ISSN 1068-3739, Russian Meteorology and Hydrology, 2017, Vol. 42, No. 7, pp. 461–470. Allerton Press, Inc., 2017.
Original Russian Text Yu.P. Perevedentsev, A.A. Vasil'ev, K.M. Shantalinskii, V.V. Gur'yanov, 2017, published in Meteorologiya i Gidrologiya, 2017, No. 7, pp. 81–93.

Long-term Variations in Surface Air Pressure and Surface Air Temperature in the Northern Hemisphere Mid-latitudes

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Received July 15, 2016

Abstract—The spatiotemporal variability of surface air pressure and surface air temperature in the Northern Hemisphere troposphere in 1990–2014 is described. In 2005 the low-frequency component (LFC) of average air temperature in January averaged over the latitude zone of 32.5 –67.5 N has stopped its increase that lasted for 35 years (from 1970). The LFC of air temperature in July has continued growing since 1975 (for 39 years). The anomalies of air pressure and air temperature for thirty-year periods and the dynamics of LFC of air temperature and air pressure in the atmospheric centers of action are analyzed.

DOI: 10.3103/S1068373917070056

Keywords: Climate changes, air temperature, air pressure, mid-latitudes

INTRODUCTION

The publication of summarizing reports on the problem of the modern climate change [5, 17] does not reduce the interest to this issue. This is related both to the instability of modern climate and to its possible negative and positive effects on natural and socioeconomic processes. There are different opinions on the reasons for the climate warming.

The authors of some papers [1, 3, 6, 11, 12, 14] dealing with the analysis of the modern climate change note a need in considering not only anthropogenic factors but also the natural ones, such as solar and volcanic activity, atmosphere–ocean interaction, El Niño events, etc. In particular, it is demonstrated in [21] that intense circulation processes related to the atmosphere–ocean interaction cause significant variations (from interannual to interdecadal) in air temperature in the mid-latitudes in winter. These variations are superimposed on the general process of global warming and considerably modify its manifestation. In view of this, J.M. Wallace in his latest paper [20] defined the priority areas of climate change investigation including a need in studying its interdecadal variations which are largely caused by the intraseasonal and intraannual variability of the climate system. Many authors identify and consider long-period variations in the climate system for explaining its processes.

According to the data of [7], cyclic variations with the period of 20–25 and 10–11 years are detected in the different parameters of ocean, ice cover, and atmosphere; in particular, long-term variations are detected in the North Atlantic Oscillation (NAO) index. It is noted in [4] that the appreciable contribution to the climate change is made by the natural oscillations whose existence is directly related to the presence either of ocean patterns or of patterns in the coupled atmosphere–ocean system which have the typical period of about several decades. The author of [8] associates the pressure wave oscillations in the Atlantic and Pacific regions with the cycles of solar activity. N.S. Sidorenkov [15] considers decadal climate changes (the global anomalies of air temperature and atmospheric circulation) jointly with variations in the Earth angular velocity, and the authors of [9] assess the statistical correlation between air temperature and precipitation in Northern Eurasia in the 20th century and the Arctic Oscillation which significantly varied during that period.