

Variation of ultra fine particle concentrations within the winter boundary layer observed by a Multicopter UAV

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A CPC (Condensation Particle Counter), which measure number concentrations of Ultra Fine Particles (UFP) with diameter of 10-100 nm was mounted on multicopter manufactured by DJI Co. Ltd., and temperature, humidity and pressure were measured simultaneously. UAV flouht until 200m above ground by manual control at Tamura Hanatae field (33.54°N, 130.32°E) and Ikino-matsubara coast (33.58°N, 130.58°E), both located around boundary of city area and rural area. Operations were carried out Nov. 29th, 30th, Dec. 8th and 9th in 2019. vertical profiles were obtained every 30-40 minuite from sunrise ot sunset on Nov. 29th and from sunrise to noon on other 3 days.

Similar variations were observed from sunrise to noon for all 4 days. High concentrations of UFP, exceed 10000 particles /cm³ appeared in surface layer and low concentrations of UFP, 2000-5000 particles/cm³, were observed in residual layers above surface layers at sunrise. Thickeness of surface layer with high concentration of UFP grew with time until around 11:00, and surface layer disappeared and concentration of UFP decreased at the time. Concentrations of UFP after 11:00 show different level, which seem to refrect the conditon of field located in upstream direction of surface wind. Lifetimes of UFP were estimated as around 5 hours, based on aerosol size distributions observed at Fukuoa University, and they are consistent with low concentration of UFP in resudual layer for all 4 days.

Keywords: multicopter UAV, boundary layer, ultra fine particles, high tempo-spatial resolution

