# National Capabilities and Initiatives - Russian Federation

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# Content

- RCC acting in Russia
- Existing infrastructure on Polar climate services
- Proposed structure of national polar RCC
- Implementation of proposed national EAACC
  - AARI, MGO, VNIIGMI functions
- Geography (area of responsibility)
- Proposals for detailed criteria for the PRCC
- Plan of national implementation

# North Eurasia Regional Climate Center

Russian Federation presently supports the North Eurasian Regional Climate Center


For RA-VI region NEACC functions as one of Long-Range Forecast nodes of the RA-VI Regional Climate Network.

For RA-II Region NEACC functions as a Multifunctional Regional Climate Center

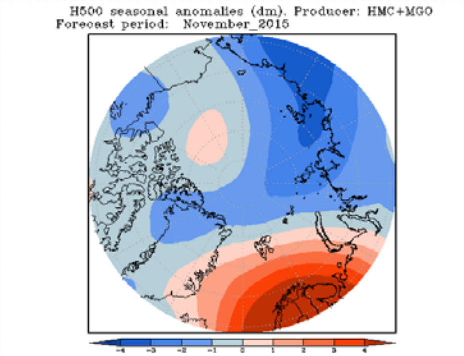
**Consortium of the Roshydromet organizations listed bellow constitutes the main body of NEACC:**

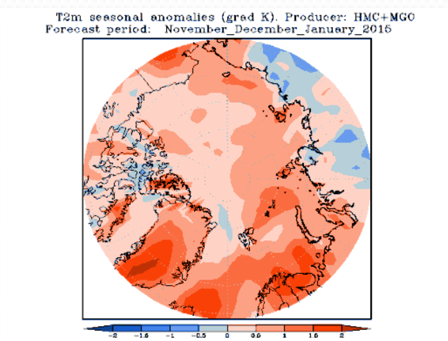
- Hydrometeorological Research Centre of the Russian Federation
- Institute of Global Climate and Ecology
- Russian Research Institute for Hydrometeorological Information – World Data Centre
- A.I.Voeikov Main Geophysical Observatory
- Droughts Monitoring Centre, Russian Research Institute of Agricultural Meteorology
- Main Computer Centre (Russian Federation)
- Aviametelecom (Russian Federation)

The North Eurasia Climate Centre (NEACC) is coordinated by the Russian Federation under the auspices of the Commonwealth of Independent States (CIS). NEACC was formally designated as a WMO RCC NEACC by WMO Executive Council in May 2013.

