Aerosol Composition and Volatility in TTL
- In situ Balloon Borne Measurements and sampling over Biak Indonesia -

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Abstract

Cloud process is one of key process of dehydration at tropical tropopause layer (TTL). Super saturations were detected frequently around TTL, and it is not understood until now. What is the ice nuclei in TTL? What kind of nucleation process is most important to form TTL cirrus? In order to understand TTL cirrus processes, balloon borne aerosol observations were conducted as one part of SOWER campaign, observation for water vapor, ozone, cloud and aerosol using many kinds of balloon borne instruments and a Lidar.

Thermo Denuding tandem Optical Particle Counters (TD-OPC) and aerosol samplers (AS) were launched by 3 kg rubber balloon from Biak Indonesia. Seven TD-OPCs were launched during January of 2011, 2012 and 2013. One TD-OPC and two AS were launched in February/March 2015. One AS, launched on 26 February, was separated from balloon at 23km after collecting 10 samples and another AS, launched on 1 March, separated at 25km after collecting 14 samples.

TD-OPC has two OPCs. One OPC measure aerosol size distribution, diameter of 0.3-10 μm, in ambient condition and the other measures those at high temperature through after heated. On the basis of knowledge about aerosol composition and origin, volatility of 4 kinds of test particle were examined in the laboratory. They show that temperature of 100 to 300 ℃ is suitable to examine the TTL aerosol.

The ratio un-volatile to ambient concentrations, for 0.3-0.8 μm in every 200 m, is low in stratosphere and high in troposphere. Those in TTL show middle value, but are little higher than those at just below TTL, suggesting possibility of direct injection from troposphere. Concentrations of un-volatile particles are around mixing ratio of 100 #/g, corresponding to volume concentration of 10 #/liter. It is similar to cloud particle concentration in sub-visible cirrus, suggesting importance of un-volatile constituent for cloud activation. Temperature dependency in residual ratio was compared with test particle examination. Residual ratios between 100 to 300℃ are similar in stratosphere and TTL suggesting major constituent is sulfuric acid, with some % of non-volatile matter. There is some slope below 200m in lower TTL, similar to the feature of anmonium sulfate.

Analyses of morphology and elemental composition of aerosols recovered from TTL are now under processing.

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