Mt. Fuji High Altitude Station (tentative) : Logistics as an NPO Station, Oxidant Determination and a Proposal for East Asia Network

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The summit of the Mt. Fuji is supposed to be one of the most promising sampling points for studying atmospheric chemistry in the free troposphere. However, since autumn 2004, the station was evacuated because JMA (Japan Meteorological Agency) decided not to further maintain the Mt. Fuji RADAR for the weather forecasting duties. We, the researchers who were interested to do research at the station, volunteered and made tremendous efforts to establish an NPO "Valid Utilization of Mt. Fuji Weather Station", in order to have the station survived as a governmental institute, and utilize it not only by ourselves but by sharing with larger scientific communities.

Strategies

From July 2007, we are borrowing a part of the station from JMA including the electrical supply. Here, we introduce how we have been managing the station during July to August in 2007 and 2008 and also how we will continue our activities in 2009.

1) Safety is the priority in the strategies of our logistics. Since life at the summit of Mt. Fuji is not easy even in summer time because of the severe meteorological conditions. We have hired 7 experienced climbers to maintain the station as "mountain crews". Two of them had experience of working at the station as part timers when the station was still operated by JMA.
2) Maintenance of electricity is another big issue. In addition to the maintenance of long power lines from the foot of the mountain, frequent thunder storms at the summit inevitably cause power failures. During the time JMA was operating the station, manually cutting the commercial electricity before being hit by the thunder storms and replacing it by an oil generator was the best way to prevent severe damage. We basically followed the same procedure.
3) One of the merits of NPO management is that the station can be open not only to atmospheric chemists but also to the researchers of other fields such as

cosmic ray observation, high altitude medical studies, researches on permafrost and moss, etc. Environmental education is also included. Figure 1 shows the relationship of the NPO and related activities.

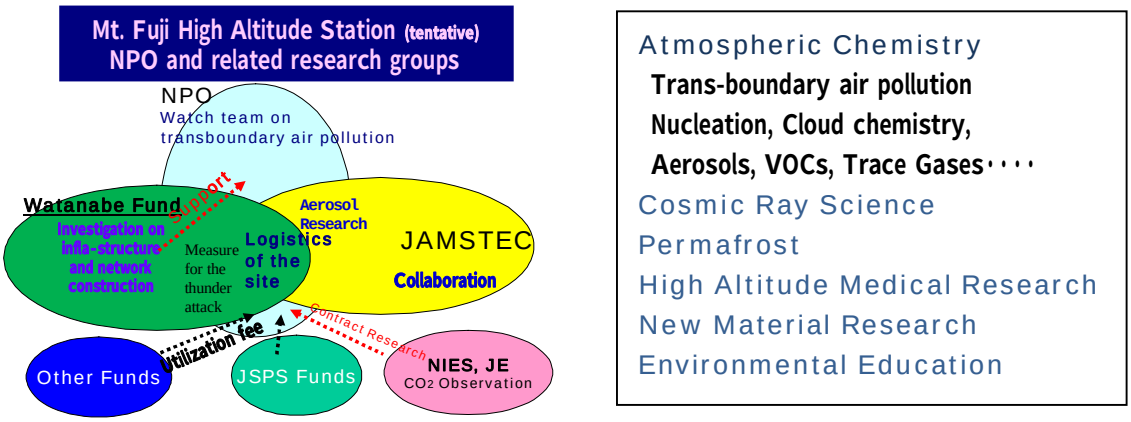

Figure 1 NPO research and fund scheme

Outcomes

In the 2007 summer campaign, maintenance of electricity was safely performed by cutting and switching to an oil generator more than 50 times. During the period from July 10 to September 5, 2007, 210 person*day utilized the station which was maintained by 3 mountain crews. 9 research projects were successfully performed and 7 of which (the titles are as follows) were reported at the symposium on January 27, 2008.

H. Yasuda et al. Continuous automatic monitoring of cosmic ray at ultra-high altitude.

Y. Igarashi et al. Aerosol characterization by using Mt. Fuji as an observation tower

Y. Nojiri et al. Long term CO_2 observation in remote and harsh environment.

M. Yamamoto et al. Effect of short period high altitude training utilizing Mt. Fuji Weather station.

R. Ide et al. Change of oxidative-stress and anti-oxidation power during climbing at Mt. Fuji.

K. Asano et al. Studies on the response of autonomic nervous system and acupuncture to acute mountain sickness during short staying at the top of Mt. Fuji

T. Masuzawa, Dynamics of permafrost and plant community during 10 years on summit of Mt. Fuji.

Following the success of 2007 campaign, requests from potential participants increased for the 2008 summer campaign. So, a selection committee was established within NPO to select the proposals. It was fortunate and surprising for us that 2 international proposals, those of Prof. G.R. Sheu (detail will be shown in their presentations) and Dr. P. Laj were among them. During the period from July 10 to Aug. 31, 263 person*day utilized the station. In addition to the list of projects in 2007 campaign, following titles were included in 2008:

G. R. Sheu et al. Long-range transport of atmospheric mercury in free troposphere

P. Laj et al., New particle formation events at Mount Fuji

A. Ikeda et al., Long range and deep monitoring of permafrost at Mt. Fuji.

In the 2008 campaign, educational and training activities were newly introduced, one of which was that of Dr. M. Horii who organized an environmental education team of junior high school students.

