Condensation of cloud microdroplets in homogeneous isotropic turbulence

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In this lecture, we will discuss some aspects of the growth by condensation of small water droplets in a homogeneous and isotropic turbulent flow. We would like to understand if peculiar features of turbulence, providing a strongly fluctuating moist environment and influencing the motion on a wide range of space-time scales, might alter significantly the condensation process.
This is a long-standing problem of cloud physics, meteorology, medicine and engineering.
We focus on the problem of warm clouds [1], where a fundamental understanding of key issues such as the turbulent mixing, or the interaction of turbulence with microphysics is important for a variety of applications (e.g. the parameterization of small scales in large scales models, the accurate prediction of the initiation of precipitation).

We introduce a simple model of advection and condensation, and consider the dynamics and growth of initially monodispersed microdroplets. In particular, we will discuss the problem of obtaining a broad droplet-size spectrum from the condensation process.

[1] H. R. Pruppacher and J. D. Klett, *Microphysics of Clouds and Precipitation*, Kluwer Academic Publishers, Boston, MA, (1997).