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Jets interacting with vegetation in the rotating LEGI platform

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Rivers and wastewater discharges flowing into lakes and coastal waters strongly affect aquatic ecosystems, based on their transport of turbulence, tracers and sediment particles. Mixing and spreading of outflows have an even greater impact when the receiving site is obstructed by vegetation canopies or mussel cultivation farms. Thus, a thorough knowledge of the interaction between effluents and receiving bodies is required to mitigate impacts and promote best environmental management practices, also following the 2015 EU Marine Strategy Framework Directive.

Although we understand quite well how turbulent jets interact with rotating frames and with vegetation in isolation, to our knowledge, no one ever investigated jets being affected simultaneously by vegetation and the Coriolis force, which is always present in the field. This was the motivation for our experimental project in the frame of Hydralab+.

We used the Coriolis rotating platform at LEGI-Grenoble. An obstructed pattern was conveniently located in a portion of the rotating tank and spanned by a momentum jet. Instantaneous measurements of the velocity in selected horizontal planes were carried out by means of a PIV system. In this way, we had the possibility i) to mimic in a large-scale model the outflow from rivers, sources and discharges entering the ocean through obstructions and ii) to study how this jet spreads, being transported in a rotating background.

In the real ocean, due to real scales, the direct effect of rotation on turbulence induced by an obstructed pattern should be quite negligible. Nevertheless, the mean flow is modified by rotation and consequently its transport of turbulent kinetic energy and scalars (tracers) is altered in the rotating frame. Furtherly, the rotational effects induce the development of an Ekman boundary layer, which effectively increases bottom friction. All these aspects deserve a thorough analysis. Data processing is ongoing, and we are obtaining some first interesting results, referring to vorticity and turbulent kinetic energy distribution.