Investigation on the factors controlling new particle formation events by long term observation in Noto peninsula

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The process by which new particles are formed from gaseouss precursors in the atmosphere is one of the main factors that affect the number size distribution of aerosol particles. Since new particle formation (NPF) is a first step for the aerosol particles to take shape and eventually act as Cloud Condensation Nuclei (CCN), it is important in understanding the contributions of aerosols on the climate and air quality. During the last couple of decades, NPFs have been observed to take place in many different environmental settings in the world. However, previous research is mostly based on case studies that covered only several weeks to several months, and there have been few reports so far on seasonal characteristics of NPF based on long term observation in coastal East Asia.
We observed particle size distributions, trace gas (SO_2) and meteorological parameters (solar radiation, temperature and relative humidity) at NOTOGRO (37.45˚N, 137.36˚E, acronym for NOTO Ground-based Research Observatory) located in Suzu City at the tip of Noto Peninsula from October, 2012 to June, 2017. In addition, hygroscopicity of particles were measured using a CCN counter.
Based on 1,262 days' worth of long term observation, we observed in total 126 NPF events. A distinct seasonality was found in terms of the NPF event frequency and spring (May) and autumn (November) were found with the highest frequencies. Comparison with other environmental parameters showed that, the values of the H_2SO_4 proxy tended to be high when NPF events occurred. This was also true in spring even when condensation sink (CS) was found to be rather high. In spring, cloud cover frequency was particularly low when NPF events occurred. These results suggested that spring events were most strongly affected by solar radiation (hence photochemistry).
In order to investigate on the chemical compounds contributing to the particle growth, the chemical components involved in the NPF was inferred from the particle hygroscopicity measured simultaneously by the CCN counter. The hygroscopicity of particles was found to be highest in winter and lowest in spring and summer. This result suggested that chemical compounds involved in the growth of new particles may vary depending on the season.

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