WAVY
A DRIFTER BY MELOA CONSORTIUM

MELOA - Multi-purpose/Multi-sensor Extra Light Oceanography Apparatus

Surface Drifter for Coastal Environments; Preliminary Results

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MELOA | Proposed Objectives

Create a family of WAVY drifters products, with different configurations and specifications, addressing different use cases for marine in situ measurements

Generate valuable in-situ data and derived data products for **GEOSS** and **Copernicus**

Open opportunities for market development of marine commercial sector & down-stream users

Provide data and information to implement the Sustainable Development Goals

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MELOA | The Consortium

- 5 private companies (PT, SP, IR, FR)
- 3 public institutes (PT)
- 1 university (SP)

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MELOA | Project Focus

To develop a surface drifter that:

Low-cost | Easy-to-handle | Wave Resilient | Multi-sensor | Extra-light

For use in all water environments: deep-sea, inland waters, coastal areas, river plumes and surf zones.

Key Features are:

•Small sized, making the WAVY very easy-to-handle

•Optimized buoyancy, reducing the WAVY vulnerability to direct wind effect

•Minimized pendular motion, facilitating the WAVY position detection

MELOA | Wavy Littoral Drifter

- 12 cm diameter , 750 g sphere
- 3.3 cm wind exposure
- double encapsulation
  - Two perfectly adjusted semi-spheres of polyuethane resin
  - Outer seal of ClearFlex® layer
- GNSS receiver: accuracy better than 3 meters
- low cost inertial sensor (MEMS type)
- 4-band GSM module
- 4400 mAh lithium-ion battery, inductively rechargeable
- Storage up to 36 hours of 1 Hz update rate GNSS logs

MELOA | Wavy Littoral Performance

- are the **GNSS acquisition** successful?
- are the **GSM communications** successful? What about raw data download procedure?
- what is the desirable **GNSS/IMU** sampling rate?
- what is the **frequency band** induced by **pendular motion**? Does it suggest any need for correction of the **IMU position** relative to the drifter center of mass?
- what about **drifting performance**?
- can one get **reliable wave data**?

