Extremes of Extratropical Storms over North Atlantic Based on Cyclone Indicators in ESIMO

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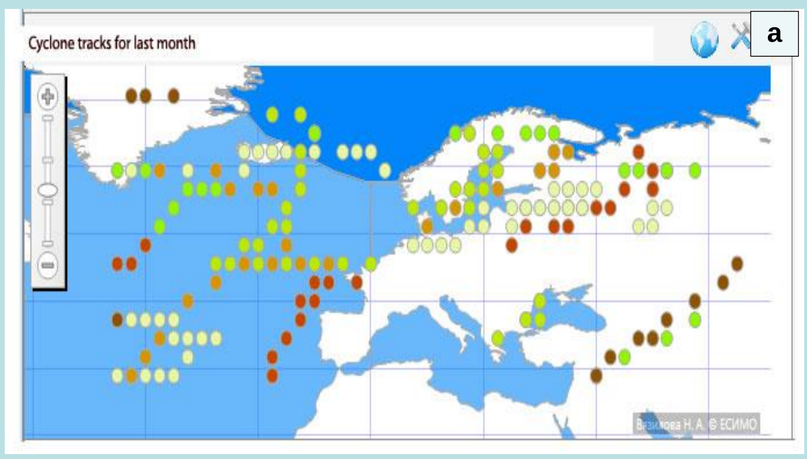
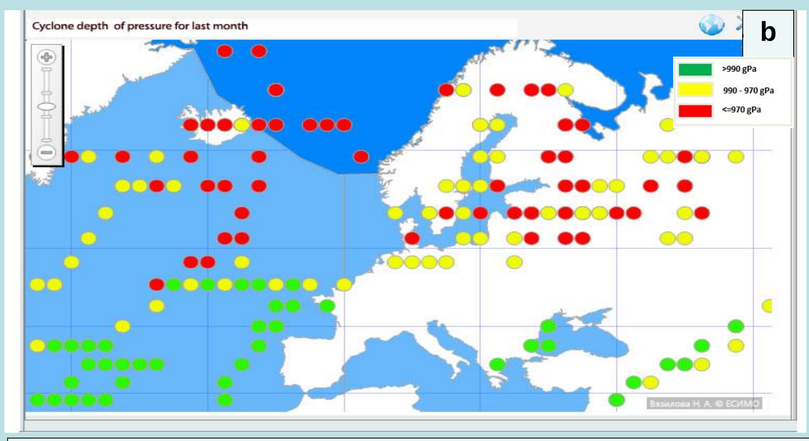


1. Introduction

The cyclone activity monitoring over North Atlantic based on: 1) the creating of cyclone parameters maps for last calendar month; 2) the integral cyclone activity indicators for selected regions.

The goal of this work is to show the changes in extremes of extratropical storms using of cyclone activity indicators. The list of cyclone activity indicators includes number of cyclone tracks, cyclone frequency, index cyclone activity, maximum storm wind and maximum precipitation near cyclone centers, that are available on the Unified State System of Information on the Global Ocean (ESIMO) portal [http://portal.esimo.ru].



