Transient evolution of warm cloud - clear air interface and its impact on cloud droplet evolution

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Three dimensional Direct Numerical Simulation (DNS) using pseudo-spectral Fourier Galerkin method is used for simulating Warm Cloud – Clear Air interfaces [1,2]. Transient evolution of transport of energy, water vapour, temperature and Lagrangian tracking of droplets are simulated for decaying turbulent atmospheric flow, where initial turbulent kinetic energy (TKE) in the simulation domain decays with time [1,2]. Simulation results shows anisotropy and high intermittency across the interface (from high TKE region of cloud side to low TKE region of clear air side), which influenced the transient evolution of passive scalar transport [3]. Cloud droplets are observed to be affected by the small scale turbulence, and they preferentially concentrated away from the regions of high vorticity. Transient evolution of various microphysical properties, such as, droplet sedimentation, condensation/evaporation, droplet inertia, droplet collision and coalescence are investigated to understand the role of turbulence in interfacial transient. Supersaturation and preferential concentration resulted in condensational growth of the droplets and increased local droplet collision rate. As a result, droplet size distribution grew with time, in contrary to the saturated case (Fig 1)

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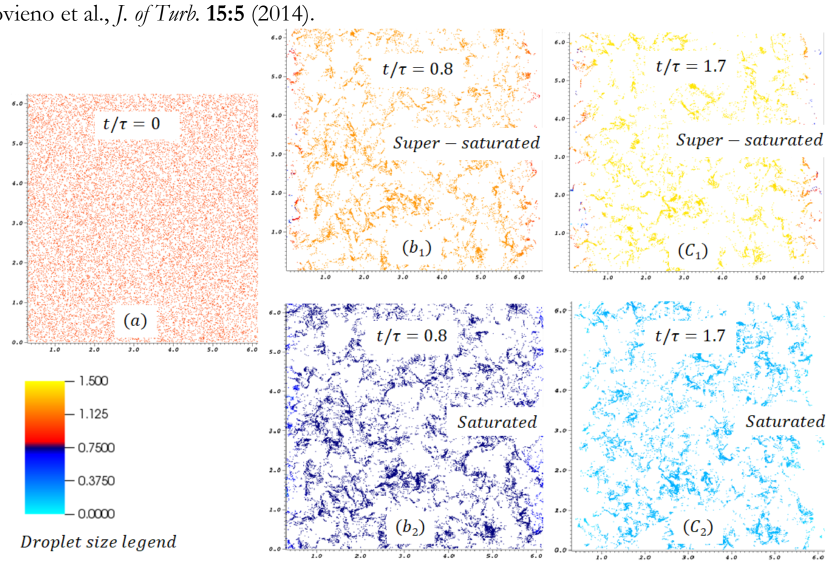

Fig 1: Water droplet clustering. (a) Initial, (b_1, c_1) supersaturated, and (b_2, c_2) saturated domain clustering after 0.8, 1.7 eddy turnover time (colour represents droplet size).

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