# NEACC: Operational long-range forecasting

http://seakc.meteoinfo.ru

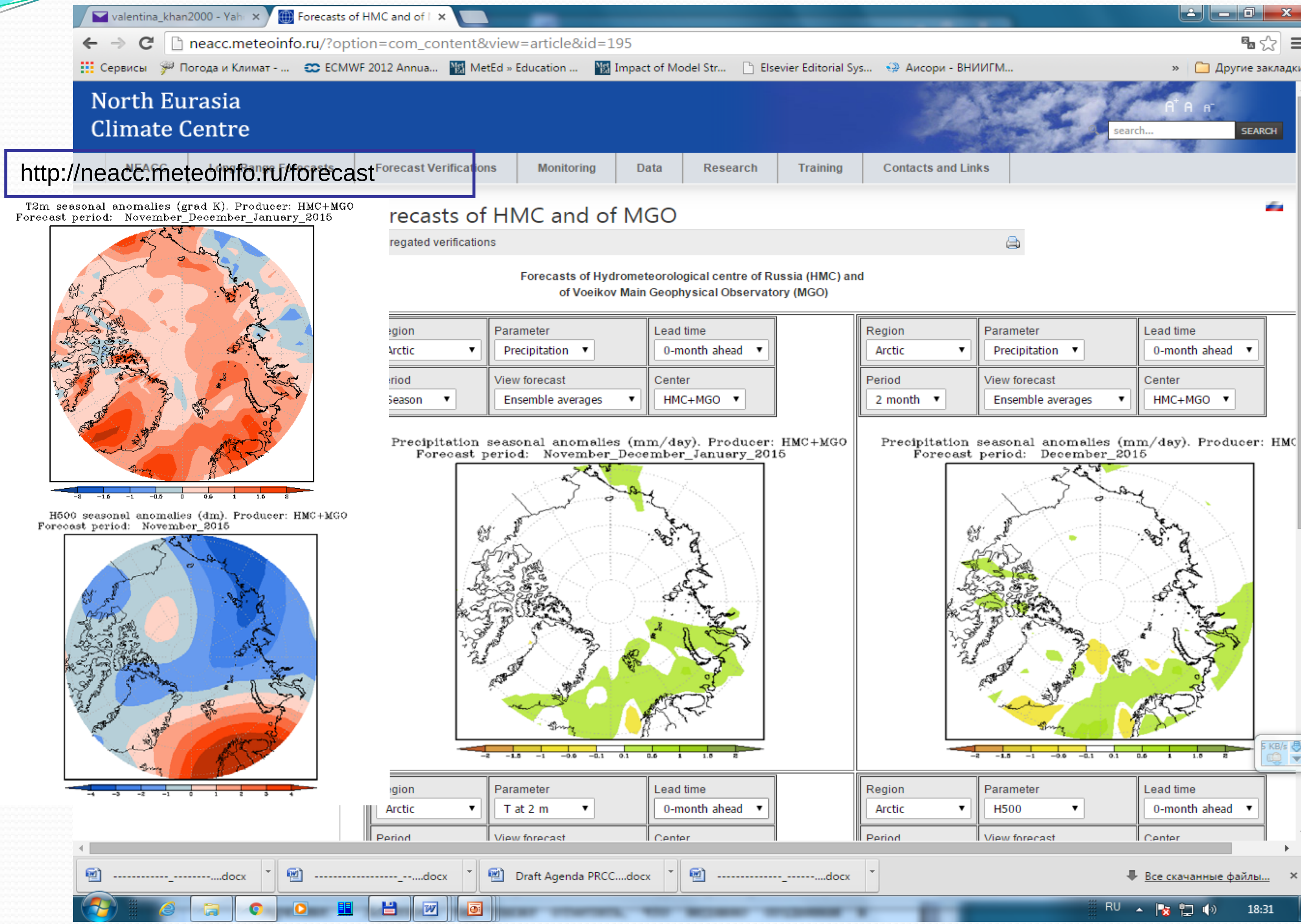



- Monthly updates of forecasting graphs on the web site of NEACC
- Monthly updates of monthly and seasonal forecasts of large scale circulation atmospheric indices.
- Monthly updates of the tables with prognostic circulation index values accompanied by composite maps of geopotential height 500 hPa, atmospheric sea level pressure, air temperature at 850 hPa, surface air temperature and precipitation for positive and negative phase of each index.
- Monthly updates of outlooks of seasonal forecasts on the website of NEACC.
- Monthly updates of digital archives of probabilistic seasonal forecasts on the website of NEACC.
- Consensus outlook for winter and summer as an outcome of NEACOF

# NEACC: climate monitoring

http://neacc.meteoinfo.ru/forecast



# NEACC: seasonal and consensus outlooks

neacc.meteoinfo.ru/?option=com_content&view=article&id=194

North Eurasia
Climate Centre

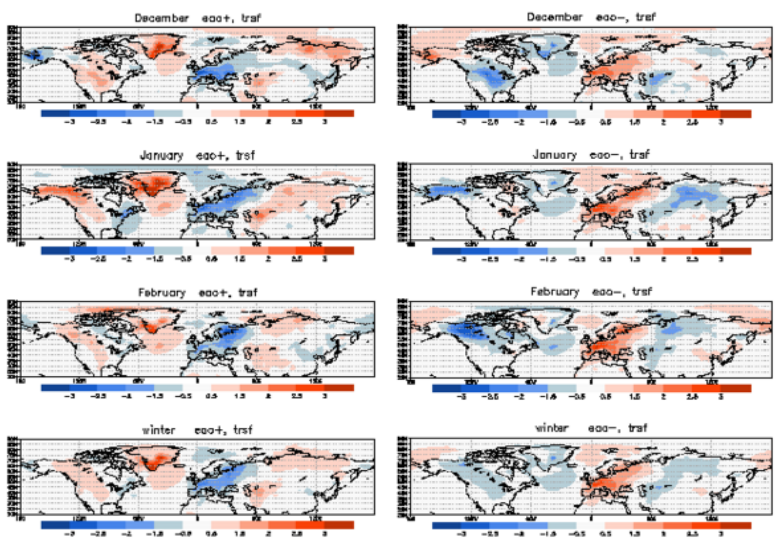
NEACC | Long-Range Forecasts | Forecast Verifications | Monitoring | Data | Research | Training | Contacts and Links

