P6.1

Measuring micro-weather in a valley cross-section

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1. Introduction

The micro-weather on the scale of a large mountain can vary considerably, influencing animals and plants on different micro-scales. Therefore, it is more important and more difficult to measure micro-weather variation at large scales. The spatial distributions of solar radiation, air temperature, relative humidity, and wind speed were measured in a valley cross-section measuring 90 m horizontally and 20 m vertically using an aerial ropeway that was installed for timber logging. The ropeway consisted of a carriage that moved along the wire horizontally with a hanging part suspended from the carriage that moved vertically. Instruments were placed at the height of the carriage and at two heights on the hanging part. The spatial variation in the micro-weather factors was measured in the valley cross-section

2. Site description

Observations were made in the Yamashiro experimental basin in western Japan (34° 47'N, 135° 51'E). The basin is located in a mountainous area consisting of valleys and ridges on a spatial scale of dozens to hundreds of meters horizontally and dozens of meters vertically. This topography extends around the experimental basin more than 5 km to the north and east, 2 km to the west, and 3 km to the south. Deciduous broad-leaved trees, such as *Quercus serrata* and *Lyonia japonica elliptica*, dominate as tall trees and shrubs. Evergreen species such as *Ilex pendunculosa* coexist, but mainly as shrubs. The total basal area at breast height was 13.3 and 6.3 $m^2 ha^{-1}$ for deciduous and evergreen species, respectively. The leaf area index was estimated using a plant canopy analyzer (LI-COR Inc., LAI-2000) as 4.42 and 2.70 in the leafy and leafless periods, respectively. In 1989-1991, the annual average temperature was 15.9°C, the annual average relative humidity was 74.7%, and the annual precipitation was 1647.2 mm [Abe *et al*., 1997]. In 1989-1990, the annual evapotranspiration rate was estimated to be 785.1 mm using the water balance method, and corresponded to 48.6% of the precipitation [Abe *et al*., 1997].

3. Methodology

The aerial ropeway is shown in Photo-1. The ropeway consisted of a carriage that moved horizontally along the wire and a hanging part suspended vertically from the carriage. Instruments were placed on the carriage and at two heights on the hanging part at 2-m intervals. The instruments were a downward solarimeter (Eko MS-42), a net pyrradiometer (Eko, MF-40), a sonic anemometer (Gill WindMaster), and a thermo-hygrometer (Vaisala HMP-45A). There was a 12-m-high observation tower southeast of the measurement cross-section where control data were measured. The measured cross-section was established 50 m from the valley head in a valley oriented in a southeast direction(Fig.-1). The cross-section area was covered with trees 5 m in height along the southwest edge, and 7 m high at the bottom; the canopy was closed during the summer. There was a gap in the canopy on the northwest edge. Although the stems and branches in a 4-m-wide strip under the ropeway had been pruned,

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adjacent trees were untouched. Measurements were made at mesh points spaced 5 m apart horizontally and 1 m apart vertically. Measurements were made at each point for 1 week. In total, measurements were made at 20 points using the instruments on the carriage and at 102 points using the suspended instruments. This report analyzes data measured from 9:00-15:00 in the leafy period between June and October 1997-2003.

4. Results and Discussion

The smallest measured relative solar radiation was 11% in the lowest points at the bottom of the valley. The smallest relative wind speed was also measured at the lowest points at the bottom of the valley. The contour line of the relative solar radiation ratio was V-shaped along the slope surface. By contrast, the relative wind speed ratio changed horizontally. The contour lines of the difference between the air temperature and vapor pressure deficit measured in the cross-section and the tower runs alongside the canopy surface (Figs.2(a)-(d)).

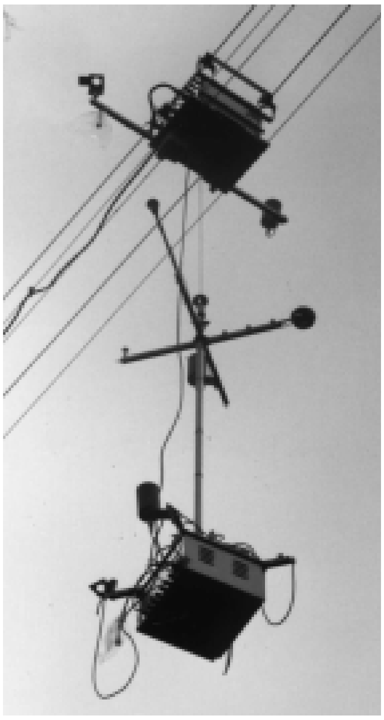


Photo-1 The rope-way for measuring the micro-meteorology

The ropeway consisted of a carriage that moved horizontally along the wire and a hanging part suspended vertically from the carriage. Instruments were placed on the carriage and at two heights on the hanging part at 2-m intervals.

