

Development of a balloon-borne chilled-mirror hygrometer for climate monitoring

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Atmospheric water vapor plays important roles in the global climate system. In upper troposphere and lower stratosphere, it contributes strongly to the radiative balance and influences variability of ozone layer through its photochemical nature. Accurate monitoring of water vapor is crucial for improving our understanding of climate change. Chilled mirror hygrometers have been used as transfer standard in laboratories and metrology labs, because this type of hygrometers can measure water vapor concentration with high accuracy. We have converted FINEDEWTM (Azbil Corporation), which is a chilled mirror hygrometer for industrial application, into a hygrometer for upper air observation. Because the FINEDEWTM uses a two-stage Peltier cooler, it does not need cryogen and thus is easy to handle. We have conducted flight tests in Japan and Indonesia to evaluate the performance. The results showed that this hygrometer has ability to measure atmospheric water vapor from the surface to the lower stratosphere. Also, simultaneous soundings with the Cryogenic Frostpoint Hygrometer (CFH) showed good agreement at least in the whole troposphere. With some more improvements, it is considered that our hygrometer will contribute to the monitoring of water vapor in the stratosphere as well as the troposphere.

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