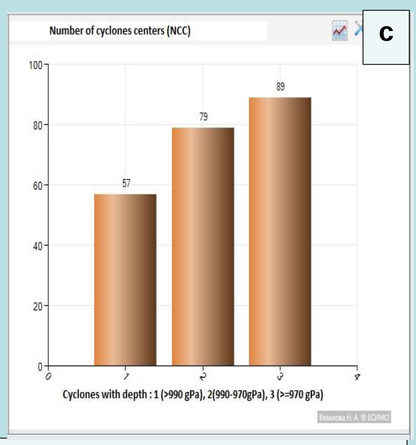


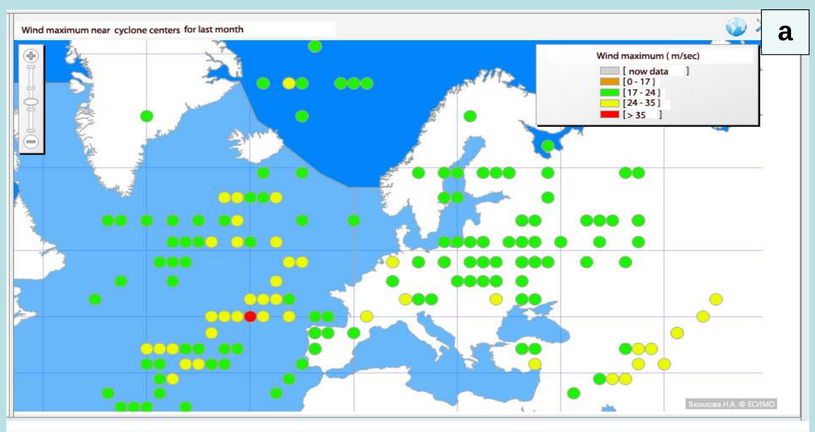
Fig.1. Cyclone track s for last calendar month . Cyclone tracks with color indication of Number cyclone track (a) , cyclone tracks with color indication of cyclone depth (b), number of cyclone centers with different cyclone depth pressure (c). Example: November 2015.

2. Data and methology

The cyclone parameters were calculated based on automated cyclone indentification and tracking algorithm using the 6-hourly SLP, surface wind and precipitation rate from the NCEP/NCAR DOE reanalyses [1].

The cyclone frequency (number cyclones centers, NCC) and cyclone activity index (CAI) are calculated as number of the cyclones centers and sum of pressure anomaly in cyclones centers during the month in every grid point. Storm activity indicators are calculated, as number cyclones with different maximum wind intensity, using Bofort wind scale.

The maximum wind strength and maximum precipitation rate near cyclone center were defined from a 5° spherical radius near cyclone center [3].



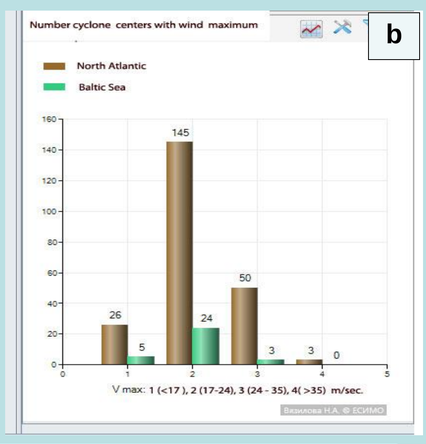
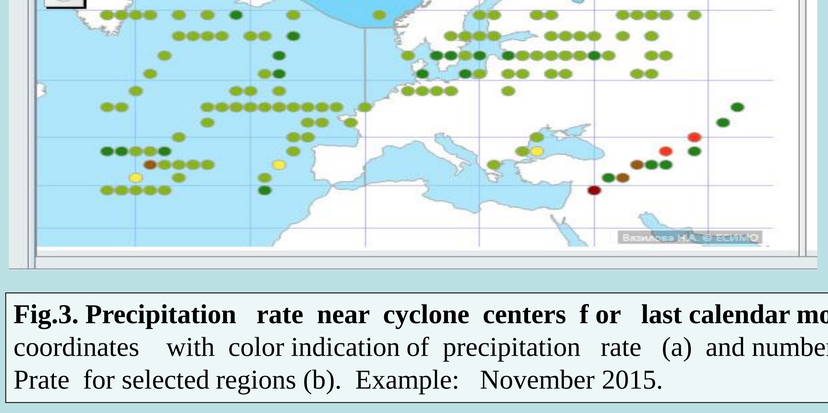


Fig.2. Wind maximum near cyclone centers for last calendar month. The coordinates of wind maximum (a) , number of cyclone centers with different wind speed for selected regions (b). Example: November 2015.

3. *The month cyclone activity monitoring* over North Atlantic includes the creating of maps with data coordinates of the cyclone track (**Fig.1**a) and cyclone depth (**Fig.1**b), maximum wind (**Fig.2**a) and maximum precipitation rate (**Fig.3**a) near cyclone center, that are presented on ESIMO portal for last calendar month.