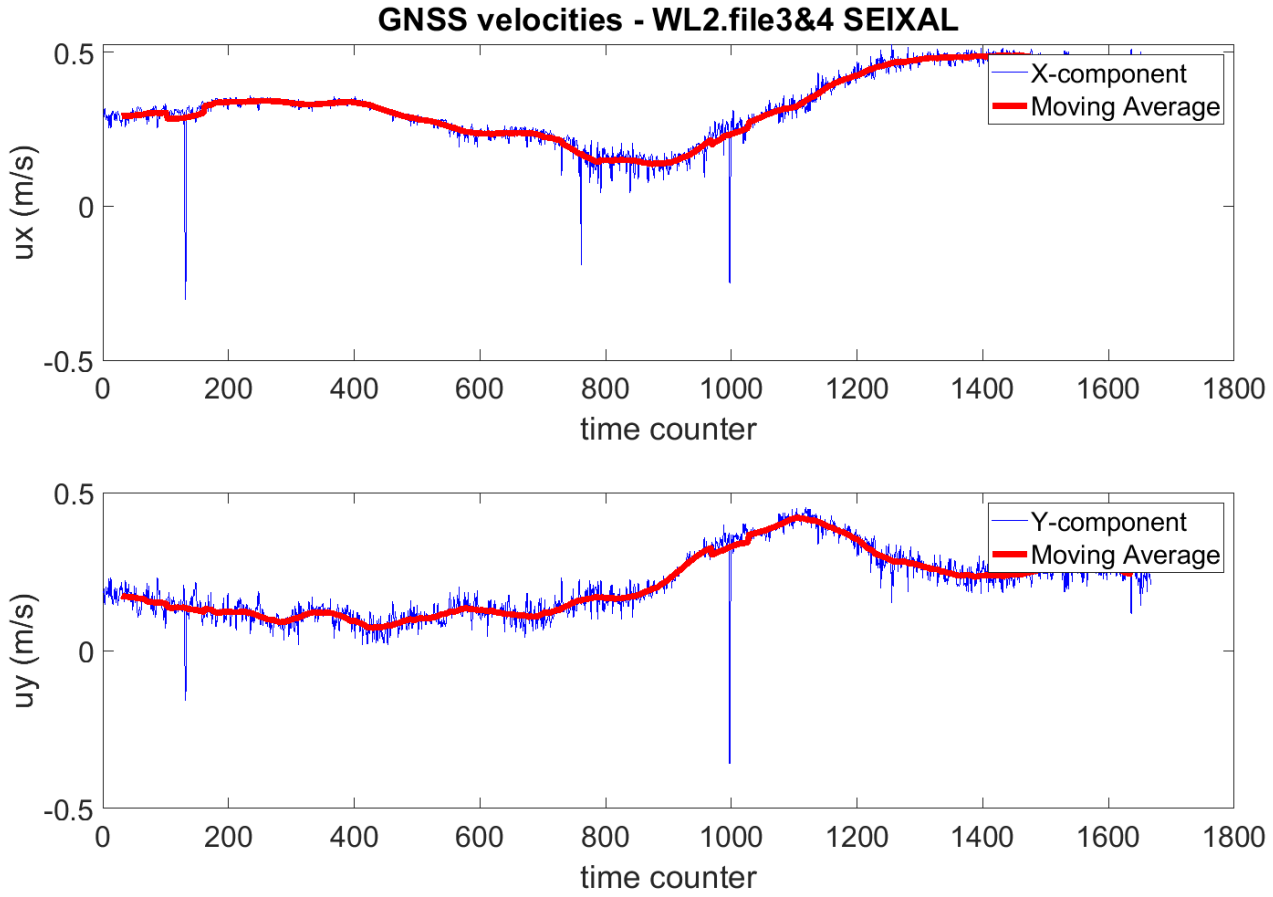
MELOA | Wavy Littoral Performance

Executed campaigns – main objectives

- **Tagus river** – WAVY drifting performance and GNSS acquisition. GSM communications and WAVYhub/WOS testing. **(8 May and 7 Jul 2019)**
- **Guincho beach** – GNSS/IMU combination. Algorithm development to extract wave parameters. **(shoaling zone – 12 May and 5 Jun 2019)**
- **Portimão harbour** – Tide and wind induced currents **(inlet harbour – 9 Jul 2019)**
- **Vagueira beach** – Wave induced current. **(surf zone – 14 Oct 2019)**

