3D Digital Twins of the Ocean: towards an intuitive and realistic visualization of wave parameters

Gerard Llorach-Tó[1,2], Enoc Martínez[3], Joaquín Del-Río[3], Gonzalo Simarro[2], Martino Pani[4], Andrea Bucchi[4], Ya Huang[4], and Emilio García-Ladona[1,2]

EGU General Assembly 2024

Question

How does the sea surface looks like?

OBSEA – ADCP – AWAC

May 25th 2018 at 16:30h, 1.75º E, 41.19º N

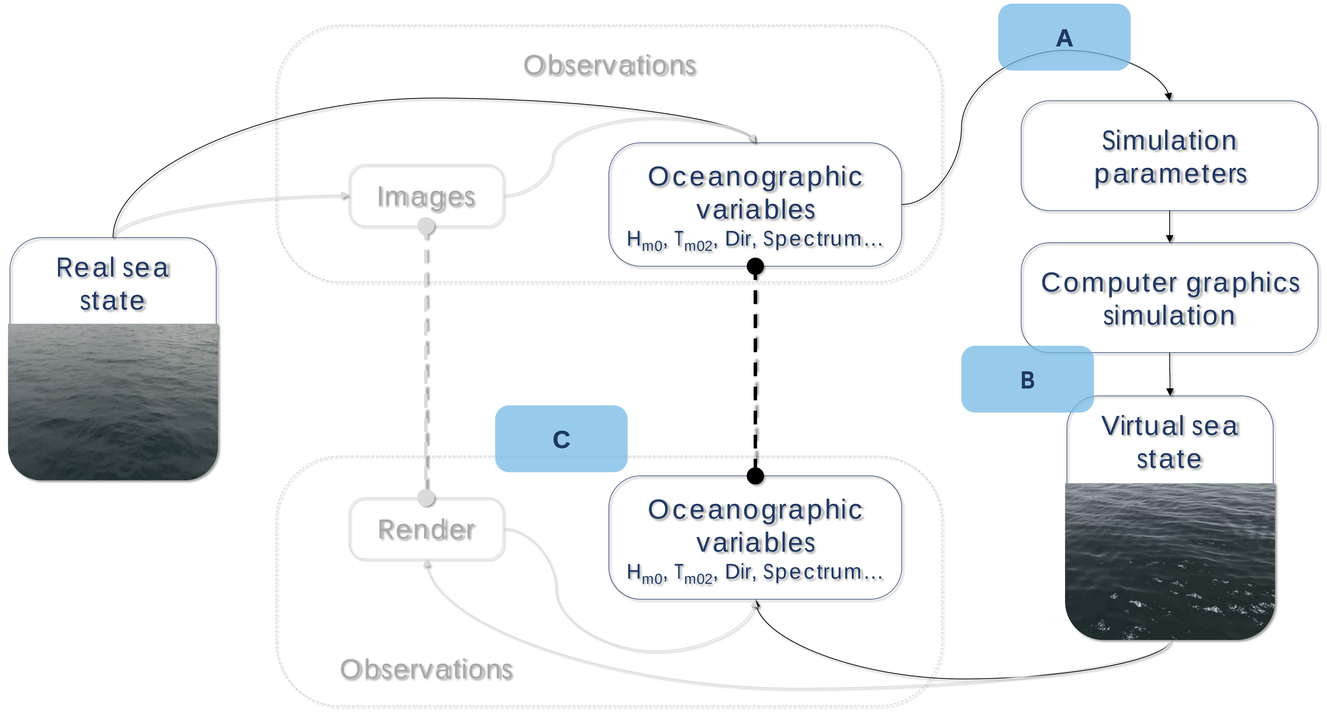
Variable	Value	Variable	Value
H_{m0}	**1.3m**	T_{m02}	**3.2s**
$H_{1/3}$	**1.25m**	T_z	**3.9s**
$H_{1/10}$	**1.6m**	T_{pk}	**5.3s**
H_{max}	**2.0m**	Dir_{pk}	**118º**
Dir_{mean}	**115º**	Dir. Spred	**22º**

CMEMS - Mediterranean Sea Waves Analysis and Forecast

April 18th 2024 at 00:00h, 1.34º E, 40.70º N

	Height	Period	Dir.
Average wave	**0.9m**	**4.1s**	**93º**
Wind wave	**0.2m**	**2.1s**	**166º**
Swell1	**0.7m**	**6.0s**	**65º**
Swell2	**0.2m**	**4.1s**	**102º**

Method



Objectives, constraints and scope

A
Generation of simulation parameters from wave data

- Operational products (real-time updates)
- Based on oceanographic data from APIs
- Deep-sea conditions

B
Realistic real-time render of the ocean

- Real-time rendering (~16 ms per frame)
- Realistic, interactive, accessible
- Web-based

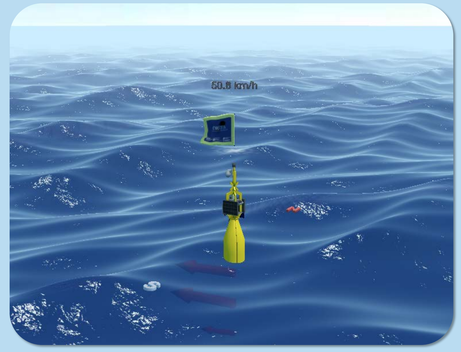
C
Validation of the simulation

- Validated (qualitative and quantitative)

Results

OBSEA – ADCP – AWAC

https://cgi-dto.github.io/OBSEA/



CMEMS - Mediterranean Sea Waves Analysis and Forecast

https://icatmar.github.io/CasablancaBuoy/

Acknowledgments

Funded by the "Fons Europeu Marítim, de Pesca i d'Aqüicultura (FEMPA)" under the Catalan Institute of Research for the Governance of the Sea (ICATMAR) - BOE-A-2023-25106

References

Llorach-Tó, G., Martínez, E., Fernández, J. D. R., & García-Ladona, E. (2023, June). Experience OBSEA: a web-based 3D virtual environment of a seafloor observatory. In OCEANS 2023-Limerick (pp. 1-6). IEEE.

Affiliations

1. Institut Català de Recerca per a la Governança del Mar (ICATMAR), Barcelona, Spain.
2. Institut de Ciències del Mar (ICM-CSIC), Barcelona, Spain
3. SARTI-MAR Research Group, Universitat Politècnica de Catalunya, Vilanova i la Geltrú, Spain
4. School of Mechanical and Design Engineering, University of Portsmouth, Portsmouth, UK