Investigation of seasonal freezing dynamics in the central part of the Russian Plane

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Abstract：During two winter seasons (2004-2005 and 2005-2006), in the vicinity of Zvenigorod (Central Russia) special geocryological and glaciological research was held in order to study the depth and dynamics of seasonal freezing. Basic reasons causing the dynamics of a seasonally freezing layer (SFL) have been evaluated. A forecast of spring flood level and the rate of the SFL influence on the agriculture have been worked out. To study the dynamics of seasonal freezing, two expeditions were held in the beginning and the end of the freezing period. The first stage of investigations revealed the ground freezing on 10% of the study area (December, 2004) while in December, 2005 about 80% of the area was frozen. In the end of the freezing period (February, 2005), frozen ground was found on 95% of flood-plains and terraces area. At the same time, in the forest on the watershed, 50% of the area was frozen. The ground on felling areas, due to the thick (about 40 cm) snow cover as well as soil water saturation in the autumn, remained unfrozen. Another reason hindering ground freezing is the warming effect of plant residues decay. In the end of cold winter 2005-2006, the area was frozen entirely. The SFL thickness after the first month of freezing, in 2004, was 15 cm on snow-free sites while at the same period of 2005 – 10 cm. In the end of winter, 2005, maximum freezing was marked

beneath a path (34 cm.) In the end of winter, 2006, the depth of freezing increased significantly. The ground freezing in loamy sand and sand deposits (massive cryostructure) was much deeper than in loamy and peat ones. Snow cover thickness was: early winter, 2004 – from 27 cm up to 70 cm (felling area), February, 2005 – from 40 cm (mean) up to 140 cm (gully). The two-level composition of the river ice was found on the flood-plane and the river coast. The SFL dynamics is caused mainly by the climate parameters, e. g.: the amount of negative degrees during the winter 2004-2005 was 5800 deg.-hours while during 12 coldest days of January, 2006, it was 6100 deg.-hours, so the rate of freezing and the SFL depth has significantly

increased by the end of the freezing period. Investigations showed that the SFL dynamics is strongly influenced by the rate of ground freezing, snow cover thickness, structure and distribution depending on wind, relief and vegetation as well as landscape peculiarities and ground properties.