MELOA | Wavy Littoral Performance – Tagus river

Drifting and GNSS acquisition performance in a **tide dominated** environment



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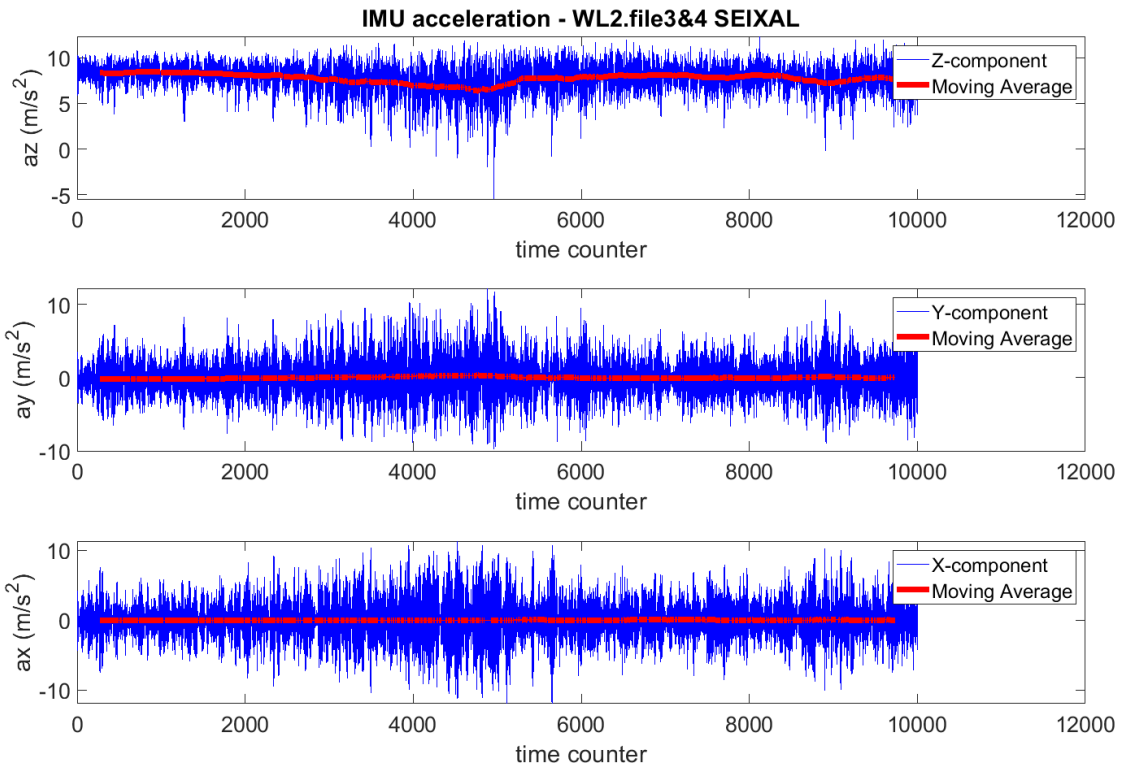
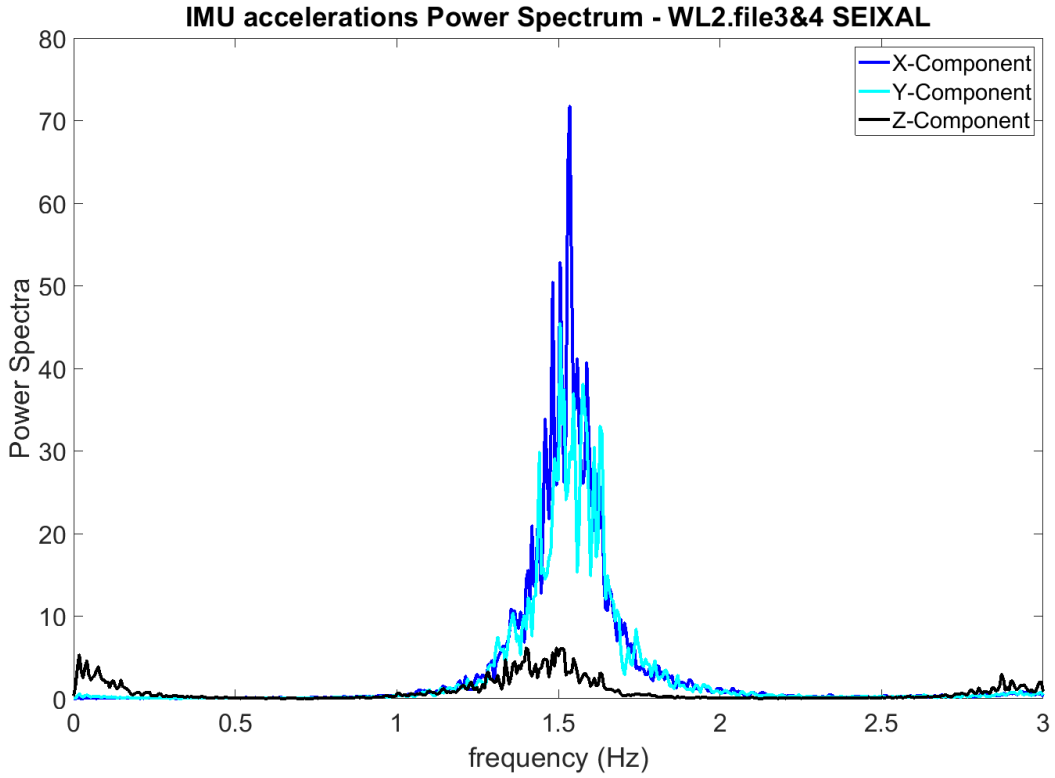
MELOA | Wavy Littoral Performance – Tagus river

