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Impact of activation process on fog life cycle

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Fogs are complex meteorological system dealing with fine scale processes. Subtle interaction between radiative, dynamic, turbulent and microphysic processes can lead to different fog life cycle, which make prediction difficult. The droplets that composed fogs are formed trough the activation of aerosol particles called CCN (cloud condensation nuclei) described by the Köhler theory (Köhler, 1936). The number and distribution of the droplets activated during fog formation is determined by the aerosols particles properties and number and the ambient vapor supersaturation of the atmosphere.
In the frame of the PreViBOSS project, an in-situ measurement platform of fog properties at ground level was deployed at SIRTA (Instrumented Site for Atmospheric Remote Sensing Research) during winter 2010 to 2013. Microphysics data supply a detailed characterization of number size spectrum from dry to wet aerosols particles and inform on the abilities of the aerosols particles to act as a CCN. 48 fog events have been studied. Supersaturation critical values and concentrations of CCN have been determined and linked to aerosols properties. The main impact of aerosols size distribution on activation have been pointed out. The study of droplets spectra evolution reveals the major physical processes into fogs and suggests that even if thermodynamic dominates the fog life cycle, activation process seems to have a significant effect.
Large eddy simulation of fog run with Meso-NH model allow to explore precisely the interaction between fog physical processes and to quantify activation impact. Supersaturation modelling is a key point, a new pseudo-prognostic scheme (Thouron et al., 2012) is used.
Confrontation between a detailed experimental study and three-dimensional fine scale simulation in LES provides an accurate investigation of the impact of activation process on fog life cycle.