Geophysical Research Abstracts
Vol. 21, EGU2019-17451-2, 2019
EGU General Assembly 2019

Iodic acid and new particle formation observed at the high-altitude station of Maïdo (Réunion)

Matti Rissanen (1,2), Clémence Rose (3), Siddharth Iyer (4), Xucheng He (2), Yee Jun Tham (2), Janne Lampilahti (2), Daniela Wimmer (5), Jean-Marc Metzger (6), Olivier Magand (7), Theodore K. Koenig (8), Henning Finkenzeller (8), Aurélie Colomb (3), Karine Sellegri (3), Bert Verreyken (9), Crist Amelynck (9), Trissevgeni Stavrakou (9), Niels Schoon (9), Pierre Tulet (6), Jean-Pierre Cammas (6), Rainer Volkamer (8), and Jérôme Brioude (6)

(1) Aerosol Physics Laboratory, Physics Unit, Tampere University, Tampere, Finland (matti.rissanen@tuni.fi), (2) University of Helsinki, Institute for Atmospheric and Earth System Research / Physics Department, Finland (matti.p.rissanen@helsinki.fi), (3) Université Clermont Auvergne, CNRS, LaMP, F-63000 Clermont-Ferrand, France, (4) University of Helsinki, Institute for Atmospheric and Earth System Research / Chemistry Department, Finland, (5) Faculty of Physics, University of Vienna, 1090 Vienna, Austria, (6) LACy, UMR8105, Saint Denis de la Réunion, France, (7) Institut des Géosciences de l'Environnement (IGE, UMR5001 CNRS-UGA-IRD-GINP) UGA, CS 40 700, 38058 Grenoble cedex 9, France, (8) Department of Chemistry, University of Colorado Boulder, Boulder, CO, USA Cooperative Institute for Research in Environmental Sciences (CIRES), Boulder, CO, USA, (9) Royal Belgian Institute for Space Aeronomy, Brussels, Belgium

Iodine oxides have been frequently shown to play a major role in intense new particle formation (NPF) events observed in coastal sites, perhaps the best known from the investigations conducted at Mace Head field station in western Ireland [1, 2]. Due to the photolability of the main iodine emissions (e.g., I2, CH2I2 and HOI) their contribution to atmospheric NPF is believed to be mainly local with negligible influence over longer distances. Very recent ice-core sampling studies have indicated tripling of atmospheric iodine levels since 1950 [3, 4].
Field measurements were conducted at the high-altitude research station of Maïdo Observatory (2150 m) [5] on Réunion Island as a part of the intensive operation period (IOP) of the OCTAVE measurement campaign. In-situ oxidant and aerosol precursor budgets were retrieved with chemical ionization mass spectrometers (CIMS) and various gas analysers, and the atmospheric charged and neutral nanoparticle size distributions were determined with a collection of instrumentation including neutral air ion spectrometer (NAIS) and particle size magnifier (PSM).
Iodic acid (HIO_3), a proposed key compound for coastal iodine-related NPF [2], was frequently observed at Maïdo shortly after sunrise, and was followed by NPF events whose strength and timing were correlated with the experimental conditions. During the IOP, various meteorological conditions were encountered from change of trade winds to tropical cyclones, constituting a highly variable dataset to inspect the generality of the observations. Especially the nearby volcanic eruption observed in the late part of the campaign resulted in peculiarly strong NPF events in which the halogen species potentially played an important role.

References

[1] O'Dowd, C. D. et al. "Marine aerosol formation from biogenic iodine emissions" Nature, 2002, 417, 632-636.
[2] Sipilä, M. et al. "Molecular-scale evidence of aerosol particle formation via sequential addition of HIO_3" Nature, 2016, 537, 532-534.
[3] Cuevas, C. A. et al. "Rapid increase in atmospheric iodine levels in the North Atlantic since the mid-20th century" Nature Comm., 2018, 9, 1-6.
[4] Legrand, M. et al. "Alpine ice evidence of a three-fold increase in atmospheric iodine deposition since 1950 in Europe due to increasing oceanic emissions" PNAS, 2018, 115, 12136-12141.
[5] Baray, J.-L. et al. "Maïdo observatory: a new high-altitude station facility at Reunion Island (21[U+25E6] S, 55[U+25E6] E) for long-term atmospheric remote sensing and in situ measurements" Atmos. Meas. Tech., 2013, 6, 2865-2877.