IMU sensor record and pendular motion (natural frequency = 1.5 Hz)





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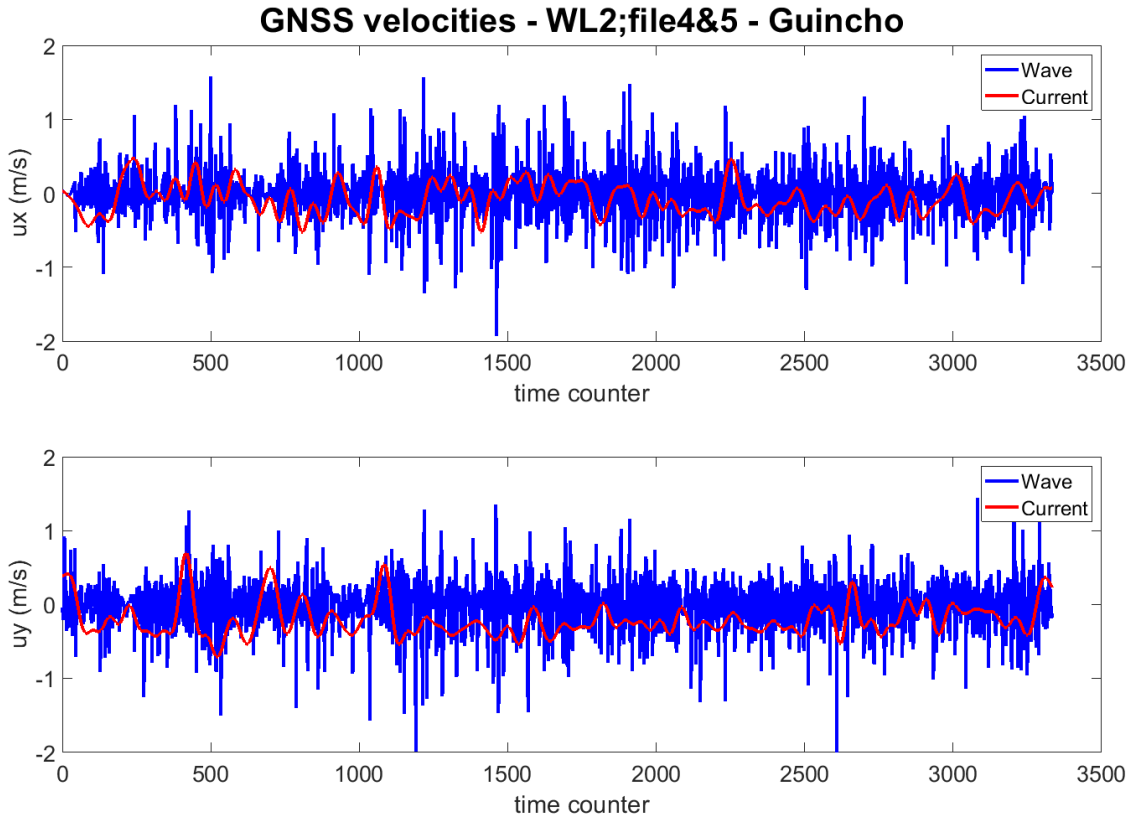
MELOA | Wavy Littoral Performance – Guincho beach

