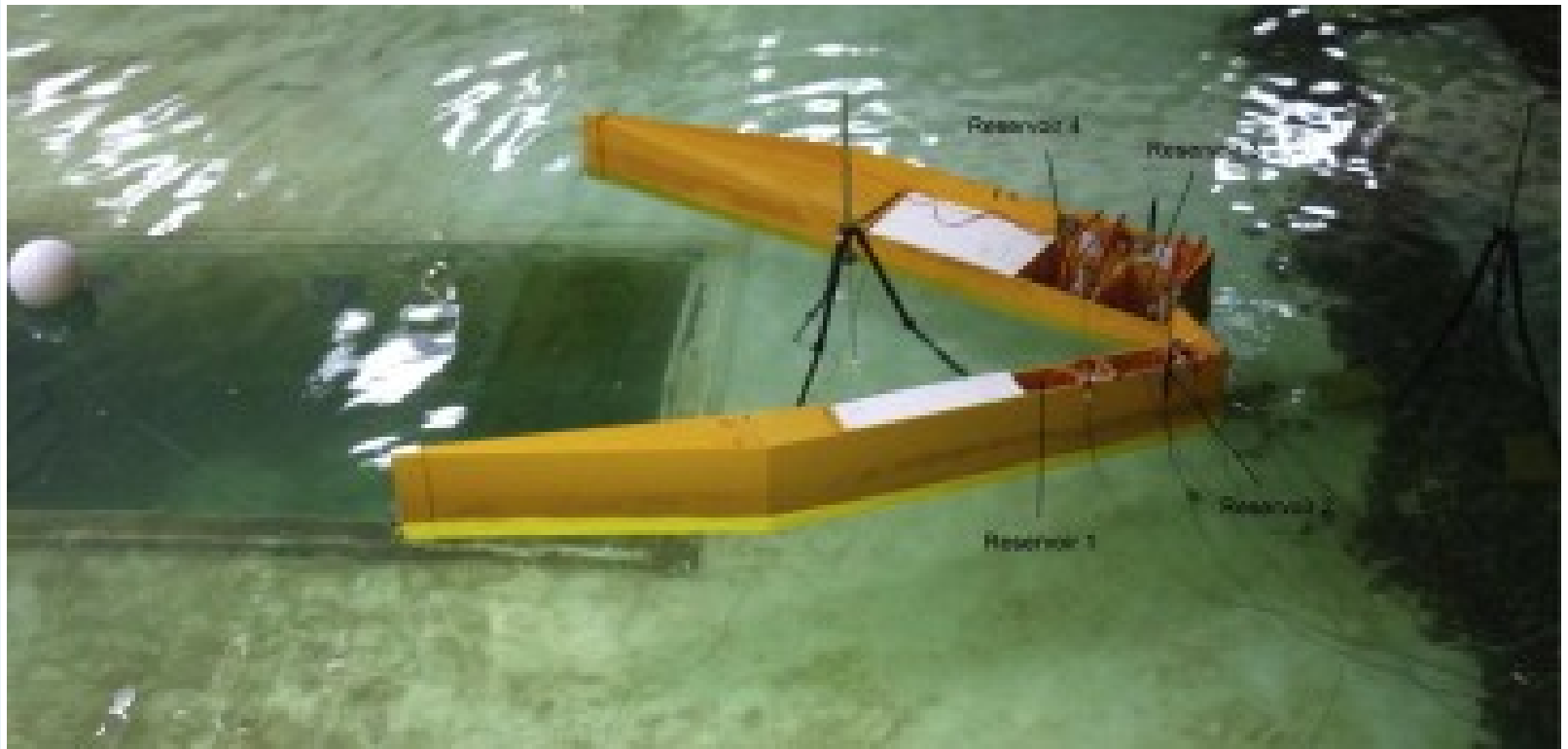
Conversores Ondas

□ Overtopping Device – WaveCat



Conversores Ondas

- Overtopping Device – WaveCat



Conversores Ondas

□ Eccentric Mass



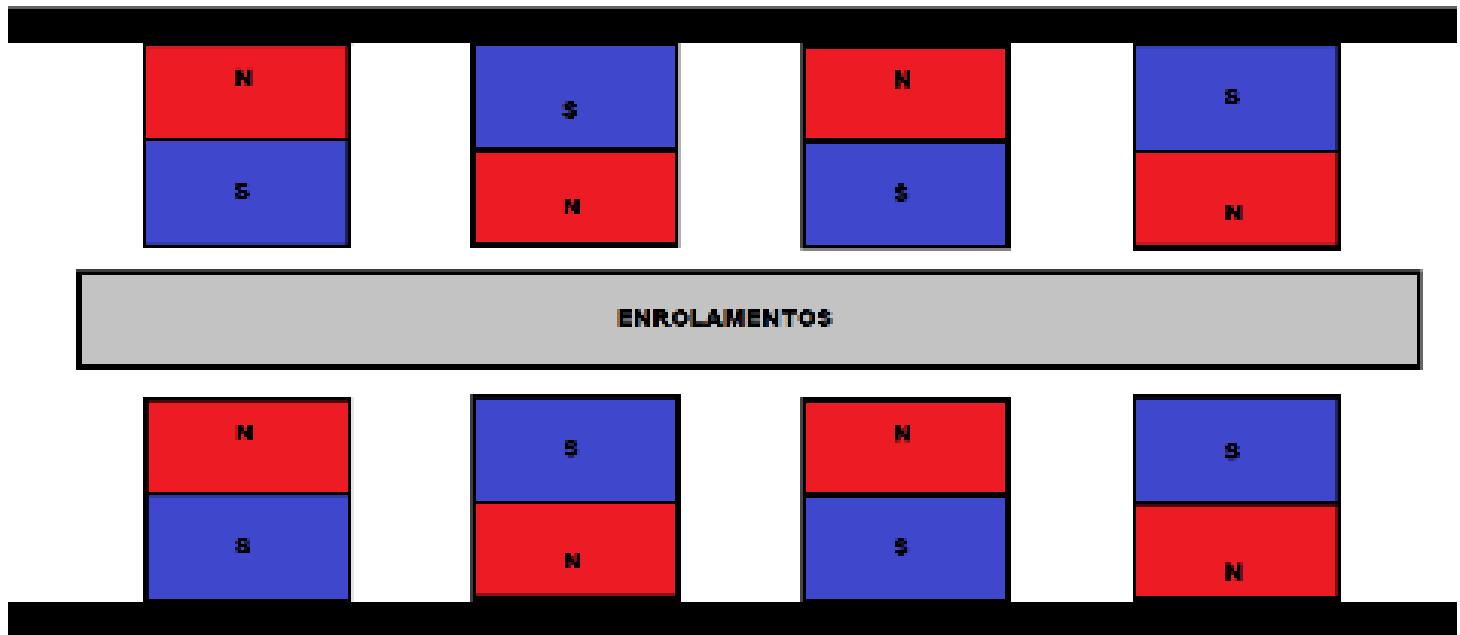
