

THYMOTE

Tidal turbulence :
modelling, observation, basin tests

DURATION: 40 months (2016-2019) | BUDGET: €1,382K

CONTEXT

Tidal sites are, by definition, sites of extreme currents. These currents flow over rocky bottoms with complex bathymetry, generating intense turbulent movements. Improving our knowledge of these turbulent processes is crucial for optimising turbine performance and minimising their structural fatigue. The development of the tidal turbine industry therefore requires a more detailed knowledge of the turbulent processes of tidal sites.

OBJECTIVE

To combine measurements and digital development to obtain high-resolution information on turbulent flows at tidal sites.

MAIN ACHIEVEMENTS

- In situ measurements of currents flowing over rocky bottoms with complex bathymetry and generating intense turbulent movements
- Tests in basins
- Development of numerical codes

CONCLUSION

THYMOTE has led to the development of numerical tools to better apprehend the turbulent processes present on tidal sites. The calculation tools developed in association with the resources of France Energies Marines are now available to support the players in the tidal turbine sector in the fine characterisation of turbulence on sites of interest for the deployment of tidal turbine systems.



TECHNOLOGIES



STAGES OF THE VALUE CHAIN



Preliminary studies



Design

RESOURCES GENERATED

- **4 measuring cages and various instruments that can be attached to them:** ADCP 5-beam, hydrophone, acoustic receivers, stereo video, camera
- **Databases:** currentology and hydroseimentary processes measured with 2 ADCP current profilers, 2 point current meters, 4 hydrophones and acoustic pebble tracing - Alderney Race (North-West of the temporary occupation permit zone) - September 2017 to May 2018

PARTNERS



This project has received €491K French State funding managed by the French National Research Agency under the Investment for the Future Programme (ANR-10-IEED-0006-11).



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LIST OF SCIENTIFIC PUBLICATIONS FROM THE PROJECT

2021

- Mercier *et al.* **Turbulence measurements: An assessment of Acoustic Doppler Current Profiler accuracy in rough environment.** *Ocean Engineering*, Vol. 226, 108819
-> <https://doi.org/10.1016/j.oceaneng.2021.108819>

2020

- Sentchev *et al.* **Turbulence characterization at tidal-stream energy site in Alderney Race.** *Developments in Renewable Energies Offshore*, pp. 616-623
- Sentchev *et al.* **New insights on tidal dynamics and tidal energy harvesting in the Alderney Race.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190490
-> <https://doi.org/10.1098/rsta.2019.0490>
- Thiébaud *et al.* **Assessing the turbulent kinetic energy budget in an energetic tidal flow from measurements of coupled ADCPs.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190496
-> <https://doi.org/10.1098/rsta.2019.0496>
- Thiébaud *et al.* **A comprehensive assessment of turbulence at a tidal-stream energy site influenced by wind-generated ocean waves.** *Energies*, Vol. 191, 116550
-> <https://doi.org/10.1016/j.energy.2019.116550>
- Thiébaud *et al.* **Characterization of the vertical evolution of the 3D turbulence for fatigue design of tidal turbines.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190495
-> <https://doi.org/10.1098/rsta.2019.0495>
- Thiébot *et al.* **Numerical modelling of hydrodynamics and tidal energy extraction in the Alderney Race: a review.** *Philosophical Transactions of the Royal Society A*, Vol. 378, 20190498
-> <https://doi.org/10.1098/rsta.2019.0498>

2018

- Ikhennecheu *et al.* **Experimental analysis of the floor inclination effect on the turbulent wake developing behind a wall mounted cube.** *European Journal of Mechanics-B/Fluids*, Vol. 72, pp.340-352
-> <https://doi.org/10.1016/j.euromechflu.2018.07.003>

2017

- Pinon *et al.* **Semi-analytical estimate of energy production from a tidal turbine farm with the account of ambient turbulence.** *International Journal of Marine Energy*, Vol. 19, pp. 70-82
-> <https://doi.org/10.1016/j.ijome.2017.05.003>

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