

Development of CO₂ measurement system in a remote area under harsh observation environment -a case of Mt. Fuji



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Background;

Though there are about 150 GHGs observation sites all over the world, still there are gap areas left over oceans (near equator), land areas around South America, Africa and Siberia. Data from those areas are important to figure out world wide carbon flow in further details. Therefore it is demanded to fill up those gap areas. However, limited observation condition, for instance, lack of observation basement, difficulties in access and transfer for constant maintenance and lack of power supply delay the launch of measurement.

Objective;

- 1, Develop a small CO₂ measurement system for remote areas with harsh observation environment, which is equipped for unique observation conditions with a satellite communication system.
(e.g. Low or High temperature, High humidity, No commercial power supply, Limit of access)
- 2, Keep a certain degree of high precision (approx. ±0.3ppm)

CO₂ measurement system; (for cold area)

- Size: 33cm × 33cm × 33cm (Weight : 9Kg)
- Power: 12VDC/100VAC (Power Consumption avg. 88Wh/measuring)
- Satellite: sending date by e-mail every day (ORBCOMM JAPAN)
- 1mins Precision: ±0.3ppm by Li-840 (LI-COR, USA)
- Standard gas: ×3 (50cc/min) • Sample gas (50cc/min)
- * Heater: warming up to over 0°C if it's needed

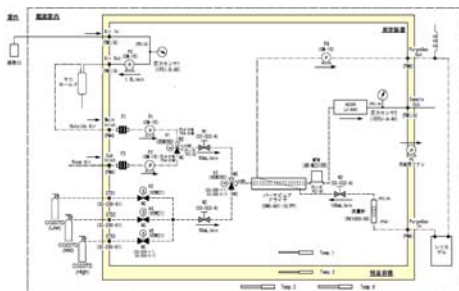
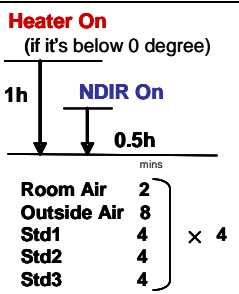


Fig1. Flow diagram

Sequence (total 2.5h)



(+ satellite communication 1h)

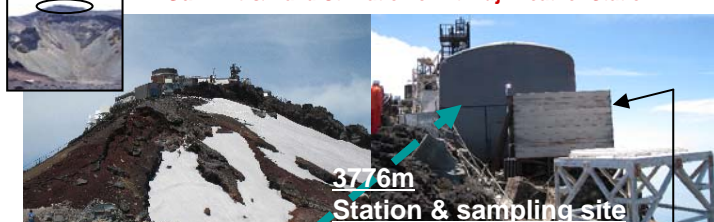
Measurement; a case of Mt. Fuji

- * 3776m, top of Mt. Fuji (35° 21'N, 138° 45'E)
- (No power supply, accessible only in Jul and Aug, Low Temp (Fig. 2))
- * 14th July 2008 – 25th August, 2008
- * 15th July, 2009 – (whole year measurement)
- * 4times / day during summer start at 3,9,15,21(JST)
- * once / day starting at 15:00 (from 16/08/2009)
- (Glass bottle sampling (1L-1.5L bottles × 16), 7-8 a.m. analyzed by GC)



(Save Mt. Fuji)

Summit & Valid Utilization of Mt. Fuji Weather Station



CO₂ measurement system Device inlet Satellite antennas



100 Pb Batteries

Acknowledgement;

This work was performed while the NPO "Valid Utilization of Mt. Fuji Weather Station" maintained JMA facilities. We appreciate for their help with the glass bottle sampling and our activities on the summit.

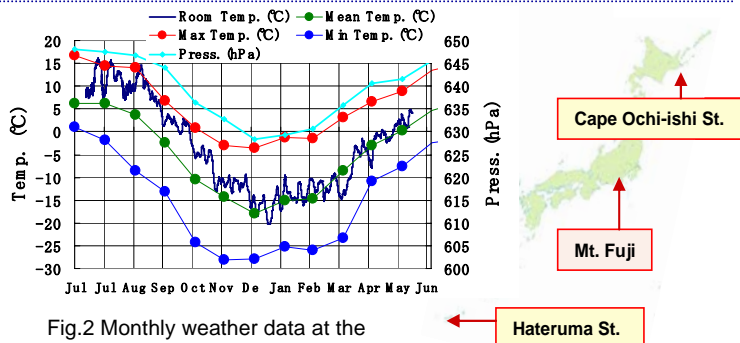


Fig.2 Monthly weather data at the summit of Mt. Fuji [2008-2009] (JMA)

Result;

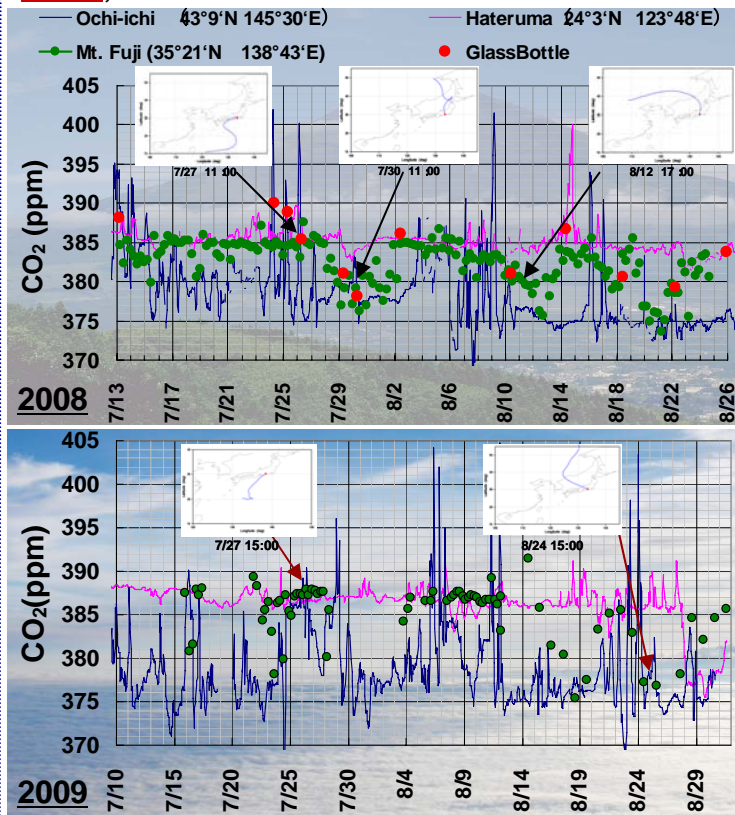


Fig.3 CO₂ concentration on top of Mt. Fuji, in comparison to CO₂ data at Ochi-ishi St. and Hateruma St. (NIES), and some trajectories at Mt. Fuji

Conclusion;

- Developed instrument worked relatively well, though there is a worry about satellite communication remained.
- The results matched with those of bottle sampling ('08), hence as an independent CO₂ measurement device, the system is usable in remote areas.
- CO₂ concentration on top of Mt. Fuji seems to depend on where the air mass comes from and it is likely to indicate the concentration of well-mixed air in this latitude. It is suggested that Mt. Fuji is a good observation spot to monitor atmospheric CO₂ trend at mid-latitude in Asia.

☆ All year automatic observation has started on 30/08/09 ☆
☆ Daily report is expected by e-mail until July 2010 ☆