Conversores Ondas

□ Eccentric Mass - Wello

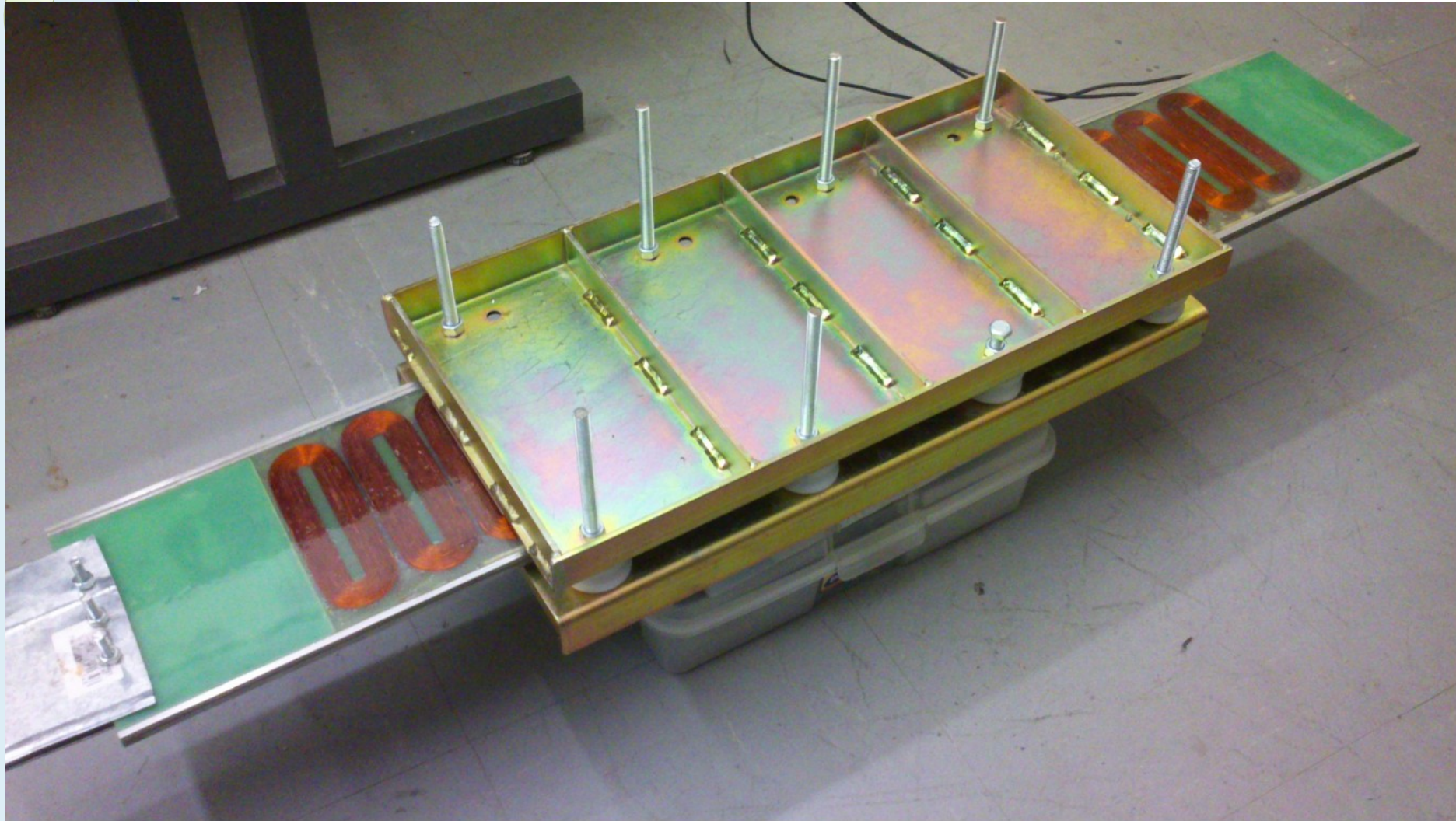


Geradores Lineares

□ Movimento linear

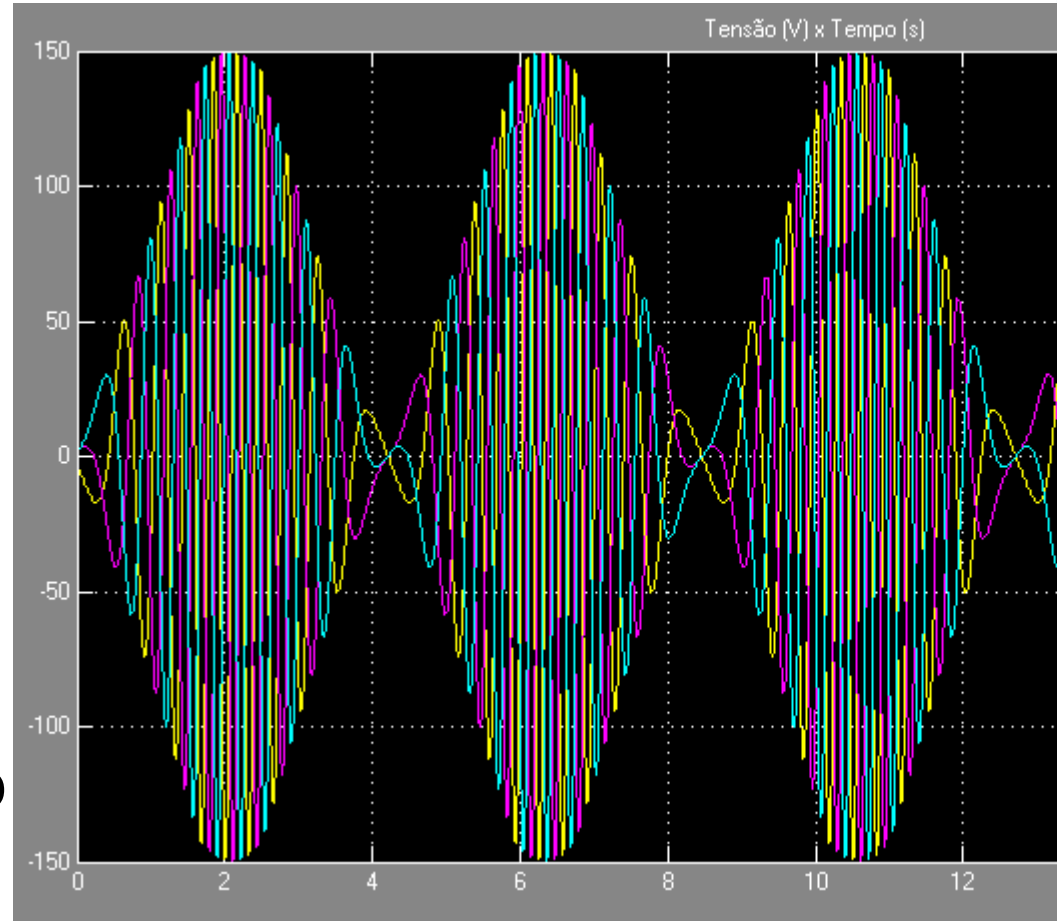


Geradores Lineares



Geradores Lineares

- $E = B.l.v$
