

Measurement and field observation of atmospheric nanoparticles in Fukue Island, Japan

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In 2012, we conducted measurement and field observation of atmospheric nanoparticles for the first time in the Fukue Island (32.8°N, 128.7°E), Japan. The time-resolved data on the mobility size distribution ($14 < D_p < 670$ nm) and total number concentration ($D_p > 3$ nm) was measured by a Long-Scanning Mobility Particle Sizer (Long-SMPS, TSI Inc.) and a condensation particle counter (CPC Model 3776, TSI Inc.). We identified a sudden increase of particle number concentration under long-range transport of air mass coming from the continent (NOAA HYSPLIT model). However, those instruments were lack of sensitivity to detect a critical size of newly-formed nanoparticles. Thus, we added a Nano-Differential Mobility Analyzer (Nano-DMA) in conjunction with CPC Model 3776 to measure mobility size distribution between 2.5 and 64 nm since 2013. We investigated and categorized the new particle formation (NPF) into two types (A and B) and analyzed the correlation between NPF and transported air pollution. The strong event (type-A) was identified as small as 5 nm and successive growth into several tens nanometer under high concentration of precursor gas (SO₂) and low concentration of pre-existing particles (PM_{2.5}). Meanwhile, unclear initial particle formation process (>10 nm) was observed for type-B. We continued field observation and added 1nm-SMPS (TSI Inc.) in 2016-campaign to measure nanoparticles as small as 1 nm. 1nm-SMPS system composed of 1nm-DMA (model 3086, TSI Inc.), a nano enhancer (model 3777, TSI Inc.), and a CPC (model 3772, TSI Inc.). In 2017, we used a Nano and Long-SMPS for a long term observation (82 days) and 1 nm-SMPS only for the intensive observation. The measurements of the concentrations and chemical composition of atmospheric aerosols and gases were available from the observation system of National Institute for Environmental Studies (NIES) and various meteorological data were available from the observation network for aerosol-cloud-radiation interaction (SKYNET).

Keywords: New particle formation, Nanoparticles, Trans-boundary transport, Fukue Island.