Environmental Changes in the Arctic and Development of Transcontinental Transportation

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ABSTRACT

During the past few decades the environmental and economic realities of the Arctic have changed dramatically. Global warming processes create new challenges. The effects of warming including record reduction in arctic summer ice extent, acceleration of glacier melt and others have significant impact on Arctic water transportation activity. The different scenarios of Arctic marine shipping development are presented. The authors state the issues connected with the usage of the Northern Sea Route and Northwest Passage. The results of the study can be used for the development of international marine shipping infrastructure, safe navigation support and systems of response to emergency situations in Arctic Ocean.

KEY WORDS: Transportation; marine; climate change; Arctic shipping development; scenarios; shipping; Arctic; infrastructure.

INTRODUCTION

The recent changes of the environment will continue into the future and cause consequences in all spheres of human life. Significant impact of global processes on regional development will be shown in more vulnerable areas of the Earth and first of all in fragile Polar areas. The studying of the possibilities of Arctic regions development in new environmental conditions now is in the focus of Polar research. The analysis of the coming changes influence will be important for the supporting of environmental security and economic efficiency of future projects of the development of marine shipping activity and prospective sea routes in the Arctic Ocean.

ENVIRONMENTAL CHANGES IN THE ARCTIC

Global Warming

During the last few decades the problem of global warming became one of the most alarming questions in scientific society. There are many hypotheses about the “natural warming” connected with solar activity, intraterrestrial processes, climate system fluctuations and also global models of atmosphere circulation under the effects of intensive and weak growth of greenhouse gases. But it is becoming obvious that slowing down of climate warming caused by anthropogenous influence will not be possible until the middle of the XXI century. The climate is becoming more changeable and amount of natural anomalies increases, including surface temperature parameters (Fig 1, a). It is necessary to notice that direction of climate changes critically depends on a choice of time horizon. Last 11 years (1998-2009) the global temperature has decreased approximately on 0,2°C. In preceding 20 years (1978-1998) it has raised approximately on 0,4°C. Within preceding 30 years (1946-1976) the temperature has decreased approximately on 0,1°C. In preceding two centuries (1740th - 1940th) the trend of global temperature as a whole was neutral - with periodic warming which followed by cooling, and behind them - the next warming. For last three centuries (since the period of XVII-XVIII centuries boundary) the temperature in northern hemisphere has raised approximately on 1,3°C. “Little Ice Age”, which took place from 1500 to 1740, was replaced by a modern climatic optimum, beginning in 1980. Within three centuries before the “Little Ice Age”, the temperature in the northern hemisphere decreased in comparison with the level reached during the medieval climatic optimum in VIII - XIII centuries. Scales of modern climatic changes are much more modest than scales of the climatic changes observed earlier in the history of a planet. The experts from the Intergovernmental Panel on Climate Change (IPCC) suppose that the growth of global temperature of 0,76°C for the last century (1906-2005) is extraordinary. But the comparable data shows that rise in temperature, for example, in the Central England in XVII century (of 0,97°C) was more striking than in XX century (of 0,90°C). According to IPCC the speed of temperature rise over the last 50 years made 0,13°C for a decade. According to the data received by means of paleoclimatology higher speed of temperature rise for a decade during half a century was observed, at least, three times: in the end of XVII century- beginning of XVIII century, in second half of XVIII century, in the end of XIX century - beginning of XX century (Illarionov, 2009). The “softening” of global warming acceleration can promote the reduction of negative trends connected with natural anomalies and improvement of traditional resources exploitation. The changing of climate warming to cooling can cause the rise of the costs of the shelf resources exploitation and water transportation development in Arctic Ocean, and complications with the solving of problems connected with the oil spills response.

Arctic Climate Change

The climate in Arctic regions has warmed at about twice the rate of the rest of the World during the period of last decade (Fig.1, b). The peak of the temperature’s rising took place in 2007. Recent warming contains a clear human impact. Regional changes of the Arctic climate effect global climate system as the Arctic plays central role in regulating Earth’s climate. The “warming” of the Northern Hemisphere’s “refrigerator” has accelerated global warming significantly. The additional heat absorbed by an increasingly ice-free Arctic Ocean in summer is already accelerating local and regional warming and preventing sea ice from recovering. Arctic climate change impacts the global system by altering atmospheric and ocean circulation that affect weather patterns.