- Baixa velocidade
- Forma de onda pulsada
- Requer acondicionamento



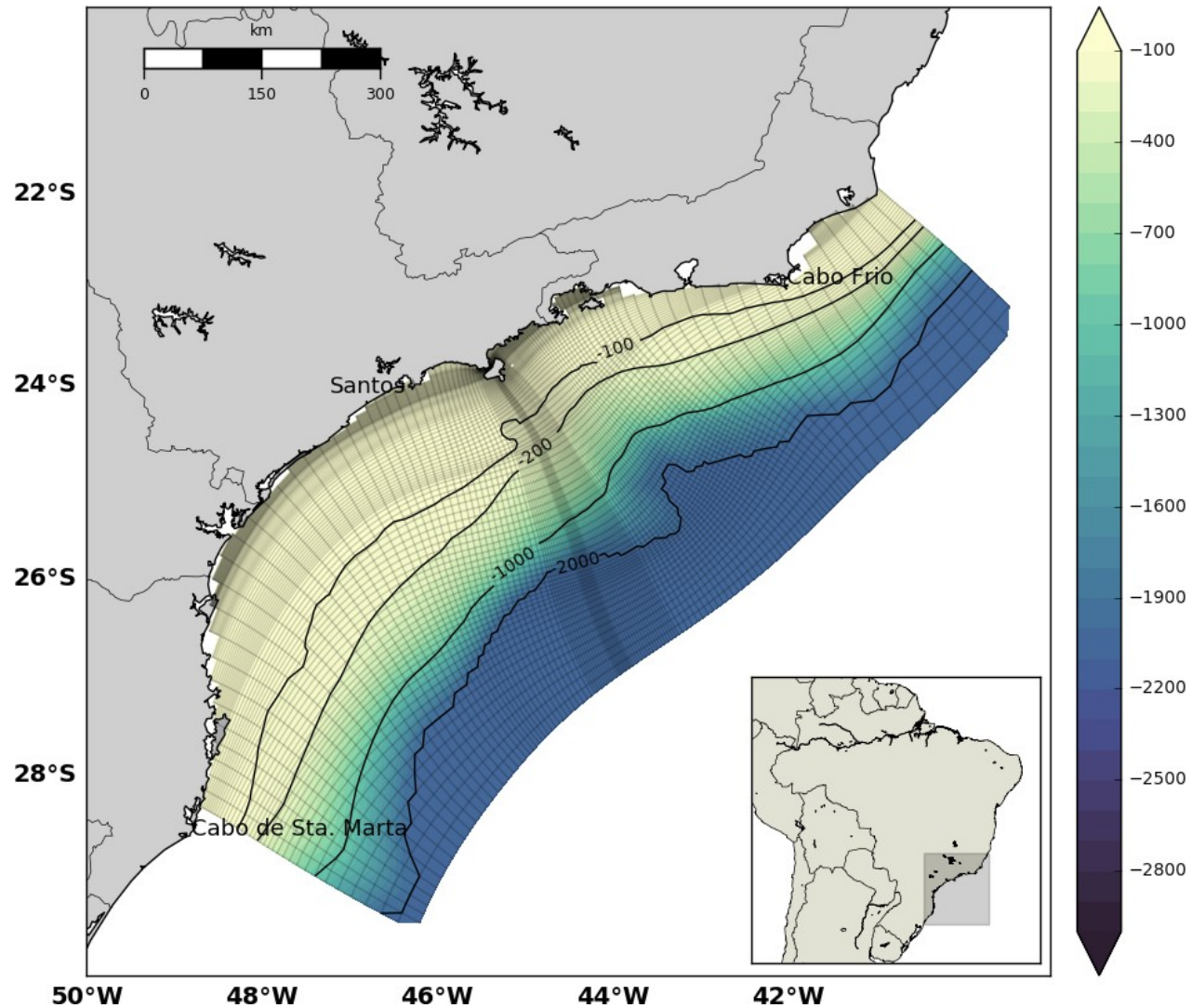


Energia de Correntes

As correntes podem ser geradas por marés astronômicas, ventos e gradientes de densidade.