Wave dominated environment



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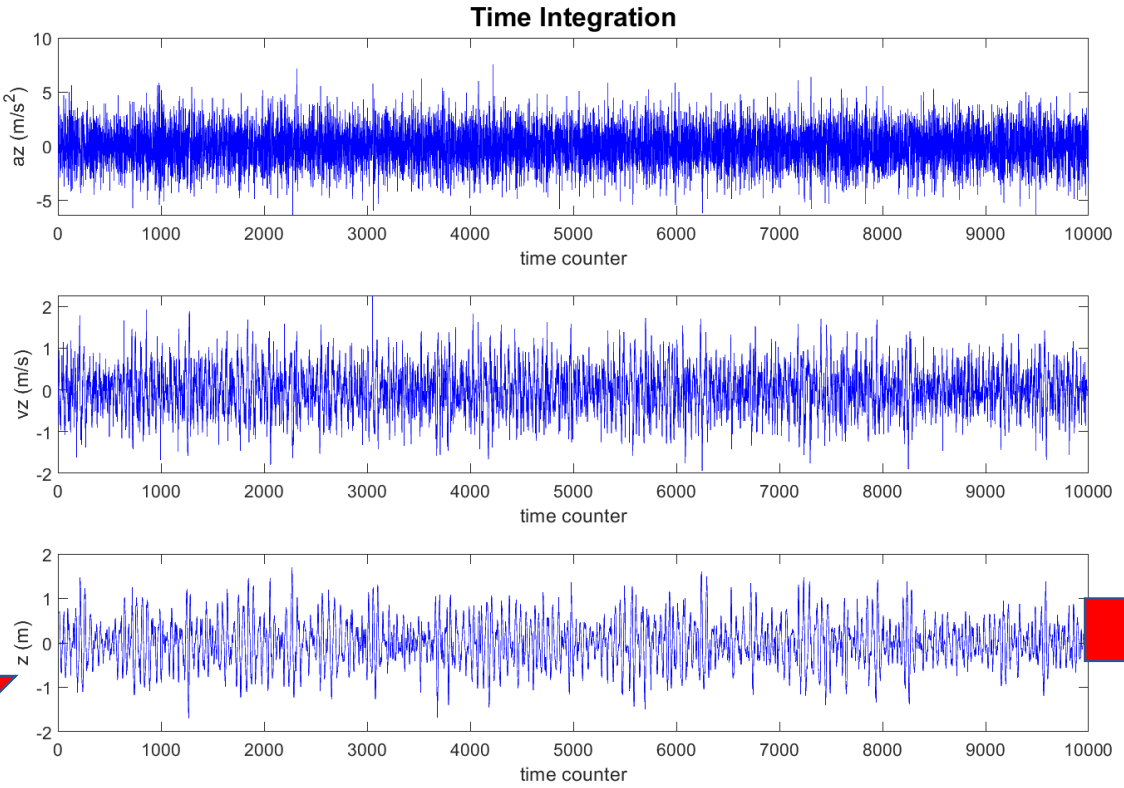
MELOA | Wavy Littoral Performance – Guincho beach

Orbital velocity and displacement (vertical component) estimated from IMU acceleration