REFERENCES

Abe T., Hattori S., Tamai K. and Goto Y. (1997): The characteristics of water budget in deciduous bload-leaved secondary forest. Applied Forest Science. 6. 175-178. (in Japanese)

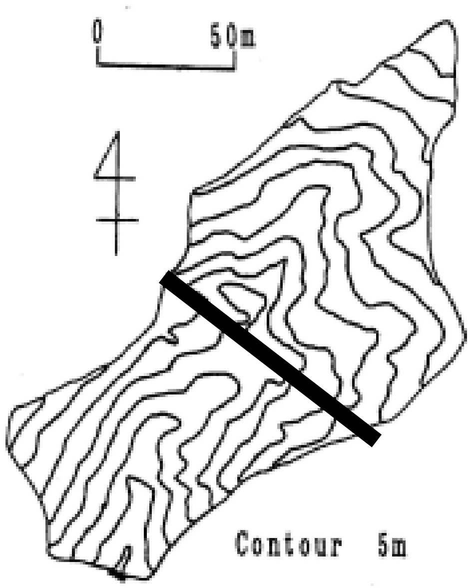
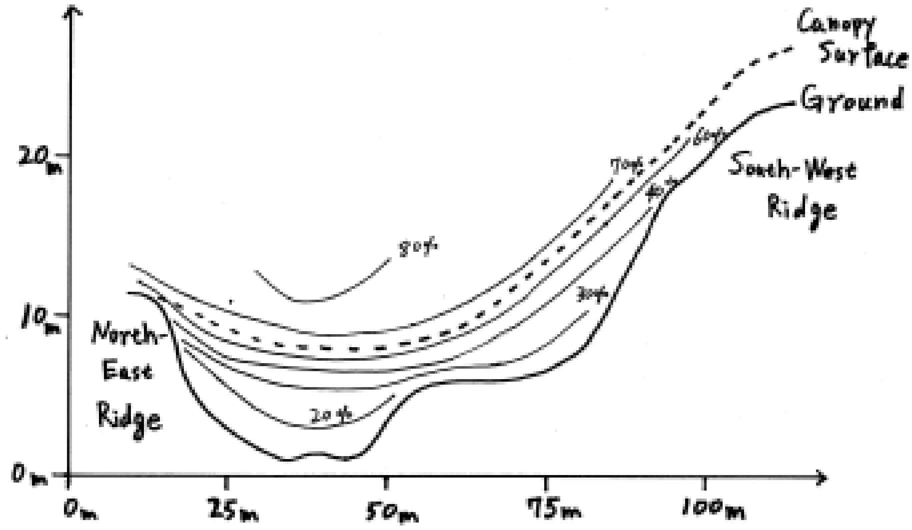
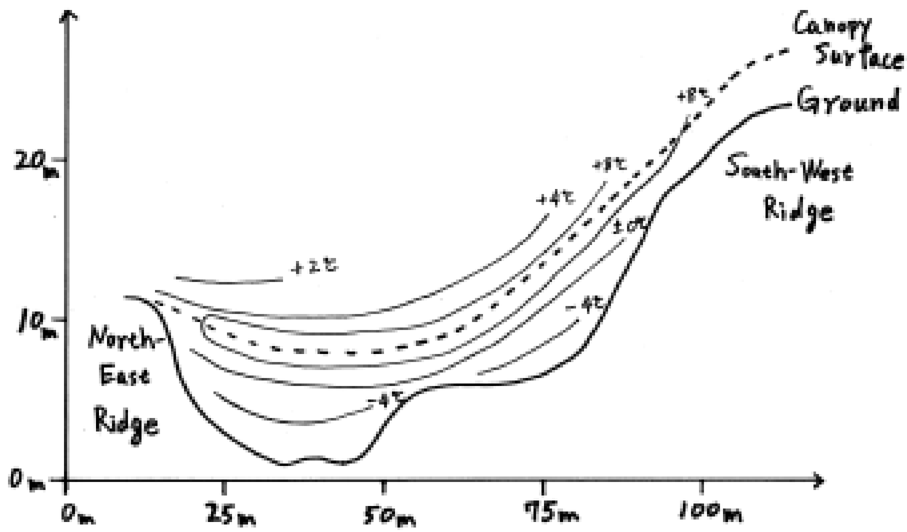


Fig.-1 Topography of Yamashiro experimental basin.