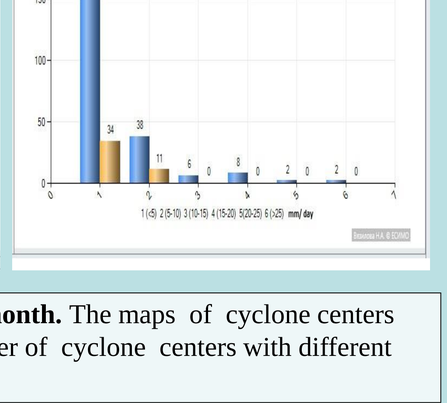


Fig.3. Precipitation rate near cyclone centers f or last calendar month. The maps of cyclone centers coordinates with color indication of precipitation rate (a) and number of cyclone centers with different Prate for selected regions (b). Example: November 2015.

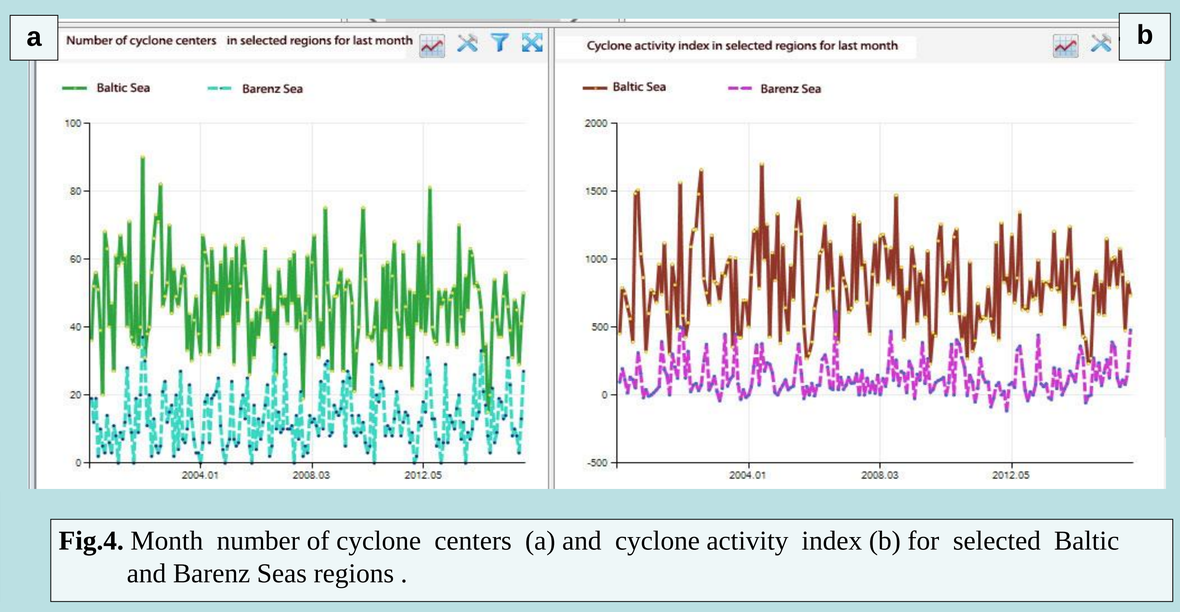


Fig.4. Month number of cyclone centers (a) and cyclone activity index (b) for selected Baltic and Barenz Seas regions .

4. *The monitoring of cyclone activity interannual variability* based on integral cyclone activity indicators for selected regions: North Atlantic, Baltic and Barenz seas as for month, as for winter and summer season for period from 1999/01 to present (**Fig.**4, 5, 6, 7).

