The Soviet/Russian Contribution to Avalanche Research[22] First serious studies of snow avalanches in Russian territory started in the 19th century and were initiated for, and related to, the transportation on road and by rail through the Caucasus Ridge. Avalanche danger and meteorological conditions along the "Military-Georgian Road" were estimated and were first published in "The Caucasian Calendar" in 1852. The avalanche map along this road – the first of its kind in Russia – was prepared by B.N. STATKOVSKII, who also participated in building the first Russian snow protection constructions. The investigations were finalised at the beginning of the 20th century by the appearance of the railroad around the Caucasus Ridge along the Black Sea coast.

This provisional end was actually only an intermission; indeed, avalanche research was relaunched and rehabilitated in the thirties of the 20th century due to the revitalisation of the idea of the construction of a railroad through the Caucasus Ridge. G.G. SAATCHAN [360], A.G. GOFF and G.F. OTTEN [117] applied equipment and experimental methods from soil mechanics to the study of the mechanical properties of snow. For the first time, the pressure exerted by a moving snow avalanche on an obstacle was measured by mechanical sensors. They also developed methods of determination of some mechanical properties of snow. The results of the studies led to schemes of estimations of avalanche velocities and avalanche pressures on obstacles, published in the first Soviet Handbook on Snow and Avalanche Research [117]. Almost simultaneously, another centre of snow and avalanche research was founded in the Khibiny mountains (Kirovsk) by the Apatite mining industry. (The Apatite mining company's snow avalanche department has been active in avalanche research until today.) Here, I.K. ZELENOI organised the Snow Meteorological Service and the first Snow Avalanche Station in the Soviet Union. The scientific research efforts resulted in the construction of a forecast method of the time of avalanche danger, the first of its kind in the history of snow and avalanche research. With their experiments A.G. GOFF and G.F. OTTEN [11] obtained records of the temporal evolution of the pressure on an obstacle that was subjected to an avalanche. Some of the protective constructions that they designed were unique worldwide. Artificial snow avalanches, released by detonations from artillery shells, were also used; they led to a detailed account of the basis of avalanche release phenomena published in [10, 11].

The growing industrial development in mountainous regions after World War II increased avalanche research activities in various regions of the Soviet Union. Results on investigations of snow avalanche research by G.K. TUSHINSKII at the mountain passes of the Caucasus, published in 1949 [427],

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22   This text was written by SERGEY SOKRATOV from the Geography Department of the Moscow State University. The authors would like to thank him very much for this contribution.

belong to these, as do the numerous investigations on thermodynamic and mechanical properties of snow and avalanche dynamics in the Elbrus region by SULAKVELIDSE [408].

In the late fifties of the 20th century, the institutions dealing with the observation and physical description of snow avalanches in the territory of the Soviet Union were subordinated to the State Committee of Hydrometeorology and Environmental Control. The Meteorological Centre of Snow Avalanche Observations and Forecast was concentrated in the Central Asian V.A. Bugaev-Hydro-Meteorological Research Institute (SANIGMI) in Tashkent; it subsequently collected information on avalanche events from all snow avalanche stations in the Soviet Union. SANIGMI was responsible for the development of a theoretical basis and of applied methods of snow avalanche forecast [210]. The Laboratory of Snow Avalanches and Mudflows (LSAM) at the Faculty of Geography, Moscow State University, became the centre of developing methods of grading and mapping avalanche danger, and studying mechanical and thermodynamical properties of snow and their spatial and temporal variability. K.F. VOITKOVSKII, E.S. TROSHKINA and V.N. GOLUBEV are today's representatives of this research.

The sixties to eighties of the 20th century were characterised in the Soviet Union by a focus of snow and avalanche research on experimental studies and mathematical modelling of snow stability on slopes, dynamics of dense, powdery and slush avalanches and their interaction with the underlying slopes and obstacles. Principal investigators are S.S. GRIGORIYAN, M.E. EGLIT, A.N. BOZHINSKII and K.S. LOSEV, [44, 84, 85, 86, 87, 88, 89, 130, 131, 132, 133].

The peak of snow avalanche research in the Soviet Union had been reached at the end of the eighties in the 20th century. From 1984 until 1991, twenty volumes on snow avalanches of the USSR were published. About 40 institutions of the State Hydro-Meteorological Service maintained snow avalanche departments in various regions of the country. Such intensive concentration resulted in several monographs entirely related to avalanche research [12, 44, 384, 434].

Since the foundation of the Russian Federation, recent activities on snow avalanche research are primarily concentrated at the Moscow State University and in the Snow Avalanche Department of the Apatite mining company. Nevertheless, some of the institutions that were actively involved in avalanche studies during the Soviet times are still active now as institutions of their own countries. These include SANIGMI in Uzbekistan, the Institute of Geography of the Kazakh Academy of Sciences, and others.