In July, a new fund from Watanabe Memorial Foundation for the Advancement of Technology was approved for 2008 to 2010 as a consignment research on the construction of trans-boundary oxidant pollution in East Asia utilizing Mt. Fuji Weather Station. Within the frame of this project, a feasibility study was performed on clean micro-grid power supplies at Mt. Fuji, which will be extended as a small scale experiment in 2009 campaign.

We also faced many difficulties such as damaged electric poles by heavy snow which caused some financial damage to NPO. Others troubles include interference in radio communication, transportation of instruments by bulldozers, many legal procedures to be followed as the station is situated within the national park. Despite the difficulties however, up to the present, no critical problems are emerging while new research results are coming up.

Oxidant Observation Data

The collaboration of NPO with JAMSTEC (Japan Agency for Marine-Earth Science and Technology) is on the trans-boundary air pollutants. As a part of this collaboration, oxidant data obtained during 2007 and 2008 campaigns are shown below. There was considerable concentration variation. But no apparent diurnal change was observed during the period, indicating the free tropospheric condition.

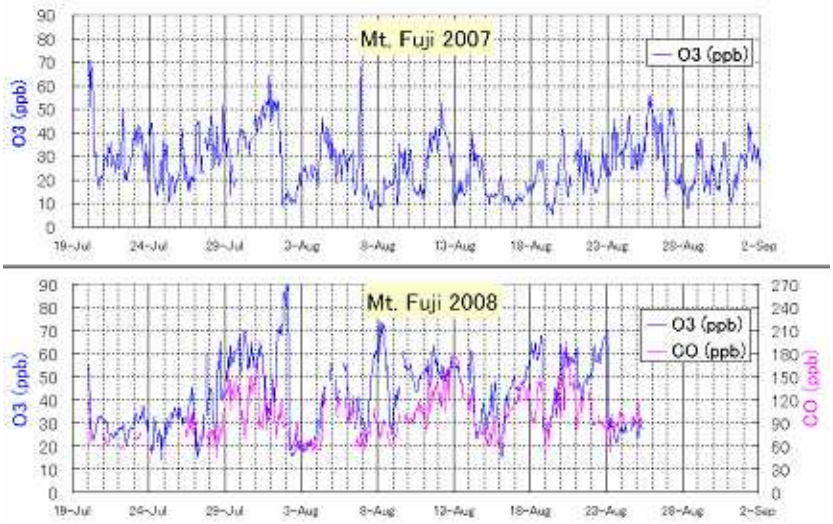

Figure 2 Ambient concentration of ozone and CO at the summit of Mt. Fuji.

In the 2008 campaign, the concentration of CO was also observed. CO can work as a indicator of polluted air mass. Concentrations of O_3 and CO showed

similar trends. This indicated that polluted air was arrived at the summit of Mt. Fuji by long-range transport. However, in some O_3 peaks (Aug. 1, 8, and 22) were not accompanied with CO peaks. Low humidity was observed in these occasions, which suggest that a mixing of the higher air mass was occurring.

Proposal for the East Asia Net Work

Establishment of an East Asian observation network (Fig.3) on oxidant concentration is necessary and of an urgent task to forecast and prevent severe environmental disorder which is to be caused by developing industry of Asian countries. The spread of the air pollution maybe similar in extent or even larger than that faced by the European countries in the 20th century.

Continuous observation of ozone concentration has already been performed at Mauna Loa, Hawaii, ABC Pyramid, Nepal and Lulin Baseline Station, Taiwan. The measuring conditions and data output are similar in all sites as shown in Table 1. So, it seems possible to operate real time data communication once data could be obtained and connected by wireless LAN system. Therefore, in order to establish East Asia Observation Network, continuous year round observation at Mt. Fuji is necessary.

NCOP (ABC Pyramid), Nepal
Dr. P. Laj
MLO (Mauna Loa Observatory)
Dr. R. Schnell
LABS (Lulin Baseline Station)
Prof. N.H. Lin
Mt.Fuji High Altitude Station
Dr. Y. Dokiya

Figure 3 East Asia Network of Trans-boundary Oxidant observation

Table 1 Comparison of oxidant determination at 4 sites

	NCOP(ABCPyramid) Nepal, 5100m	MLO (Mauna Loa Observatory) USA, 3397m	LABS(Lulin Baseline Station) Taiwan, 2862m	Mt. Fuji High Altitude Station (tentative) Japan, 3776m
Inlet	tefron tube tefron filter	10m above the ground	12m above the ground (through the steel chimney of 6m)	tefron tube (0.25 inch) tefron filter
Instrument	ThermoEnvironmental Instruments, Model 49C	TEI Model 49-S, Pulsed Fluorescence Ozone Analyser	ECOTECH ML9810B	ThermoEnvironmental Instruments, Model 49C
Measuring Conditions Calibration	Continuous, Sample flow rate at 1-3 liters/min (usually at 1.8 l/m). Zero and span checks are automatically performed every 24 hours	continuous	Continuous, Sample flow rate at 0.45 L/min. Zero and span checks are automatically performed every 24 hours (between 01:46:02 to	continuous
Out Put	concentration (ppb) via RS-232.RS-232	concentration (ppb)	a digital signal in concentration (ppb) via RS-232.	concentration (ppb) every 1miute

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