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Subnival pressures originated by the displacement of a seasonal, late-lying snowpatch, Ancares Sierra, northwestern Spain.

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Seasonal, late-lying snow cover is an active geomorphic agent at high elevations in the Ancares Sierra, northwestern Spain (lat. 42º50'N, long. 6º49'W). Movements of the snow cover are frequent and are thought to be mainly due to a combination of snowcreep and subnival sliding. Snowslide erosion is characterized by plucking of bedrock fragments; clasts are dragged at the base of the snowpatch abrading rock surfaces and producing scratches similar to glacial striations. Temperatures recorded at the snowpatch-bedrock interface suggest the absence of significant freeze-thaw activity beneath the snow cover. Therefore, erosion action is mainly attributed to the mass displacement of the snow cover rather than to frost shattering. In order to determine the subnival pressures beneath the snow cover, a 28º angle rock slope within the Cuiña Cirque (1.860 m.a.s.l.) that showed widespread evidence of plucking and abrasion was instrumented. Winter snow depth can exceed 4 m at this site and the occurrence of basal ice layers is frequent. In August 2005 three groups of steel rods, each consisting of six rods 12 mm in diameter and 15.3 cm in length, were emplaced at the top, the intermediate part and the foot of the rock slope. Five rods in each group were notched to diameters of 2, 4, 6, 8 and 10 mm (notch 3 mm wide). The rods were firmly inserted into the bedrock perpendicular to the rock surface and protruding 10 cm from it. Inspection in July 2006 revealed failure of rods notched to 2, 4 and 6 mm and partial bending of rods notched to 8 and 10 mm at the upper location, failure of rods notched to 2, 4, 6, 8 and 10 mm and total bending of 12 mm rod at the intermediate location, and failure of rods notched to 2, 4, 6 and 8 mm and total bending of 10 and 12 mm rods at the lower location. The pressures required to bend and break the rods were determined in laboratory tests using rods similar to those employed in the field. Threshold values at which deformation or breakage take place were identified. When applied to the field data, these threshold values suggest that subnival pressures ranged from 5.5 to 14.5 kg cm-2 at the upper site, 20.3 to 52 kg cm-2 at the intermediate site and 16.5 to 52 kg cm-2 at the lower site. Such pressures exceed those previously reported for snowcreep in the geomorphological literature.

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Key words: seasonal snow cover, snowcreep, snowslide, nival plucking, subnival pressure, Ancares Sierra.