In this presentation we will talk about the numerical computations of 2D Boussinesq equations with fractional dissipation using parallel pseudospectral method. Given smooth initial data, whether the solutions of the system with all the possible values of the parameters develop finite time singularity or not is yet to be known. We will present the evolution of geometry of the level curves, energy spectra and associated norms of two major quantities involved in the system. The solutions were computed for different values of parameters. Some of our computational results strongly indicate potential singularity in finite time suggesting a need for further investigations.