## Indices of Circulation

Long-Range Forecasts

### Composites (NCEP/NCAR Reanalysis -2)

| Indices | Season | Parameter |
|---|---|---|
| EA | Winter | T at a height of 2 m |




*Figs. (left) and figs. (right) are the composites of the meteorological fields for the positive and negative phase of*

### The Model of Hydrometeorological centre Forecast

| index | NOVEMBER, DECEMBER 2015, JANUARY, | | | |
|---|---|---|---|---|
| | 1 month | 2 month | 3 month | 4 month |
| EA | -0,4 | -1,05 | -0,58 | 0,09 |
| WA | 1,45 | 1,12 | 0,09 | 0,57 |
| EU | 1,51 | 0,98 | 1,4 | 1,76 |
| WP | -0,96 | 0,25 | -0,76 | -0,91 |
| PNA | 0,24 | 0,62 | 0,36 | 0,16 |
| NAO | -0,27 | 0,16 | 0,15 | 0,31 |
| POL | -1,18 | -1,04 | -0,12 | -0,83 |
| AOS | -0,24 | 0,09 | -0,91 | -0,6 |

*Red (blue) represents the positive (negative) phase of index*

### Designation

1. EA - East Atlantic Oscillation
2. WA - West Atlantic Oscillation
3. EU - Eurasia Pattern
4. WP - West Pacific Oscillation
5. PNA - Pacific – North American Pattern
6. NAO - North Atlantic Oscillation

# NEACC - North Eurasia Climate Outlook Forum

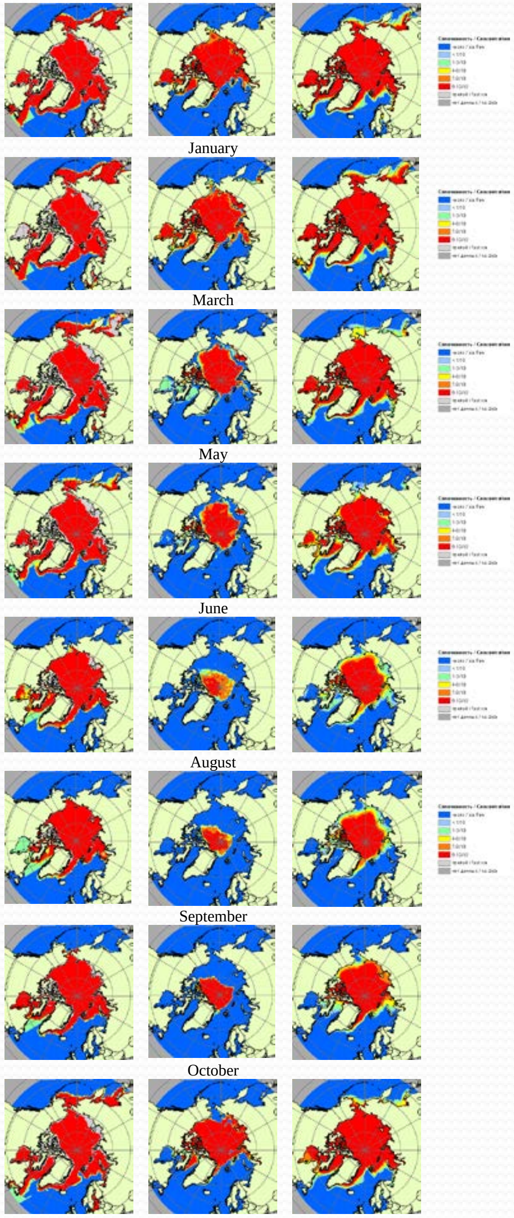
**North Eurasia Climate Outlook Forum (NEACOF):**

