

Measurements of cloud particles and sea salt aerosols at Tarawa (1.35N, 172.92E), Kiribati using balloon-borne Cloud Particle Sensor (CPS) under the SOWER campaigns

Masatomo FUJIWARA¹, Takashi ONO¹, Suginori IWASAKI², Yoichi INAI³, Satoru MIMURA¹,
Masahiko HAYASHI⁴, Takuji SUGIDACHI⁵, Sergey KHAYKIN⁶, Alexey LYKOV⁷, Vladimir YUSHKOV⁷,
Masato SHIOTANI⁸, Fumio HASEBE¹

¹ Hokkaido University, Sapporo, Japan

² National Defense Academy, Yokosuka, Japan

³ Tohoku University, Sendai, Japan

⁴ Fukuoka University, Fukuoka, Japan

⁵ Meisei Electric Co., Ltd, Isesaki, Japan

⁶ LATMOS, CNRS, Université de Versailles St. Quentin, Guyancourt, France

⁷ Central Aerological Observatory, Dolgoprudny, Russia

⁸ Kyoto University, Uji, Japan

The Cloud Particle Sensor (CPS; Fujiwara et al., 2016) is a small-mass (200 g) balloon-borne sensor flown with Meisei radiosonde. The CPS is equipped with a diode laser at 790 nm and two photodetectors, with a polarization plate in front of one of the detectors, to count the number of particles per second and to obtain the cloud-phase information (i.e., liquid, ice, or mixed). The lower detection limit for particle size was evaluated in laboratory experiments as 2 μm diameter for water droplets. The upper limit of the directly measured particle number concentration is $\sim 2 \text{ cm}^{-3}$ ($2 \times 10^3 \text{ L}^{-1}$), which is determined by the volume of the detection area of the instrument; in a cloud layer with a number concentration higher than this value, particle signal overlap and multiple scattering of light occur within the detection area, resulting in a counting loss, though a partial correction may be possible using the particle signal width data. We have flown a total of 13 CPSs at an equatorial Pacific site, Tarawa (1.35N, 172.92E), Kiribati, in January 2016, in November 2016, and in November 2017 under the Soundings of Ozone and Water in the Equatorial Region (SOWER) project. For 11 CPS flights, the Fluorescent Advanced Stratospheric Hygrometer for Balloon (FLASH-B) instruments were flown simultaneously, while for the rest 2 CPS flights, the Fukuoka University Optical Particle Counter (OPC) instruments were flown simultaneously. In the presentation, we will show the measurements of cirrus cloud layers in the upper troposphere and of non-spherical particles in sub-saturated marine boundary layer. The latter particles were found in all the 13 soundings and are most probably sea salt aerosols.

Key words: cloud particles, sea salt aerosols, radiosonde, balloon sounding, equatorial Pacific

Reference

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