



## **The fog life cycle described by the ParisFog field experiment**

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The objective of the Parisfog field experiment (SIRTA Observatory, 20 km South Paris, 2006-2007 winter) was to document the radiative, thermodynamics and dynamics processes during the fog life cycle, which depend and modify the microphysical properties of the atmospheric particles, from the Aitken and accumulation mode aerosols to the fog droplets. The radiative processes concern the extinction of light and the radiative cooling of the surface atmospheric layer. The dynamics and thermodynamics processes design the advection, the turbulence in the surface atmospheric layer, and the condensation of water vapour on the atmospheric particles. The experimental set-up was composed by a visibilimeter, a telemeter, two optical particle counters, a pyrgeometer, as well as anemometers, thermometers and humidity sensors mounted on a meteorological mast. Fog life cycle is described and interactions are observed between particle concentration, horizontal visibility, radiative cooling, advection and turbulent kinetic energy. The dense and extended fog of the 18-19 February night, one of the best documented during ParisFog, is the case study:

- The radiative cooling of the surface atmospheric layer, which starts 8 hours before the fog outbreak, is interrupted twice due to: 1) a cloud overpassing at around 600 m altitude, and 2) the fog outbreak. In both cases the droplets generate a temperature increase of around 2°C in few tens of minutes. The cloud overpassing lasts 15 minutes but delays the cooling by one hour.

- A change in the wind direction 6 hours before the fog outbreak indicates transport of pollution aerosols on the experiment site. Hydration phase preceding the fog outbreak affects these aerosols, building up a brownish haze where wet aerosols are not larger than  $2 \mu\text{m}$  diameter.
- Turbulent kinetic energy increases to  $0.25 \text{ m}^2\text{s}^{-2}$  at the fog outbreak and stays larger than the mean nocturnal value by a factor of two, for more than 30 minutes.
- Three phases of fog development are identified: 1) visibility is stable around 70 m; 2) visibility progressively increases to 110 m, and 3) high variability is observed between 70 and 200 m.