Studies on monitoring methods for assessment of global warming impacts with alpine vegetation in Japan.（Abstract of the Final Report）

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1.Introduction. In Japanese alpine zone, we recognized many biological changes which may be global warming impacts. However these changes could not be evaluated to be whether global warming impacts or not . However, in the fourth Assessment Report of the Intergovernmental Panel on Climate Changes evaluated changes of many physical and biological systems depended on global warming. The main object of this monitoring project was to assess changes of alpine vegetation in Japan referring to IPCC's evaluating procedure.

2.Research Objective. It was first purouse was to grasp climate changes in Japanese alpine zone. Therefore, annual change of annual mean air temperature at top of Mt. Fuji (3,776m) was shown in Fig.1.These data source were reports published by the Japanese Meteorological Agency.

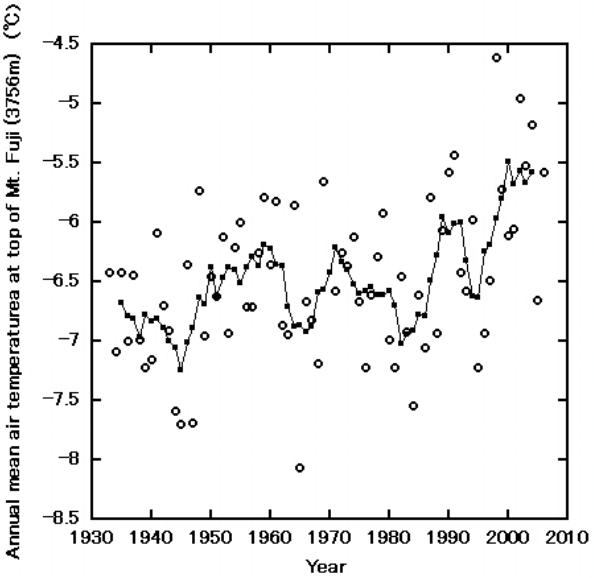

Figure 1 Anuual change of annual mean air temperature at top of Mt.Fuji. Open symbols show annual mean temperature and Closed symbols show moving average values for 5 years.

The annual mean temperature at top of Mt.Fuji has risen from 1980's. And in recent years, non-snowfall period at Mt. Norikura-dake has become gradually longer. This data source was a report by Saitou and Makoto (2002)[1].
Next , three fixed monitoring fields (Mt.Apoi, Mt.Hakusan and Mt.Kitadake) in Japanese alpine zone have been set (Fig. 2).

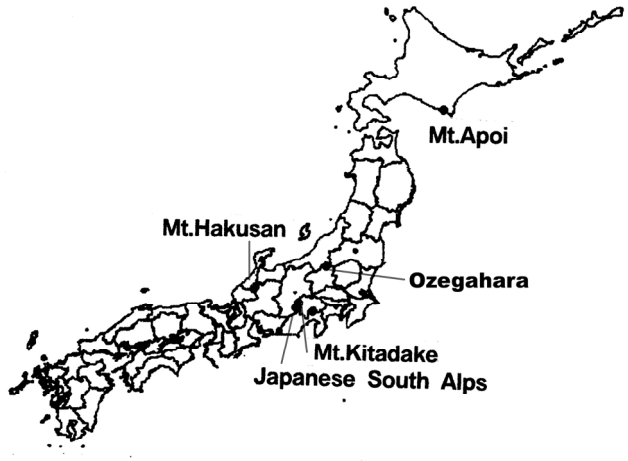

Figure 2 Observation fields of this project in Japanese alpine zone.

At these sites, we have observed flowering time of 3 plant species (*Callianthemum miyabeanum* on Mt. Apoi, *Fritillaria camtschatcensis* on Mt. Hakusan, *Callianthemum insigne* on Mt. Kitadake), and the surface area of perennial snow patch "Senjagaike Sekkei" on Mt.Hakusan early in October before snowfall. Furthermore, the past record on the flowering time of these plants and size of the snow patch were collected. And then it was suggested that the flowering time of these plants has been advanced and size of snow patch gradually decrease .

Vegetation analysis was carried out on altherbosa in Japanese South Alps, and these results were compared with those obtained about 30 years ago. As the result, the species composition of the vegetation greatly changed. I t was concluded that the cause of the changes was damage by Japanese deer. Recently, population size of Japanese deer increase, and distribution range of Japanese deer expanded. It was said that one of reason of these phenomena was recent warm-winter and decrease in snow depth. Furthermore, we checked the existence of *Pinus . pumila* at the same sites where *P. pumila* were growing about 30 years ago reported by Chikada (1981) [2]. *P. pumila* disappeared at some sites which were close to distribution south boundary . So, it was concluded that the distribution south boundary of went up north. From the results got from this research project , it was suggested that the effects of global warming has appeared in Japanese Alpine zone.
And because meteorological long-term record about snow depth on Japanese alpine zone was very few, the technique which utilized satellite image (MODIS) was established to estimate change in snow area in Japanese alpine zone.

Reference

1. *Saitou Moriya and Irie Makoto (2002) Meteorological observation at Mt. Norikura Solar Observatory. Kokuritutenmondaihou 6:37-47.
2. *Chikada Fumihiro (1981) Plant population in Shizuoka Prefecture. Daiichihouki.
*Titles and other in Japanese are tentative translated by the auther.