INTRODUCTION
Understanding the behavior of turbulent dispersed multiphase flow is extremely important in a wide range of environmental and industrial applications. Coalescence and break-up of deformable droplets is one of the most interesting and very complicated problems in fluid dynamics. These phenomena commonly occur in atmospheric raindrop formation, and among dispersed phase systems such as in liquid-liquid extraction, emulsion polymerization, waste treatment and hydrogenation fermentation.

METHODLOGY
We consider a two-phase flow system composed by large and deformable droplets (density \( \rho_d \) and viscosity \( \mu_d \)) dispersed in a turbulent carrier flow (density \( \rho_c \) and viscosity \( \mu_c \)). The evolution of the complex turbulent multiphase flow is described here employing a Phase Field Method (PFM).

The two phases composing the mixture have the same density (\( \rho_d = \rho_c \)) but different viscosity (\( \mu_d, \mu_c \)). Two main dimensionless parameters characterize the system: the Weber number (We), ratio between the inertial and surface tension force; and the viscosity ratio (\( \eta = \mu_d / \mu_c \)), ratio between droplets and continuous viscosity. The simulation setup adopted is a 3D fully developed turbulent channel in which a swarm of droplets (\( R_\alpha = 256 \)) has been released.

RESULTS
During the motion, each droplet can interact with the turbulent structures and with the surrounding droplets, the possible interactions can be classified as follows:

- **i.) Bouncing**

- **ii.) Coalescence**

- **iii.) Break-up**

The number of droplets depends on how frequently these phenomena occur. In the figure below, the time evolution of the dimensionless number of droplets (\( N_d / N_0 \)) is reported for different values of the parameters (We and \( \eta \)).

Figure 4: Time Evolution of the normalized number of droplets \( N_d / N_0 \) (where \( N_0 \) is the initial number of droplets) for two different Weber numbers (ratio between inertia and surface tension force) \( \text{We}=0.75 \) (Panel a) and \( \text{We}=1.50 \) (Panel b).

REFERENCES

CONCLUSIONS AND FUTURE DEVELOPMENTS
Through these simulations, we have extended our knowledge on the role of surface tension (We) and viscosity (\( \eta \)) on the dynamic of a swarm of large deformable droplets in well bounded turbulence.

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