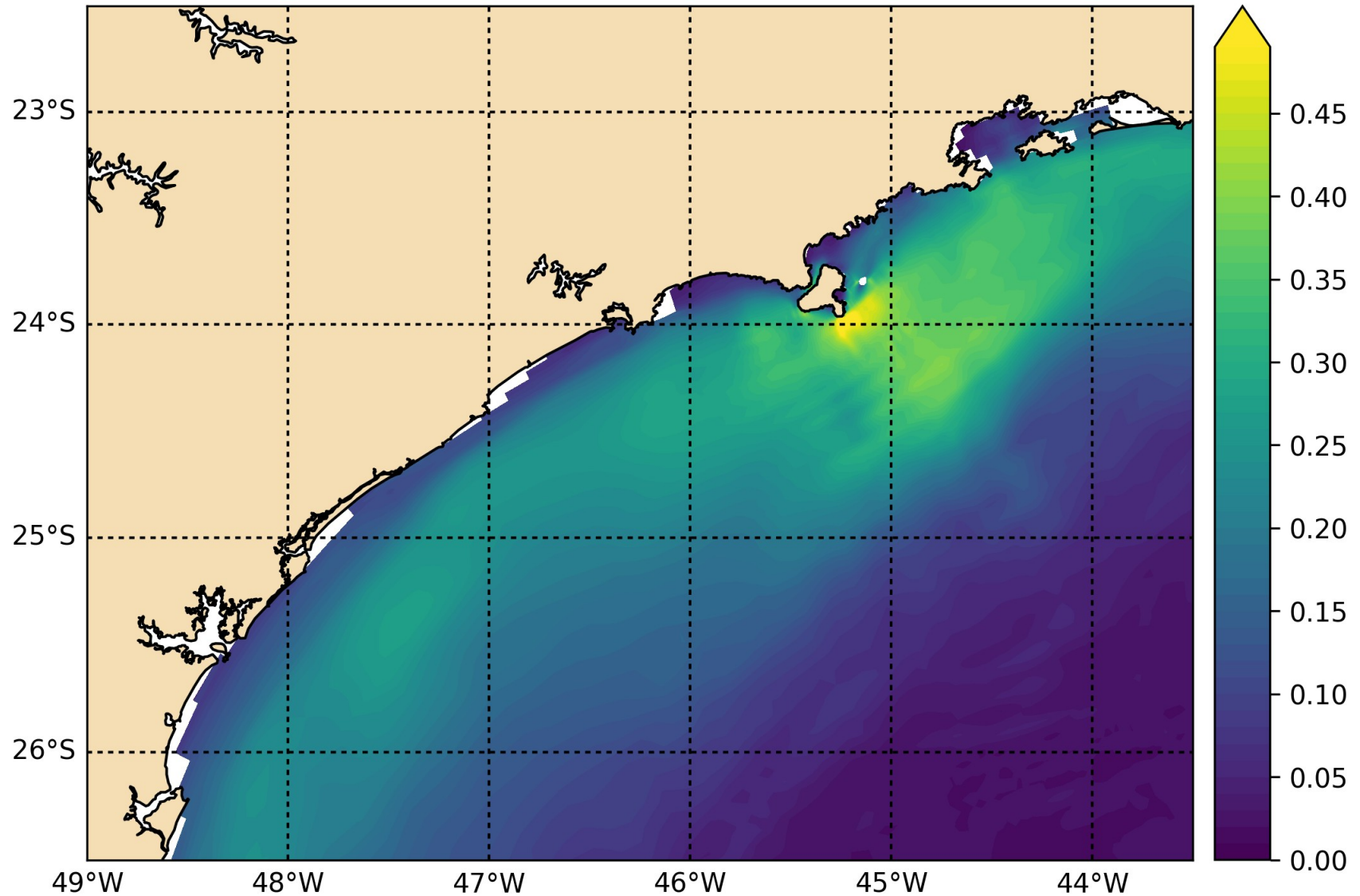
<https://teses.usp.br/teses/disponiveis/21/21135/tde-09012019-135013/pt-br.php>

