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Observations of freeze-thaw cycles on rock surfaces in low mountain area

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Rock-surface temperatures were measured on a tor and a large block located below the timberline in the Kobugahara Highlands, an upland plateau composed of granodiorite in central Japan (1300 m a.s.l.). Many blocks in the region originate from core stones distributed on the plateau, and there are several block streams in the valley bottoms. The tor is situated at the upper end of one of these block streams. The large block appears to have detached from another tor. The mean air temperature of the coldest month is -4 celsius degree. Rock-surface temperatures were recorded continually every 30 minutes from December 1, 2002 through December 13, 2004 by thermistor probes connected to miniature data loggers. The results showed that each year can be divided into four periods: (1) a period with no freezing between April and the first half of November, which forms the first part of an annual FTC; (2) a period with diurnal FTC between the second half of November and the end of December; (3) a period with permanent subzero temperatures during January and February, which forms the second part of the annual FTC; and (4) a second period of diurnal FTC during March. These periods can be recognized in other regions, and the length of each period is affected by the latitude, altitude, and local environment. This study revealed that a freeze-thaw environment exists on rock surfaces below the timberline. It is clear that annual changes in the freezing index are large, and that there are large variations in the numbers of FTC and EFTC within the same area. These differences are primarily caused by differences in the depth of snow cover. The diurnal and the annual freeze thaw cycles and effective freeze thaw cycles were recorded at each site. The freezing index of rock-surface temperature showed a marked variability from year to year. In addition, differences in local conditions at observation sites within a given area greatly affected the rock surface temperature. These are important considerations in relation to local weathering below the timberline.