Karl Ernst von Baer's contribution to the research into the climate of polar regions in the period of 1830 to 1840

Erki Tammiksaar
Baer-Museum, Tartu, Estonia
erki@zbi.ee

In scientific circles, the Baltic-German scholar Karl Ernst von Baer (1792-1876) is known as the founder of the science of modern embryology and the discoverer of the mammalian ovum. However, von Baer was not only an embryologist, but a versatile scientist with a very wide sphere of interests. The aim of the present study is to assess the importance of von Baer's geographical contributions to the development of meteorology in Russia. This article was prepared on the basis of numerous documents in archives in Germany, Russia and Estonia.

Von Baer's interest in the Arctic and the climatic conditions there had already been evident during his studies at the University of Dorpat/Tartu (1810-14). He read Arctic literature and wrote later (in the 1820s) reviews on the investigations in this field. Although already at the beginning (1819-25) of his Königsberg period von Baer made several attempts to make exploration trips to the northern areas of the Russian Empire, these research programs were given up at the last moment. Instead, he discovered the mammalian ovum in Königsberg. It was only when living in Russia (1834-67) that geographical, including meteorological investigation projects again became topical to von Baer.

During the period von Baer lived in Königsberg he had an opportunity to learn new conceptions and mathematical methods in meteorology. His theoretical views on meteorology were greatly influenced by distinguished scholars and close colleagues in Königsberg, such as Friedrich Wilhelm Bessel and Heinrich Wilhelm Dove. Von Baer also knew Alexander von Humboldt and his works. He had met him several times at Bessel's home in Königsberg and sent him his writings on the physical geography of the Arctic.

In 1829 von Humboldt visited Russia. At the festive assembly organised in his honour by the St Petersburg Academy of Sciences, he suggested setting up a network of meteorological stations throughout the big Russian Empire in order to collect more material proving the existence of marine and continental climates in Eurasia. When von Baer came to Russia in 1834, the project was still at its initial stages.

Starting in 1837 preparations for an expedition to Novaya Zemlya, von Baer began to collect systematically meteorological data from his friends and colleagues who had been to Siberia. He received meteorological information

from seafarers, military men, explorers and scholars, and others. He also tried to organise a network of meteorological observers through the army doctors serving in Siberia. Von Baer evaluated these data in his meteorological articles. He not only collected meteorological data on different regions of the Russian Empire, but also popularised meteorology as a separate field of science in Russia. The first newspaper article in Russia, treating in a very popular manner the development of meteorology as a science and the tasks to be solved by this branch of science, was also written by von Baer.

The data von Baer had collected on the climate of the Russian Arctic and Siberia enabled him to draw a very important conclusion for physical geography. Von Baer, as a matter of fact, was the first to prove that the origin, development and distribution of permafrost in Siberia (and throughout the world) was closely connected with the continental climate there.

Von Baer-s interest in meteorological data had several aspects. Initially, he wanted to collect information on the climatic conditions of the little-studied regions of the Russian Empire. For the second, Von Baer was also a biologist interested in the influence of climate on the distribution of living organisms on Earth. That was also the reason why he was interested in Novaya Zemlya. Already, before the expedition, von Baer published the regular of long-term continuous meteorological observations by Russian naval officers who had spent a winter on Novaya Zemlya, but which had not been paid attention to by scientists (1832-33; 1834-35). Making use of these data, he calculated the average daily, monthly and annual temperatures in Novaya Zemlya. Comparing these with observation data from other Arctic areas, von Baer concluded that the average annual temperature in Novaya Zemlya was lower than on the western coast of Greenland, Labrador, Spitsbergen, or at Yakutsk.

The analysis of the average temperature in Novaya Zemlya led von Baer to the conclusion, that the climate on the east coast of Novaya Zemlya was more severe (-9.45 C) than on the west coast (-8.37 C). In spite of scanty data, von Baer supposed that the average yearly temperatures of the west and east coasts throughout the entirety of Novaya Zemlya remained almost constant, except northeast of Cape Nassau on the west coast, where navigation in a northerly and northeasterly direction was always impossible because of ice ridges, which caused the average temperature to be lower. Von Baer ascribed the difference in air temperatures at the east and west coasts to the mountain range in the middle of Novaya Zemlya, which prevented air masses from getting mixed, thus acting as a peculiar kind of "watershed" between two climatic zones.

According to von Baer, the coldest month in Novaya Zemlya was March, not February as in the areas of moderate climate. The warmest month was August, not July. The main reason for the lateness of these seasons, according to von Baer, was the influence of the Kara Sea, which most of the year was under ice cover. The lateness of the seasons was particularly clearly observable on the east coast of the islands, but also noticeable on the west coast.

Another significant result of the expedition to Novaya Zemlya related to the dominant view among scientists yet in the 1830s that on the mountains of the polar regions the snow border reached down to sea level. Von Baer had accepted that notion prior to the expedition, but during the expedition it became clear that the location of the snow border on Novaya Zemlya did not depend as much on the average temperature per year or per month than on the amount of solar radiation reaching a specific area in summer and winter.

In addition to the theoretical importance, von Baer considered it very important from the practical point of view. He was the first who made an attempt to apply meteorological data collected by him and other investigators in the development of agriculture in Russia. The cool climate of Russian Lapland and Russian Alaska made the growth of grain crops impossible there. It was very expensive to the Russian government to supply these regions with food. Von Baer hoped to be of help to the Russian government in this respect and he suggested to grow goosefood (an Andean pseudocereal Chenopodium quinoa) in Siberia. This plant was successfully cultivated in South America at the altitude of 4 000 m. He even published articles on this topic in different journals. Unfortunately, the attempts to sow the goosefood in the provinces of Archangelsk and Perm proved unsuccessful.

In this short article, however, the importance of the results of von Baer's investigation in Novaya Zemlya and of his scholarly articles in the development of meteorology is analysed for the first time, making use of respective literature and archival documents. Von Baer's articles on the climate of different regions of the Russian Arctic were the first of their kind in Russia. His writings on the climate of Novaya Zemlya, Taymyr peninsula and Russian America enabled Russian and foreign scholars to learn about the specific features of climate in different regions of the Russian Empire and were used for more than thirty years as the bases of surveys on the twin-island, being taken over without making any changes in them. The meteorological data evaluated by von Baer and the hypotheses put forward in his articles were used by renowned Russian and German meteorologists: Adolf Theodor Kupffer, Konstantin S. Veselovskiy, A. I. Voejkov and botanist Ernst Rudolf Trautvetter, Alexander von Humboldt and Heinrich Wilhelm Dove. Thus, it is understandable why Humboldt in his letter to

Georg von Cancrin, the Minister of Finances of the Russian Empire, wrote that in Russia there were three meteorologists, Adolph Theodor Kupffer, Ludwig Friedrich Kämtz and von Baer, who could make envious any European country.