Study of the interaction between fog and turbulence

Carlos Román-Cascón (1), Francisco Salamanca (1,2), Carlos Yagüe (1), Gregorio Maqueda (3), and Samuel Viana (4)

(1) Universidad Complutense de Madrid, Dpt.Geofísica y Meteorología, Madrid, Spain (carlosromancascon@fis.ucm.es), (2) CIEMAT, MAdrid, Spain, (3) Universidad Complutense de Madrid, Dpt.Astrofísica y Ciencias de la Atmósfera, Madrid, Spain , (4) AEMET, Barcelona, Spain

The adverse effects of fog on human life are clearly visible, especially on transport in its different ways: air, maritime and terrestrial; however, a well forecasting of fog is one of the goals still not achieved by the operational meteorological services. The physical processes involved in the evolution of fogs are not well understood, and therefore, not well parameterized in the weather forecasting models. In particular, the role of the turbulence over the formation or dissipation of fogs is one of the most interesting features to study. While some authors establish that turbulence is a factor inhibiting the formation of fog, other found the opposite, i.e. turbulence acts favoring the formation of fog. Maybe, a combination of both theories leads to the conclusion that there exists a threshold on the relation between turbulence and fog.

This work studies the relation between turbulence and fog from a detailed analysis of different observational data recorded at CIBA (Research Centre for the Lower Atmosphere). This experimental site is placed around 30km north-west from Valladolid city, Spain, in the Northern Iberian plateau, on a region known as Montes Torozos, which forms a high plain of nearly 200 km2 elevated above the plateau. This place is especially suitable for the formation of radiative fogs. Besides sonic anemometers and standard instrumentation (temperature, wind and humidity measurements), particle concentration (PM10, PM2.5 and PM1) and high resolution microbarometer data are available. The near airport Villanubla also supports METAR information in order to better determinate the fog events.

This analysis includes a widely study of vertical profiles of different meteorological magnitudes, as wind speed and temperature, relative humidity, inversion strength, stability or particle concentration. Also the turbulent fluxes and turbulent kinetic energy are evaluated for several heights during the fog events. A statistical analysis of the data is also done in order to draw some conclusions about the most appropriate conditions to develop/dissipate fogs.