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# The SOuth west FOGs 3D experiment for processes study (SOFOG3D) project

Frédéric Burnet (1), Christine Lac (1), Pauline Martinet (1), Nadia Fourrié (1), Martial Haeffelin (2), Julien Delanoë (3), Jeremy Price (4), Sebastien Barrau (1), Thierry Bergot (1), Guylaine Canut (1), Alain Dabas (1), Cyrielle Denjean (1), Jean-Charles Dupont (2), Rachel Honnert (1), Jean-François Mahfouf (1), Thibault Montmerle (1), Alexandre Paci (1), Greg Roberts (1), Yann Seity (1), and Benoit Vié (1)

(1) CNRM, Université de Toulouse, Météo-France, CNRS, Toulouse, France, (2) IPSL/LMD - Ecole Polytechnique - Palaiseau, France, (3) LATMOS/IPSL/UVSQ, Guyancourt, France, (4) Met Office, Exeter, United Kingdom

Fog strongly perturbs the aviation, marine and land transportation, leading to human losses and high financial costs. The primary objective of SOFOG3D is to advance our understanding of fog processes at the smallest scale to improve forecasts of fog events by numerical weather prediction (NWP) models. Specifically, SOFOG3D conducts process studies on very well documented situations, using synergy between 3D high-resolution Large Eddy Simulation (LES) and unprecedented 3D detailed observations.

A 6 months field experiment will take place during wintertime 2019/2020 in the South-West of France to provide 3D mapping of the boundary layer during fog events. The observation strategy is to combine vertical profiles derived from new remote sensing instruments (microwave radiometer (MWR), Doppler cloud radar and Doppler lidars) and balloon-borne in-situ measurements, with local observations provided by a network of surface stations, and a fleet of Unmanned Aerial Vehicles (UAV) to explore fog spatial heterogeneities.
Three nested domains will be instrumented with increasing density to provide observations from regional scale (300x200 km) down to local scale on the super-site (10x10 km), thanks to Meteo France and U.K. Meteorological Office sensors. On the super site, meteorological conditions, visibility, aerosol optical, microphysical and hygroscopic properties, fog microphysics and liquid water content, water deposition, radiation budget, heat and momentum fluxes on flux-masts will be performed on four areas to investigate the impacts of surface heterogeneities on fog processes, as well as turbulence anisotropy. Combination of cloud radar and MWR measurements will allow optimal retrieval of temperature, humidity and liquid water content profiles. They will be validated with in situ measurements from tethered-balloon, radiosoundings and UAV.

LES of the most documented fog cases of the campaign will be run at metric resolutions to provide spatio-temporal turbulence and microphysical characteristics of the fog layer and the atmosphere above, supplementary from measurements. They will assess recent advances in parametrizations (two-moment microphysical schemes, turbulence and radiation). Their combination with 3D experimental data will deliver a comprehensive description of the impact of surface heterogeneities (types of vegetation, rivers, orography) on the fog life cycle.
SOFOG3D will particularly focus on the impact of entrainment at fog top, the surface energy budget, the impact of aerosols on radiative cooling and heating, and the dissipation period, through radiation, droplet sedimentation and deposition processes.
SOFOG3D will also investigate how improving the initial conditions of NWP models can improve fog forecasts. To that end, data from a ground-based MWR network will be assimilated using an innovative ensemble-based variational data assimilation scheme.

We will present the instrumental set-up that will be deployed during this campaign and discuss the main objectives of the project.