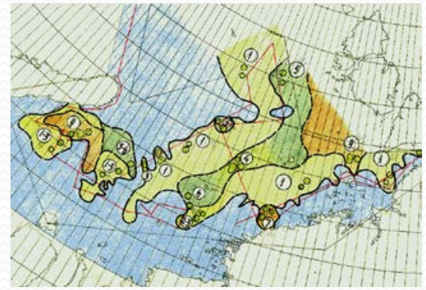
- NEACOF was initiated by the North EurAsia Climate Centre (NEACC); the first session took place from 17 to 19 May 2011, hosted by Hydrometcenter of Russia.
- Participating countries: Azerbaijan, Armenia, Belorussia, Kazakhstan, Kirgizstan, Moldova, Russian Federation, Tajikistan, Uzbekistan, Ukraine;
- The last session of NEACOF - NEACOF-9 was held in November 10-12, 2015 in Moscow.

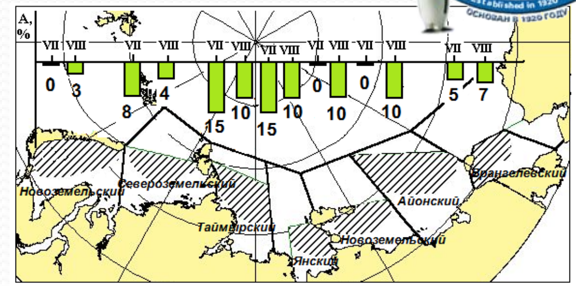
Preparation of consensus winter 2015/2016 forecast.

November 11, 2015

# Existing infrastructure on Polar climate services: AARI

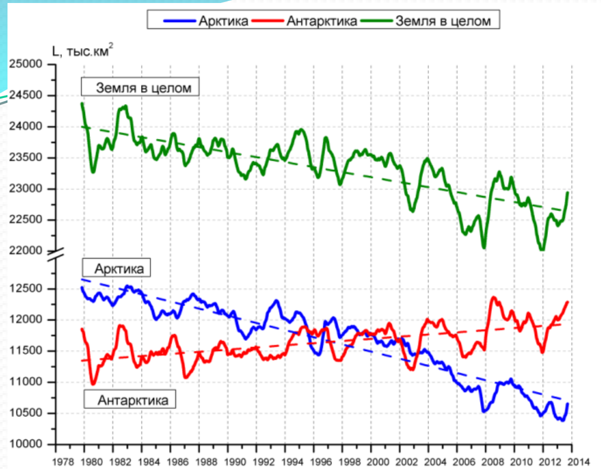


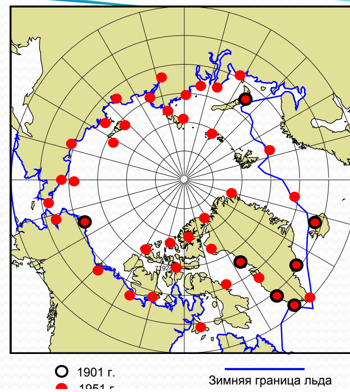


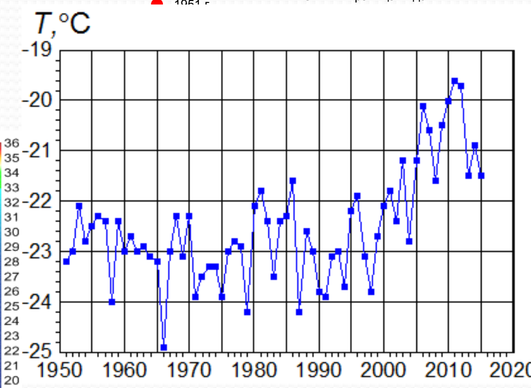

- Monitoring of the Arctic and Antarctic marine environment, short, medium and long-term forecasting, operational support at sea and are the prime AARI responsibilities since 1920s
- Several operational and scientific departments are supporting RCC functions
- AARI is supporting the WMO "Global Digital Sea Ice Data Bank" project integrating together with NSIDC the national ice services sea ice climatology based on ice charting

