Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)
©2011. Japan Geoscience Union. All Rights Reserved.

MIS029-05 会場:203 時間:5 月 23 日 17:30-17:45

富士山頂における大気イオンの粒径分布測定
Size distribution measurement of air ions at the summit of Mt. Fuji

松木 篤 [1*], ジュリアン・ブーロン [2], キャリン・セレグリ [2], パオロ・ラジ [3], 三浦和彦 [4], 岩坂泰信 [1]
Atsushi Matsuki[1*], Julien Boulon[2], Karine Sellegri[2], Paolo Laj[3], Kazuhiko Miura[4], Yasunobu Iwasaka[1]

[1] 金沢大学, [2] 物理気象研究所, [3] 雪氷・環境地球物理学研究所, [4] 東京理科大学
[1]Kanazawa University, [2]LaMP, [3]LGGE, [4]Tokyo University of Science

Atmospheric aerosols regulate the climate either by interfering with solar and terrestrial radiation, or indirectly by acting as cloud condensation nuclei upon which water vapor condense onto. The term new particle formation literally refers to an event by which new particles are formed in the atmosphere through condensation of precursor gases. Such gases are often adsorbed on preexisting particles (e.g. in polluted environments) and there will be no net change in the number of particles. On the other hand, explosive blooms of tiny particles have been observed in rather clean environments. The condition or mechanism that triggers the new particle formation is still not very well constrained, but attracted much attention as an important pathway for increasing the number of cloud condensation nuclei.

Elevated concentrations of ultrafine particles have been observed during ground-based measurements in the Asian high mountain ranges (Nishita et al., 2008; Venzac et al., 2008). These events were commonly associated with characteristic daytime upslope valley winds, consistent with reports from other parts of the world. If any, new particle formation in Mt.Fuji may be unique in its way since the mountain consists of a steep single peak. Our focus is to monitor the variation of air ion clusters and intermediate ions at the summit of Mt. Fuji, in order to conduct an in-depth identification of the types of nucleation events taking place over the unique topography.

We have measured the size distribution of ion clusters (0.4nm?2nm) and charged nanoparticles or intermediate air ions (2nm-10nm) for the first time at the summit of Mt. Fuji (3776m, 35.36N, 138.73E) using Air Ion Spectrometer (AIS, Airel Ltd.). AIS was installed in a corner of former building of Mt. Fuji weather station of JMA (Japan Meteorological Agency) during the 2009 summer measurement campaign (14 Jul-23 Aug). In 2010 (18 Jul-24 Aug), AIS was replaced by NAIS (Neutral cluster & Air Ion Spectrometer) which is capable of measuring uncharged clusters in addition to naturally charged air ions.

Unlike in Himalayas (Venzac et al., 2008), only one daytime event was observed (5 Aug 2010) through the 10 weeks worth of measurement, that accompanied typical banana-shaped continuous growth pattern with high concentration of intermediate ions covering the entire measuring range of AIS. This example strongly suggests that the new particle formation indeed took place at the site.

To our surprise, the elevated concentrations of ultrafine particles (D>10nm) were regularly found instead during the night hours (21:00-04:00LST). The positively charged particles were more pronounced during these events. Since there was no intermediate ion growth connecting ion clusters and the ultrafine particles, this gap suggests that the particles possibly nucleated at some distance from the measurement site (e.g. in the free troposphere), or via mechanisms other than ion-induced nucleation. We plan to compare these findings with the meteorological parameters, trace gases and aerosol concentrations to analyze the condition of such events in more detail.

Reference:
Nishita C., Osada K. Kido M., Matsunaga K., & Iwasaka Y., J. Geophys. Res., 113, D06202, doi:10.1029/2007JD009302, 2008.

Venzac H., Sellegri, K., Laj P., Villani P., Bonasoni P., Marinoni A., Cristofanelli P., Calzolari F., Fuzzi S., Decesari S., Facchini M.C., Vuillermoz E., & Verza G.P., PNAS, 105 (41), 15666-15671, 2008.

Acknowledgement:
This work was performed during the period in which the NPO ”Valid Utilization of Mt. Fuji Weather Station” maintained

the facilities. We would like to ac-knowledge the summit crew and NPO personnel for organizing and safely maintaining the measurements. The authors thank H. Okochi, H. Kobayashi, N. Kaneyasu, F. Taketani, H. Takahashi, Y. Minami, Y. Igarashi, H. Yasuda O. Nagafuchi, S. Kato and other research team members for their very warm support.

キーワード: 大気エアロゾル, 新粒子生成
Keywords: atmospheric aerosols, new particle formation