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Last decades were characterized by a growing interest in aerosols: mainly for their effect on human health and on the energy balance of solar and planetary radiation, thus their role in climate change. In this study, we analyze the evolution of vertical profile of black carbon (BC) through tethered balloon observations and chemistry-transport modelling. Black carbon is regarded as the second most important anthropogenic climate forcing agent and its concentration varies significantly depending on the altitude and the sources on the territory.
In winter of 2010 University Of Milan Bicocca conducted three intensive measurements campaigns over three Italian basin valleys (Terni, Po Valley, Passiria Valley). The choice of the valleys was made taking into consideration the orography and the river basin structure. The measurement campaign was based on a helium-filled tethered balloon, on which the instrumentation for the analysis has been mounted; the instrumentation consisted on a meteorological station, an OPC, a cascade impactor and a micro-Aethalometer.
Subsequently, at University of L'Aquila simulations were produced to help interpretation of these vertical aerosol profiles (mass, composition and distribution) and related optical properties (scattering, absorption) using a chemistry-transport model (WRF-CHIMERE) at high horizontal resolution (1 km). The analysis focused primarily on the calculation of the heating rate and of the Direct Radiative Effect (DRE), and on the analysis of the large observed day-to-day variability of aerosol profiles.
Critical events for air quality were analyzed (episodes of exceedances of the European PM10 daily limit of 50 μg/m3), and the model showed that they are primarily influenced by local traffic and domestic heating emissions, combined with weather conditions that favored the accumulation of pollutants from day to day.