# AARI: Arctic climate monitoring

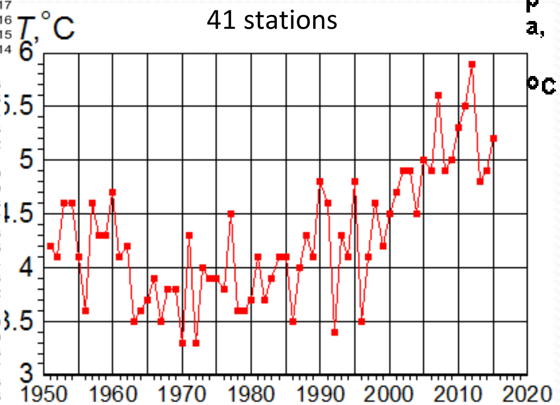



Smoother (365 days) daily ice extent values and linear trends for Arctic and Southern Ocean for 1978-2013

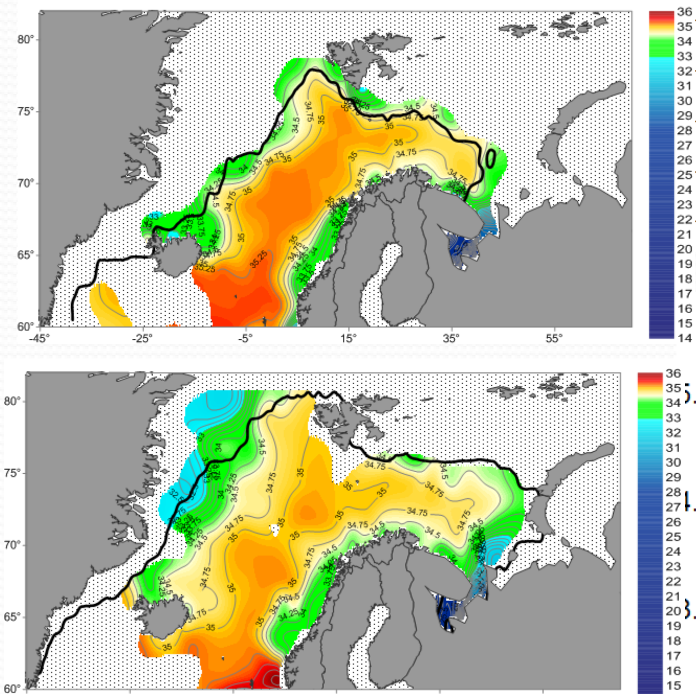


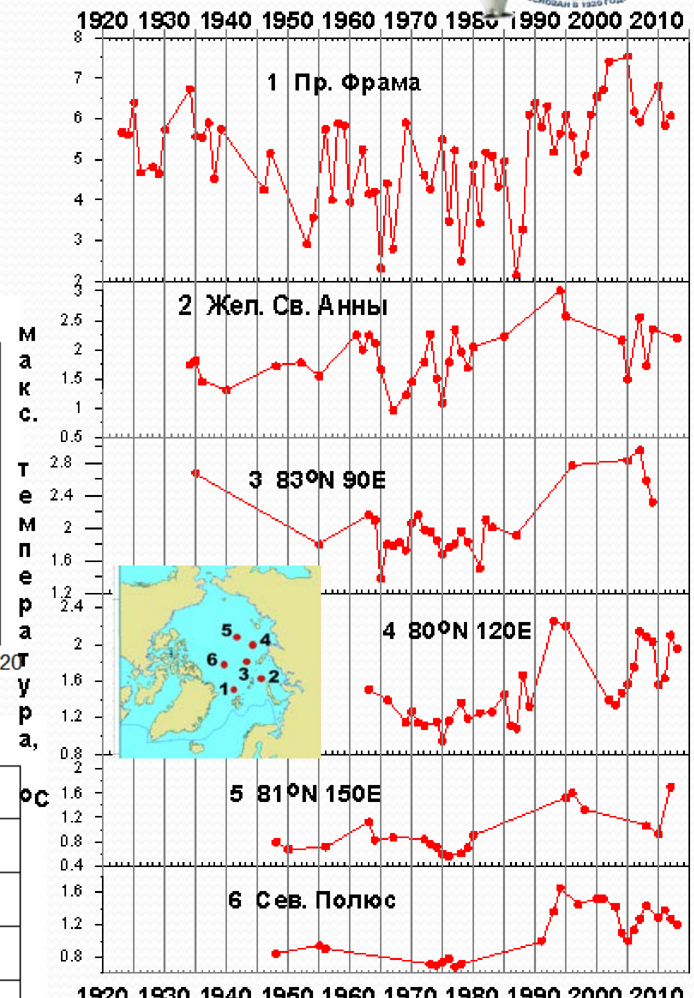