Potencial em SSB - Correntes

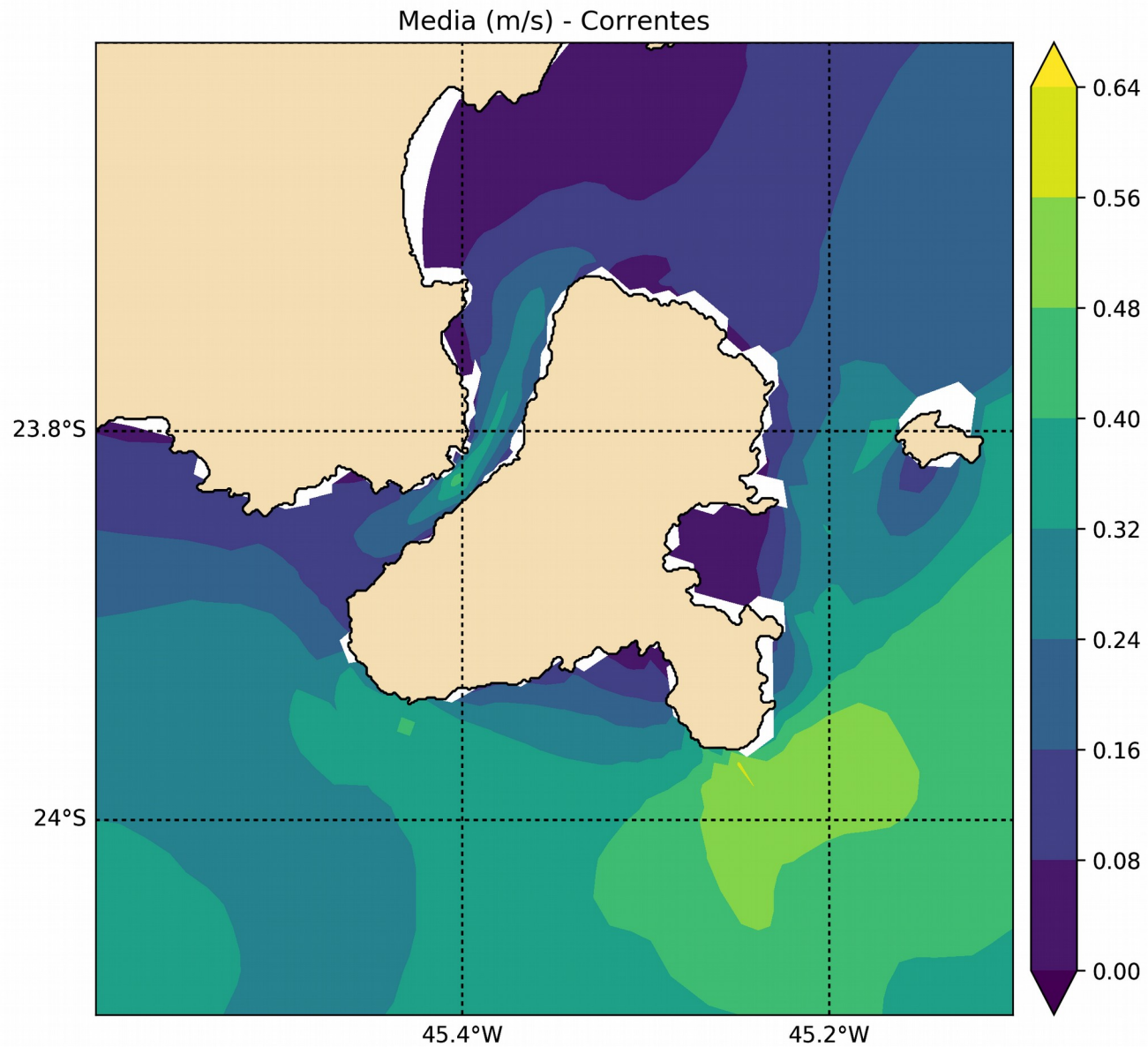


Potencial em SSB - Correntes

Media (m/s) - Correntes



Potencial em SSB - Correntes



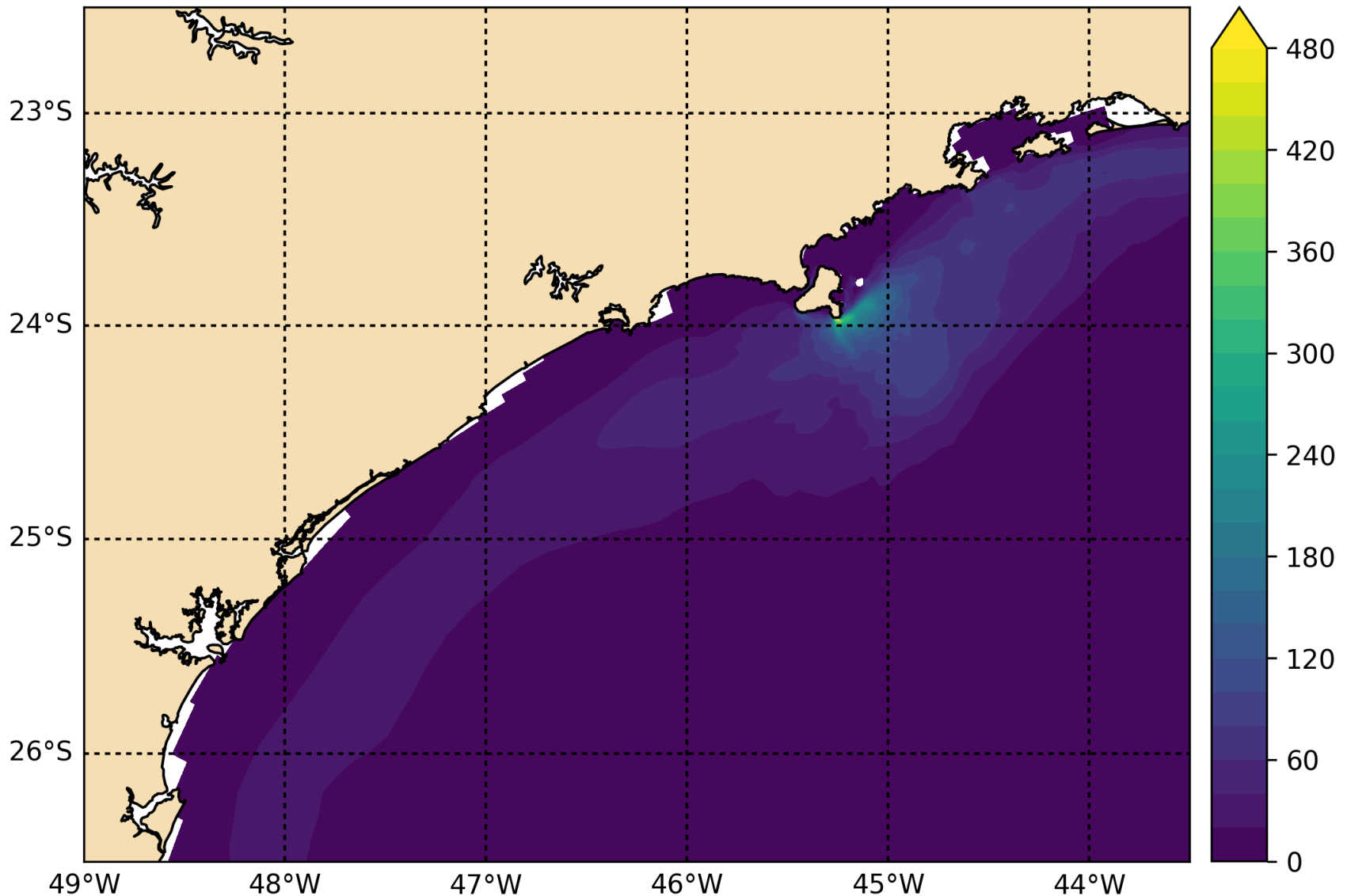
Potencial em SSB - Correntes

Densidade de potência

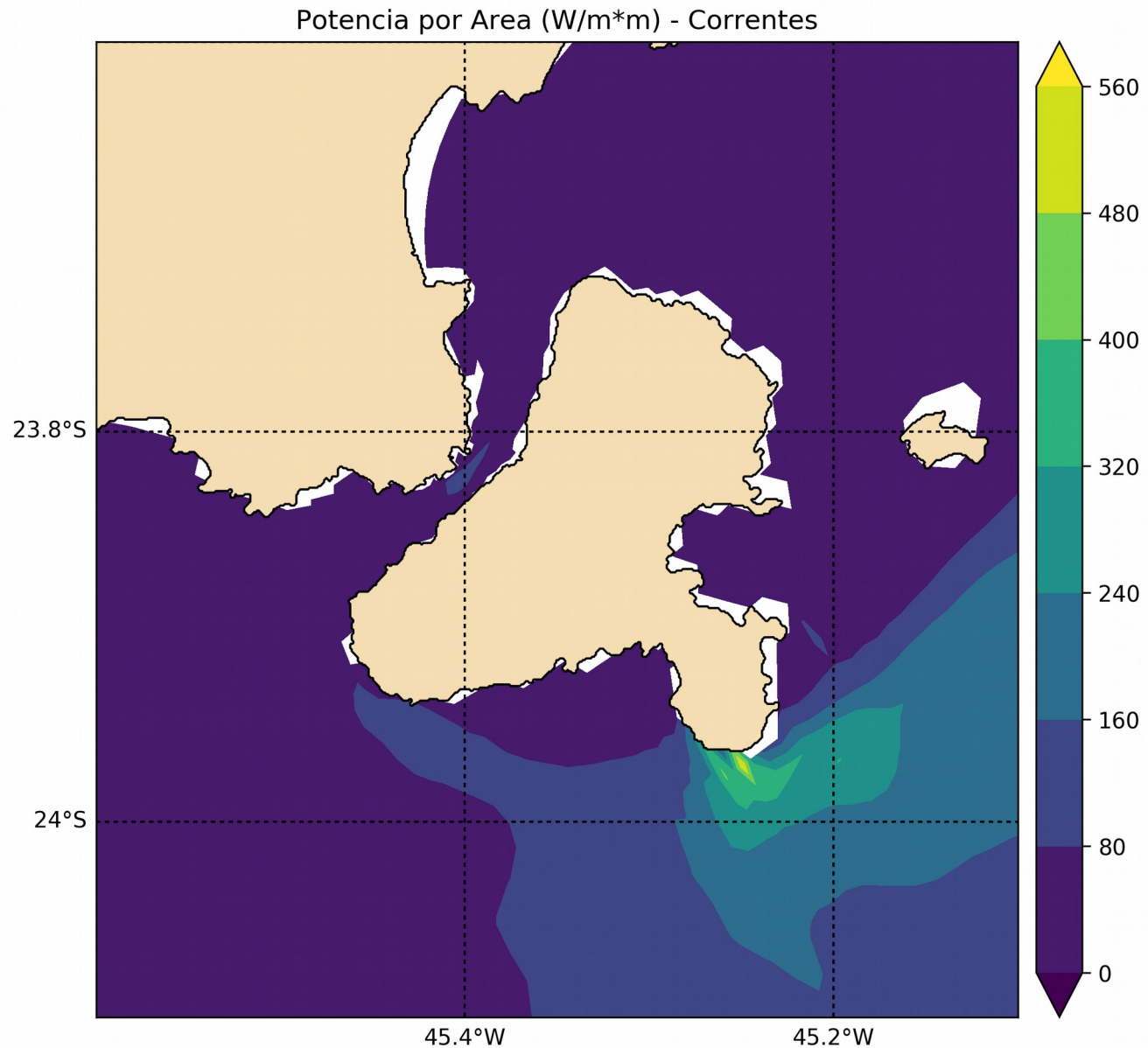
