

Enhanced new particle formation above the marine boundary layer over the Yellow Sea: Potential impacts on cloud condensation nuclei

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Aircraft measurements of aerosols were conducted over the Yellow Sea and East China Sea from February 14 to March 10, 2013, during the Aerosol Radiative Forcing in East Asia 2013 Winter campaign. Ground-based measurements of aerosols were also conducted on Fukue Island, Japan. The aircraft measurements revealed large increases in particle number concentrations in the nucleation mode at altitudes of ~0.5-3 km over the Yellow Sea. This feature was attributed to enhanced new particle formation (NPF) above the marine boundary layer over the Yellow Sea. The number ratio of Aitken-mode (10-90 nm) or accumulation-mode (> 90 nm) particles to black carbon particles (tracer of primary emissions) was used to quantify the effects of NPF on particle number concentrations. We estimated that NPF increased Aitken-mode particle number concentrations by an order of magnitude at altitudes of ~1-2.5 km over the Yellow Sea. Synchronized aircraft and ground-based data suggest that vertical transport of Aitken-mode particles formed over the Yellow Sea led to large variability in the particle growth events observed on Fukue Island. A shift of sea surface temperature near Fukue Island and the resultant promotion of vertical mixing are likely the key mechanisms for this complex feature. Potential impacts of NPF on cloud condensation nuclei over the East China Sea are also discussed.

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