Interaction of a turbulent, submerged jet with a free surface

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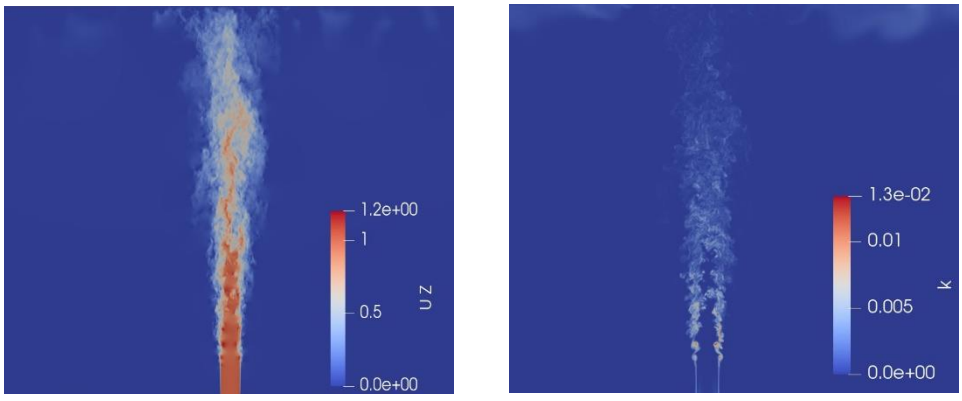
Jets play an important role in a number of environmental and industrial flows. For example, in the marine environment, wastewater is usually discharged as a free, turbulent jet, which mixes with the large water mass of the recipient fluid body and gets diluted in order to minimize pollution effects. Thus, the study of the behaviour of jets is important to accurately assess their impact on the surrounding environment.

In the present work, Large Eddy Simulation (LES) is used to study a submerged, turbulent, round jet discharging into a cubical domain delimited by a top surface which should mimic the top surface of the generic terrestrial water body; the Reynolds number $Re = \frac{ud}{\nu}$ (where u is the jet inlet velocity, d is the jet diameter and ν is the kinematic viscosity) at the jet inlet is $2\text{x}10^4$, while the ratio between the height of the domain h and d is equal to 17.5. Scalar and vectorial quantities such as velocity and pressure fields are investigated to calculate the penetration depth of the jet, its spready, the flow entrainment and other related quantities. Comparisons with available literature data will be given. Possible simplified models and parametrizations will be also discussed.



(a) (b)

Figure 1: (a) Instantaneous velocity component along the jet axis and (b) Turbulent kinetic energy

References

- Abramovich G. N., The Theory of Turbulent Jets, 1963, MIT Press