Chapter 19
Temperature in the Arctic and the Antarctic:
The Differently Directed Trends

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ABSTRACT

This chapter aims at the consideration of world temperature dynamics and its prediction in the polar regions of the planet. The global warming started in the 17th century and has been progressing since then. The decline in average global temperature began in 1997. There exist various factors which affect the process, the abiotic ones being among the major in controlling the climate. The climate is also dependent on the interaction between abiotic, biotic, and social spheres. This system seems rather stable and not very much dependent on human activity. The effects of contemporary cooling are not expected to be significant for the mankind but are definitely important for the polar regions. In the Arctic, the temperature is increasing. The one in the Antarctic declines. The average global temperature thus becomes variable. Modern science is able to predict climate change, but extensive studies free of political and economic pressure have to be conducted.

INTRODUCTION

Ecological problems have a big importance under present time. One of them is problem of possible global warming based on green house effect. Majority of countries signed "Kyoto protocol" at 1997. This document limited pollution of green house gases by industry and transport. Scientific basis for such a protocol appeared to be sick. Main input of such gases has natural origin. General mechanism controlling climate is obscure. The processes taking place in atmosphere are not accorded to "green house effect". But we may get way toward its understanding.

The purpose of this work is to consider the main temperature trends of our time, taking into account global climate processes, the factors affecting them and their possible consequences for the biosphere and the noosphere mainly for North and South regions of the Earth. Data from the World Meteorological

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Organization, the European Geosciences Union [EGU] (n.d.), the materials of the International Polar Year, and other sources listed below are used. Let us try to consider the problem, both on Earth scales and locally, in the North-Western, Northern, and Antarctic regions. The climate on Earth varies periodically depending on the recurring processes occurring in the system Earth – Sun – surrounding space. The general methodology for studying these processes was laid by Chizhevsky, Vernadsky (Sidorenkov, 2008; Sapunov, 2011), and other scholars.

BACKGROUND

Polar regions are of particular importance in the dynamics of the global climate as a "kitchen of weather" (Gough, Cornwell, & Tsuji, 2004; Tsaturov & Klepikov, 2012). It is there where the cyclones and anticyclones form along with prevailing winds. They are also indicators of the general state of climate on the planet. Arctic and Antarctic regions have both common characters and principal differences. Arctic region is under control of methane (CH_4) emission and anthropogenic pressure. Antarctic is almost free from anthropogenic pressure and thus develops as a significant source of global cold snap. We live in a relatively cold period. During 80% of the entire history of the Earth, Greenland and the Antarctic were free from ice (Sapunov, 2011; Howat, Negrete, & Smith, 2014). In XVII-XX centuries, global temperature increased and the ice in Greenland and the Arctic Ocean melted (Helm, Humbert, & Miller, 2014). According to the chain reaction principle, this led to the emission of greenhouse gases (pseudo green house effect) (Sapunov, 2011), such as CO_2 and CH_4, from melting permafrost, which, in turn, accelerated ice melting in the North (Semiletov, Makshtas, Akasofu, & Andreas, 2004).

The dynamics of the regions temperature traces cycles in 60 years, corresponding to the cycles discovered in the XX century by Kondratiev (as cited in Sapunov, 2011). They are connected with not social, but natural processes (Akimov, Kozlov, & Kosorukov, 2014; Jurganov, Leifer, & Lund Mair, 2016; Konovalenko, 2008). In this case, the homeostatic nature of the North ensures the relative stability of the continental ice (Machguth et al., 2016; Nghiem et al., 2012). Excess of CO_2 entering the atmosphere in a result of permafrost melting is compensated by the intensification of photosynthesis (Semiletov et al., 2004). Since 1997, a period of global cooling began. At the same time, big (several millennia) climatic cycle increased while more noticeable small one (several centuries) decreased. This was particularly noticeable in the southern hemisphere in a form of growth of glacial massif in the Antarctic. At the same time, the asymmetry of the Earth began to grow. In the North, both ice melting and the rise in temperature tend to decrease (Sapunov, 2011). These data must be taken into account for further forecasting of climatic trends. Important instrument for climate prediction is theory of cycles.

There are several groups of Earth and space cycles. All these cycles control the climate. In the second half of the XX century, indeed, there was some warming and an increase in average temperature by 0.25-1.00 degree. This was accompanied by a decrease in the stability of the weather. However, this did not happen everywhere. So, in the European North, average temperatures have even fallen slightly. In the late XX century, in Saint Petersburg, there was a series of relatively warm winters, but coldest January 1987. Summer temperatures have decreased in recent years. In general, the average temperatures on the Earth's scales were almost unchanged. According to the International Polar Year data, since 1997, a new cycle has started, leading to a global cooling (Kokin & Kokin, 2008; EGU, n.d.). Global warming stretched from the XVII century to the end of the XX century. The melting of glaciers and the rise in the ocean level were not observed. In principle, it could not be. It is calculated that if the whole energy