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Observation of Cloud Water Chemistry in the Free Troposphere and the Atmospheric Boundary Layer on Mt. Fuji (6)

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Context/Purpose: Mt. Fuji is an isolated peak and its top is located in the free troposphere, so we could observe the background concentration of various chemicals in the ambient air over Japan, background pollution due to the long-range transportation from Asian Continent, and aerosol-gas-cloud interaction. To clarify cloud water chemistry in the atmospheric boundary layer, long-term observation through the whole year has been performed at the southeastern foot of Mt. Fuji from 2006.
Method: Cloud water samples were automatically collected by an active string-type cloud water sampler (Hokuto Electronics. Co., DFC-2200) at the southeastern foot of Mt. Fuji (1284 m a.s.l.). Concentrations of major inorganic ions in cloud water were measured by ion chromatography. The pH and electric conductivity were measured after the filtration by 0.45 μm membrane filter. Major inorganic ions were measured by ion chromatography. Twelve trace metals were measured by ICP-MS, while Hg was measured by a reducing-vaporization mercury analyzer. The origin of air mass was determined by the backward trajectory.
Results/Interpretation: The annual average of LWC has been on the order of 0.10 g/m3 from 2009 to 2018, while the annual occurrence of cloud has remained below 10 % from 2009 to 2015, but it increased after 2016 and was 16 % in 2018. Volume weighted mean annual pH was less than 4.0 from 2009 to 2014, but it increased along with the decrease of nitrate/nss sulfate ratio after 2015. The total concentration of major inorganic ions has reached the highest concentration (2.7 meq/L) in 2015 during the nine years from 2009 to 2018, but it decreased to about 1.0 meq/L. Atmospheric loadings of As, Se and Cd varied similarly and reached the maximum concentration (As: 0.21 ng/m3, Se: 0.15 ng/m3, Cd: 0.05 μg/L) in 2014, but it decreased from 2015. While the atmospheric loadings of Hg did not show a clear trend because of the discharge of volcanic gaseous mercury from Mt. Fuji.
Conclusion: The decreasing trend of the atmospheric loadings of acidic substances and some harmful trace elements in cloud water at the foot of Mt. Fuji after 2015 suggested that the air quality is improving due to the reduction of both domestic emissions and transboundary pollution in recent years.