$$\frac{P}{A} = 0,5 \rho v^3$$

Potencial em SSB - Correntes

Potencia por area (W/m²) - Correntes

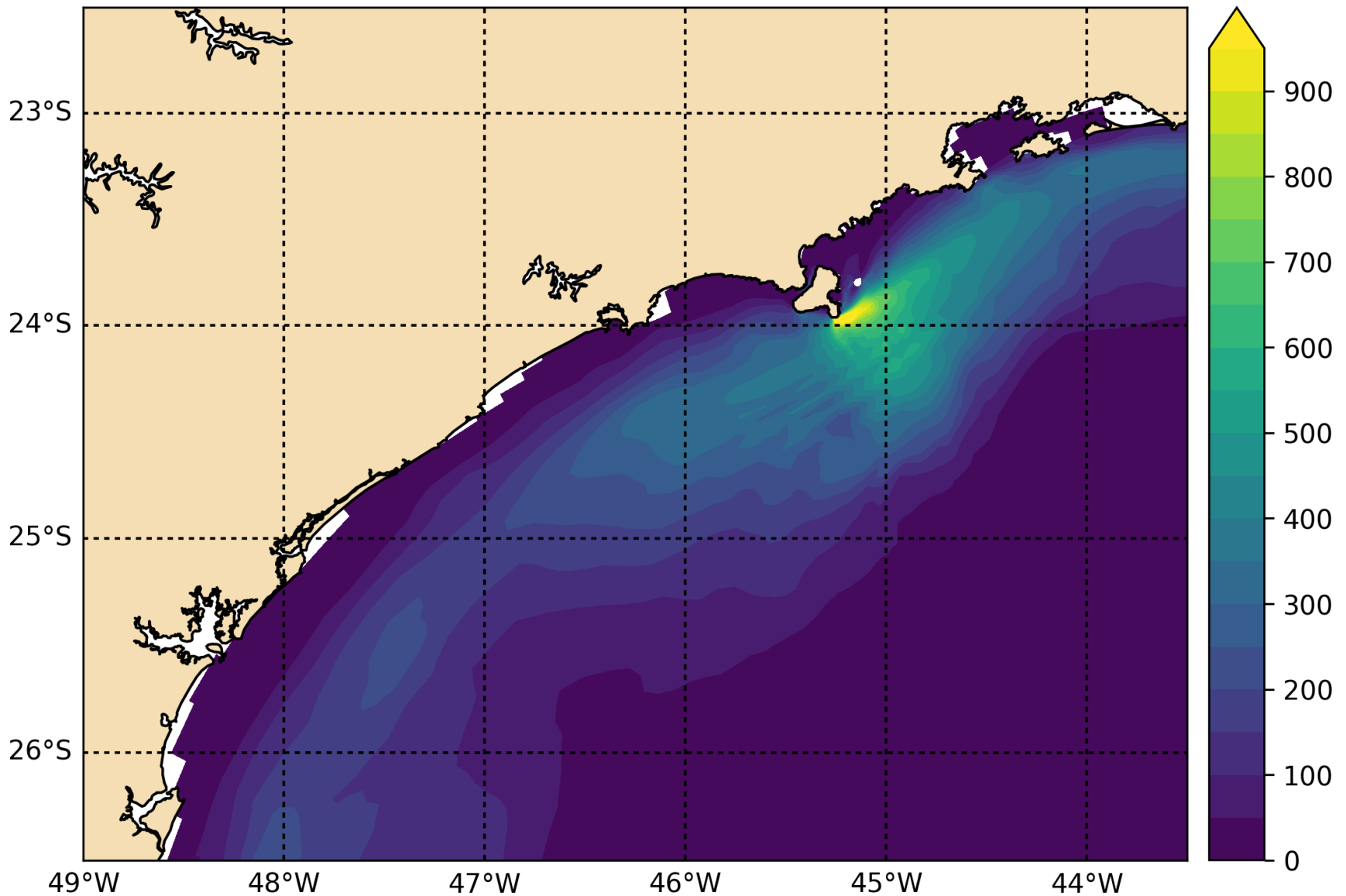


Potencial em SSB - Correntes



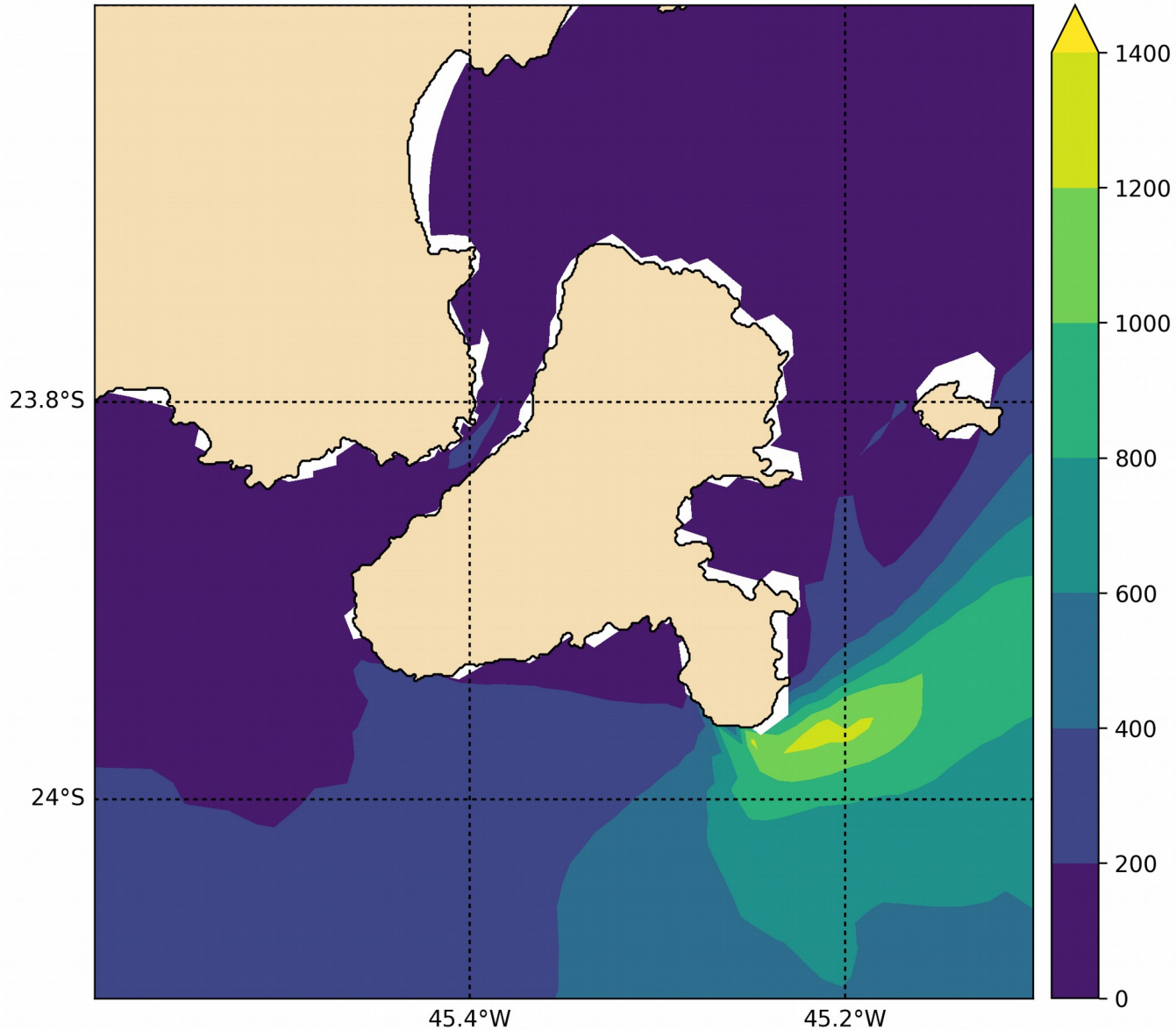
Potencial em SSB - Correntes

Potencia por area (W/m^2) - Correntes - Sup



