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Peroxyacetyl Nitrate Indicating the Influence of Continental Outflows and Ship Emissions Over the Yellow Sea During KORUS-AQ Campaign

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The measurements of PAN, NO_2, O_3, CO, SO_2, BC, PM10, and scattering coefficient in Research Vessel Gisang 1 were conducted in Yellow Sea from May 2nd, 2016 to June 12th, 2016 during KORUS-AQ Campaign. PAN was measured using GC-LCD (Gas Chromatography with Luminol Chemiluminescence Detection) every 2 minutes. Mean and 95th%tile concentration of PAN and O_3 were 0.88 and 2.19ppbv, and 59.3 and 90.0ppbv, respectively. The Chinese outflow with westerly wind was identified by high concentrations of PAN and CO. On the other hand, with easterly wind from the Korean peninsula, high concentrations of NO_2 and O_3 flow were observed.
In Chinese outflow, the mean concentration of CO was 510ppbv, higher than that of Korean outflow (356ppbv). In contrast, the mean concentrations of O_3 and NO_2 in Korean outflow were 72.1 and 5.7ppbv, higher than those of Chinese outflow (62.2 and 3.5ppbv), indicating the impacts of nearby west coast of Korean peninsula. During the haze episodes, the variations of PM10, O_3, and PAN showed similar patterns, implying long-range transport of pollution plumes. When RV Gisang1 captured ship emission impacted air, O_3 dropped with a sharp increase of NO_2, BC, and SO_2 up to their 99th%tile concentrations (27.5ppbv, 5.74μg/m3, and 6.21ppbv). PAN concentration also increased by 0.56ppbv in average. O_3/PAN slope was 4.7 in typical Chinese outflow, lower than that of Korean outflow (14). In ship emission impacted air when BC was the highest, O_3/PAN was -11.5, resulting in decoupling of O_3 and PAN. Therefore, the enhancement of PAN in different episodes may suggest that PAN as a tracer distinguishes the various plumes such as aerosols, O_3, and ship emission.