Hs = 1.14 m ; Tpk = 8.3 s ; PkDir = 311º

Time Integration



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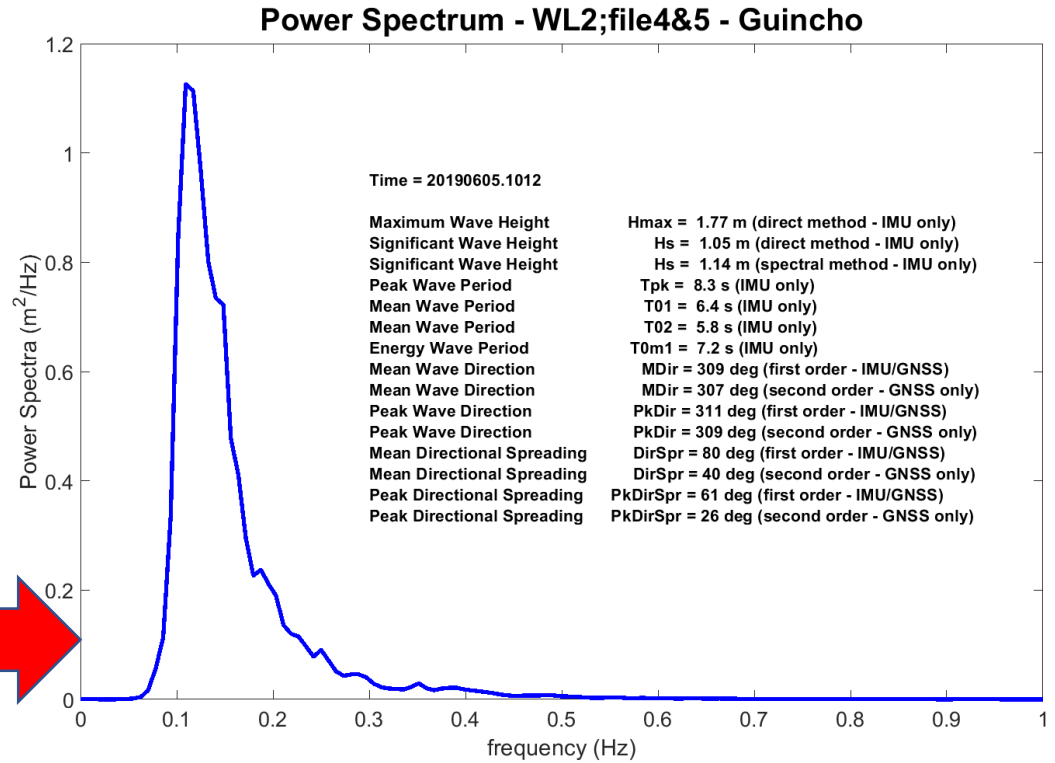

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MELOA | Wavy Littoral Performance – Portimão harbour

Tide and Wind induced current environment

% Time;Lon;Lat;Hm0;Hs;Hmax;Tpk

20190709.1040	-8.5303	37.1048	0.55	0.51	0.92	8.3
20190709.1122	-8.5310	37.0998	0.60	0.57	1.06	8.6
20190709.1203	-8.5289	37.0962	0.53	0.48	0.83	8.5
20190709.1245	-8.5240	37.0941	0.50	0.47	0.97	8.5
20190709.1320	-8.5183	37.0932	0.50	0.47	0.84	8.6

Assessing navigation safety requirements

- Mapping tide induced current at harbour inlet
- Harbour approach wave field

MELOA | Wavy Littoral Performance – Vagueira beach

Wave induced current dominated environment

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MELOA | Wavy Littoral Performance – Conclusions

- **IMU** sensor response **OK**.
- Pendular motion around **1.5 hz**.
- **GNSS** acquisition works perfectly (**at least for 1 hz and 2 hz**). One founds only **residual faults**. Is still necessary to check if the new ones with 4 hz sampling rate show the same behaviour.
- **IMU/GNSS** sampling rate configuration ??? (**IMU = 6 hz**; **GNSS = 2 hz** or **IMU = 4 hz** ; **GNSS = 4 hz**) - **Need Validation (ONGOING)**

Thank You!

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MELOA | Evolutions

- **Adding a low-cost accelerometer:** by means of which the change in the vertical coordinate may be acquired (and thus wave height and other wave parameters) in coastal applications, where the acquisition rate is of up to 4 Hz;
- **Replacing GSM by satellite communications and including additional sensors** (e.g. water temperature) in a version conceived for offshore applications, typically corresponding to long-term missions with lower acquisition rates;
- **Add a detachable, continuously adjustable, ballast module** for use in waters of any density;
- Equip with a **low cost inertial sensor** (MEMS type), a **multi-GNSS board**, an **atmospheric pressure sensor**, and a data processor for derivation of wave parameters from the integration of GNSS and IMU data, with a power generation device to satisfy the additional power requirements of this version.