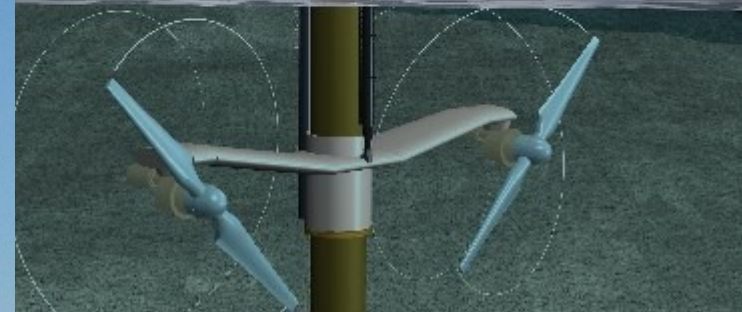
Potencial em SSB - Correntes

Potencia por area (W/m²) - Correntes - Sup



Energia Oceânica

- Correntes - SeaGen



Energia Oceânica

- Correntes – Orkney EMEC



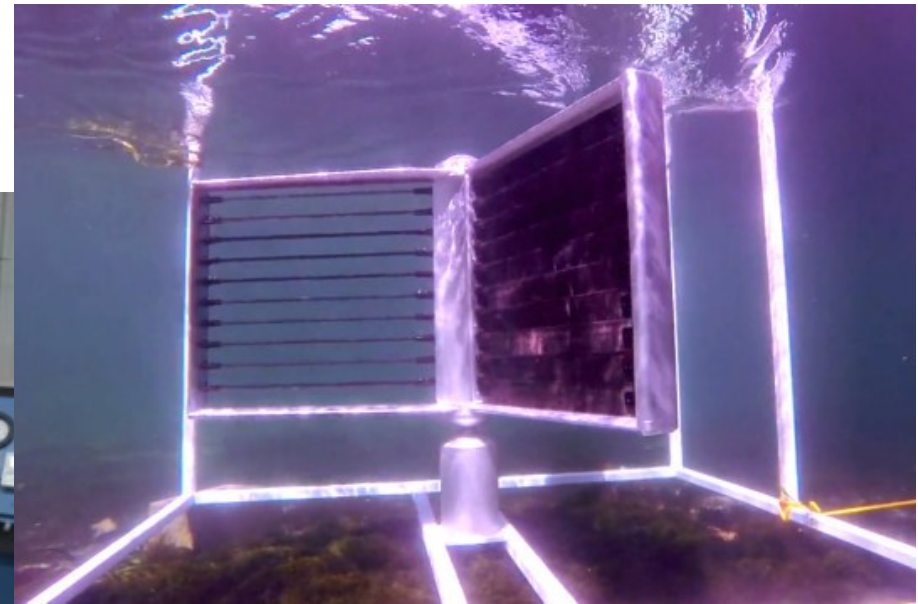
Energia Oceânica

- Correntes - SABELLA



Energia Oceânica

