Wave power density maps (wave_power_maps.nc)

Wave power density (aka wave energy flux) is the basics to assess the potential of a geographical site or region for wave electricity production from wave energy farm. The directionally unresolved wave power is the time averaged energy flux through a vertical cylinder of unit diameter, integrated from the sea floor to the surface. It is calculated as :

$$P = \rho g \sum_{i,j} c_{g,i} S_{ij} \Delta f_i \Delta \theta_j$$

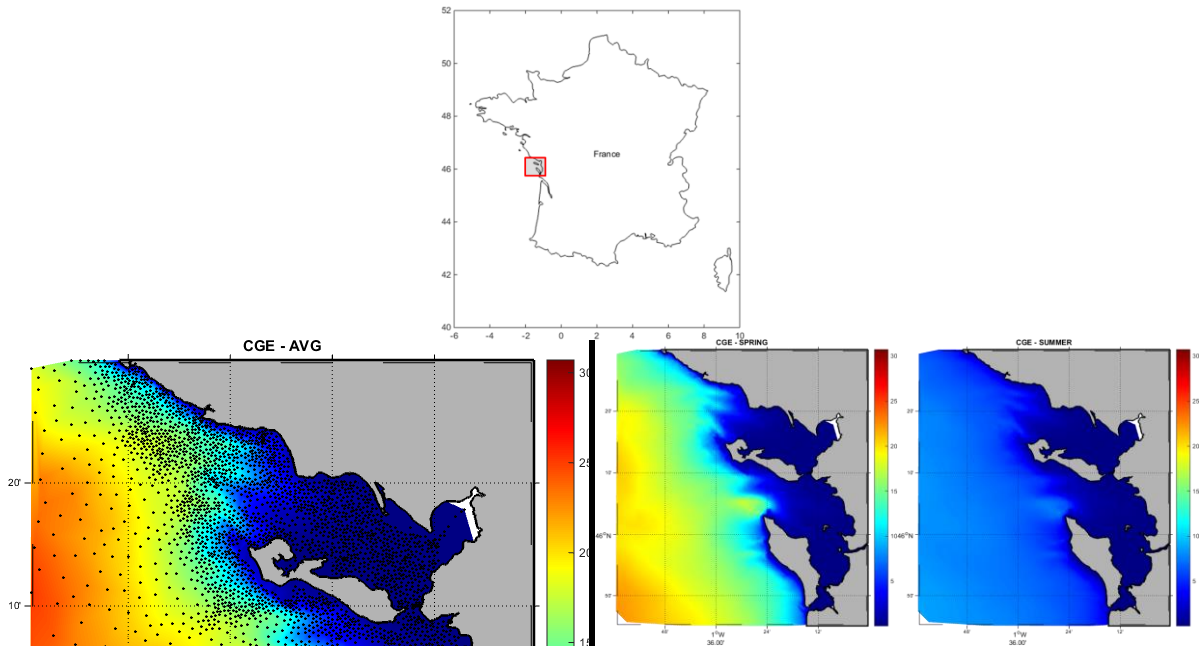
with

$$c_{g,i} = \frac{\pi f_i}{k_i}\left(1 + \frac{2k_i h}{sinh(2k_i h)}\right)$$

The wavenumber associated with a given frequency and depth is implicitly defined through the dispersion relation:

$$(2\pi f_i)^2 = g k_i tanh(k_i h)$$

P: Wave power density is expressed in W per unit of wave-crest length (W/m)
ρ: Seawater density (kg/m^3)
g: Gravity (m/s^2)
$c_{g,i}$: Group velocity of the ith discrete frequency (m/s)
S_{ij}: Variance density over the ith discrete frequency and jth discrete direction (m^2/Hz.rad)
Δf_i: Frequency width of the variance density of the ith discrete frequency (Hz)
$\Delta \theta_j$: Angular width of the variance density jth discrete direction (rad)
F_i: ith discrete frequency (Hz)
h : Water depth (m)
k_i: Wave number associated with the ith discrete frequency (m^{-1})



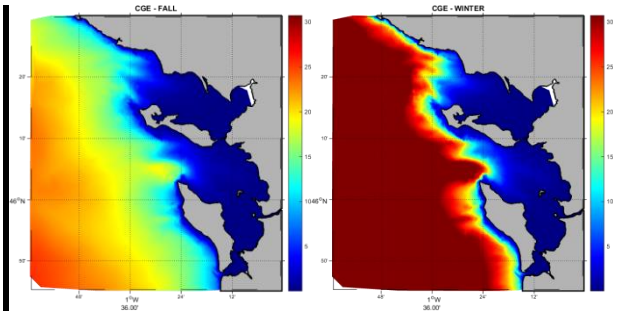


Figure: Example of wave power density (kW/m) maps produced using the data available from here. Average values are in the left panel, with black dots representing the hindcast grid. Seasonal values are in the right panel.

Wave power density maps are displaying the spatial distribution of annual/seasonal averages of wave power density. Seasons are December-February (winter), March-May (spring), June-August (summer), September-November (fall). All averages are computed based on the hourly outputs of the 19-year seastate hindcast Homere (Boudière et al. 2013). This hindcast was identified as the most appropriate single source of sea state variables for precise characterization of marine resources for marine energy purposes along the western coast of France (Dubranna et al. 2015).

Data download: Annual/seasonal averages of wave power density can be downloaded here using standard protocols (OPENDAP, HTTP, etc.).

Targeted end-users: Decision makers from national to local scale, investors, utilities and scientists.

References

Boudière, E., C. Maisondieu, F. Ardhuin, M. Accensi, L. Pineau-Guillou, and J. Lepesqueur. 2013. A suitable metocean hindcast database for the design of Marine energy converters. International Journal of Marine Energy **3-4**: e40–e52.

Dubranna, J., T. Ranchin, L. Ménard, and B. Gschwind. 2015. Production and Dissemination of Marine Renewable Energy Resource Information. *11th European Wave and Tidal Energy Conference*.

Contact

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