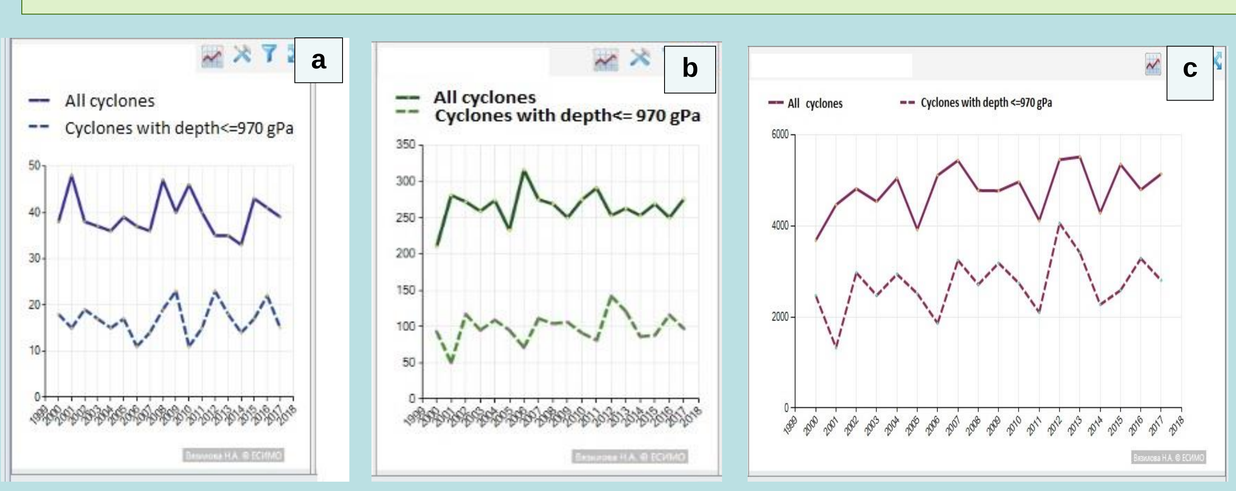


Fig.5. Number of cyclone tracks (a), cyclone frequancy (b) and cyclone activity index (c) for North Atlantic region. Winter season: ONDJFM.

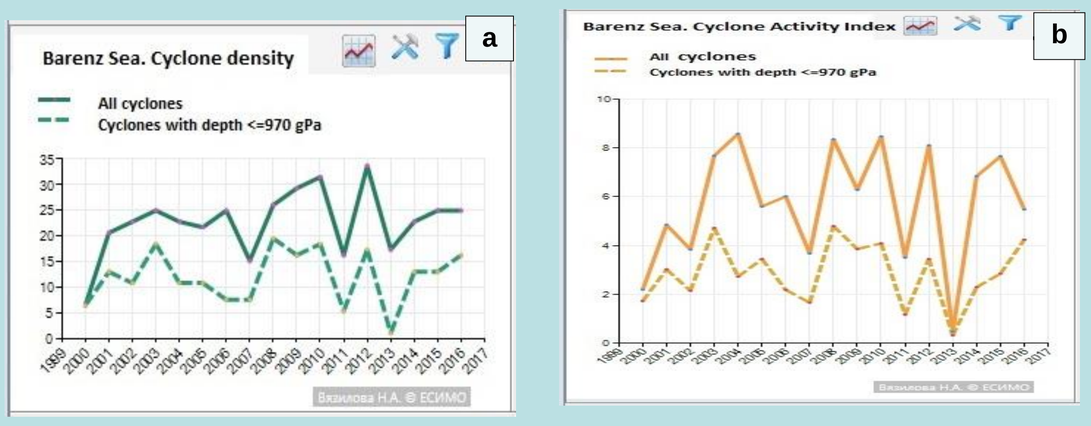


Fig.6. Cyclone density (a , c) and cyclone activity index (b, d) for Barenz Sea (a, b) and Baltic Sea (c, d) regions. Summers season: AMJJAS. (NCC and CAI, divided on number points in region)

5. Summary

Extreme storms are usually defined as cyclones with extreme wind, wind strength 24 m/sec and more [3]. Analyses of distribution for cyclones with different maximum wind intensity (weak strong, moderately strong, extreme wind) shows (Fig.8), that in high-latitude North Atlantic most part of storms with extreme wind are the cyclones with extreme depth of pressure, with an MSLP of 970 hPa or less.

Fig.7. Number of cyclones centers with different wind maximum. Baltic Sea region. Summer (a) and winter (b)seasons.

Рис.8. Interannual variability of Procent (%) for cyclones with depth <=970 gPa in the storms with different wind speed: _____(<17 м/sec,), - - - - (17 - 24 м/sec), ... (> 24 м/sec).

References

1. Vyazilova N.A. Cyclonic Activity and Circulation Fluctuations in the North Atlantic- Russian Meteorology and Hydrology, 2012, N.7, c. 5-14.
2. Vyazilova N.A., A.E.Vyazilova . On the ExtremeCyclone Activity in the North Atlantic. Russian Meteorology and Hydrology, 2011, N.11, 5-17.
3. Vyazilova N.A., A.E. Vyazilova. Storm cyclones in the North Atlantic - Russian Meteorology and Hydrology, 2014, N.6, 19-27.