- Corrente – Crowd Energy



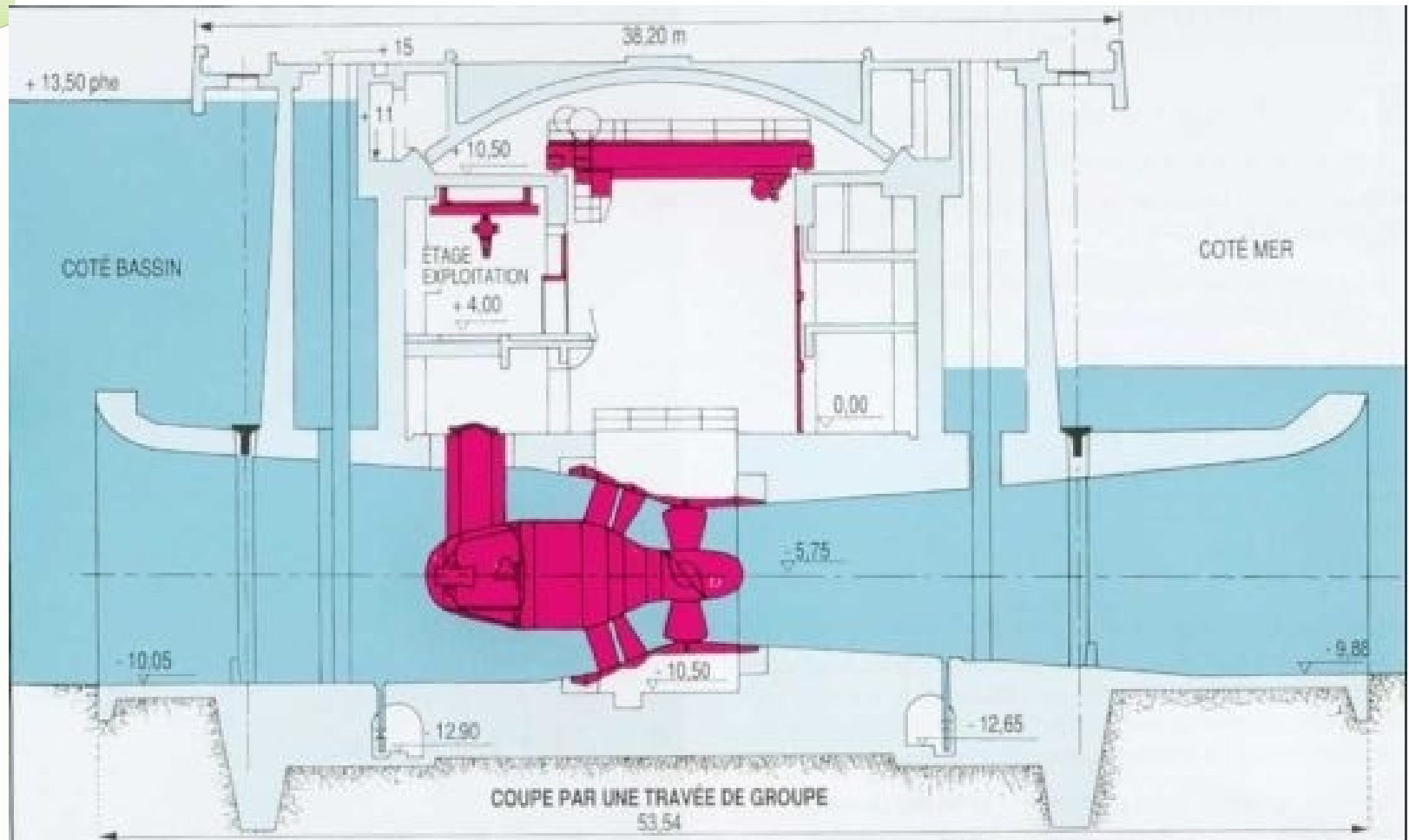
Energia Oceânica

- Maré com barragem - La Rance
240MW



Energia Oceânica

- Maré com barragem - La Rance



Energia Oceânica

- Maré com barragem - Sihwa-Lake
254MW



Energia Oceânica

- Estuário do rio Bacanga - MA