Thick line indicates the location of measured cross-section

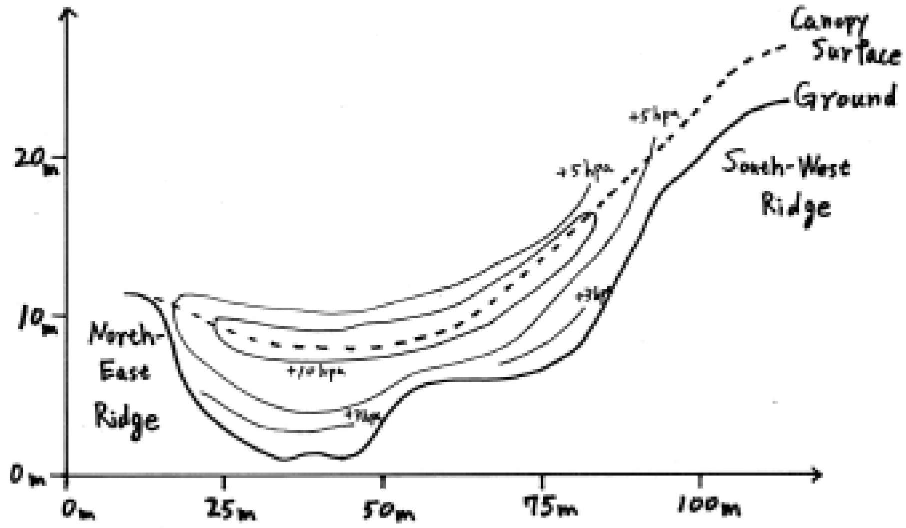


(a) Relative solar radiation

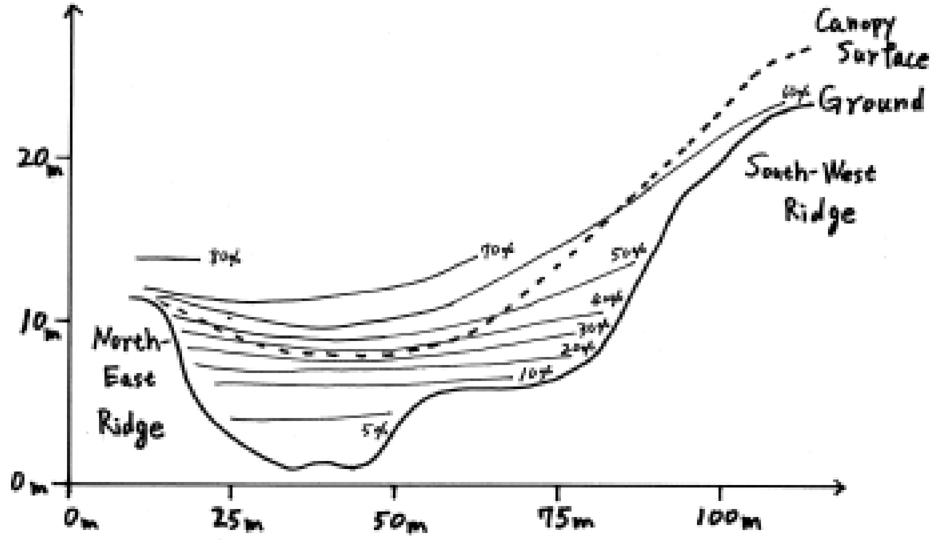


(b) Difference of the air temperature between at the cross-section and the tower

Figs.-2 The contor line indicating the micro-weather variation at the cross-section of valley.



(C) Difference of the vapor pressure deficit
between at the cross-section and the tower



(d) Relative wind speed

Fig.-2 (continued) The contor line indicating the micro-weather variation at the cross-section of valley.