

Development of a cloud particle sensor for radiosonde sounding

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A meteorological balloon-borne cloud sensor called the cloud particle sensor (CPS) has been developed. 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. For the current model the output voltage often saturates for water droplets with diameter equal to or greater than ~ 80 μm . The upper limit of the directly measured particle number concentration is ~ 2 cm^{-3} (2×10^3 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. The CPS is currently interfaced with either a Meisei RS-06G radiosonde or a Meisei RS-11G radiosonde that measures vertical profiles of temperature, relative humidity, height, pressure, and horizontal winds. In the presentation, results from four flights, two in Japan and two in Indonesia, are discussed in detail.

Keywords: cloud, radiosonde