Winter air temperature based on 41 stations




Summer air temperature based on 41 stations



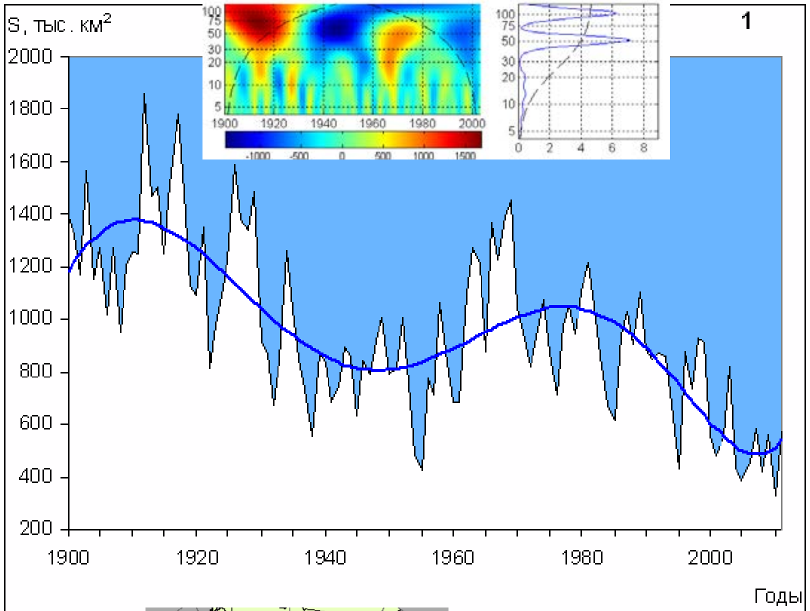
Sea surface salinity and ice edge in June 1969 (top) and 1987 (bottom), Salinity – NOAA NODC, ice edge - HadSST

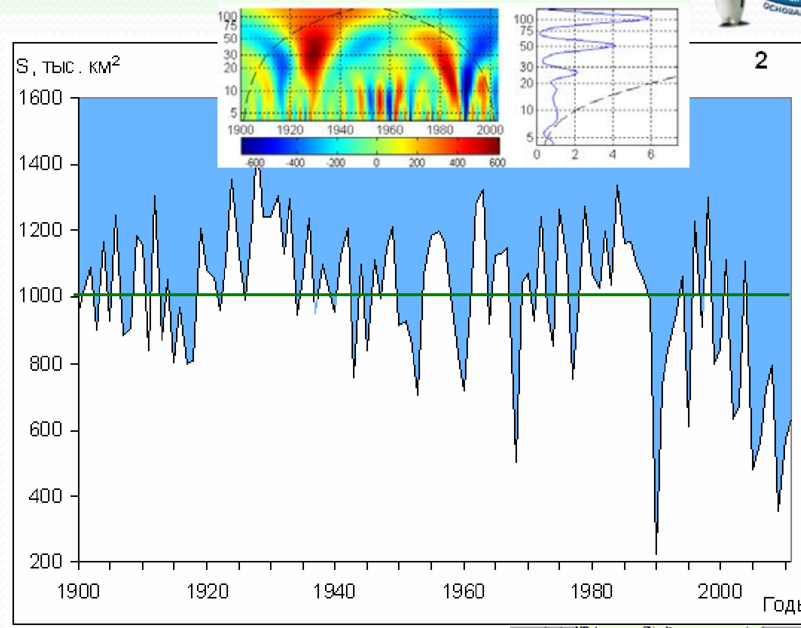


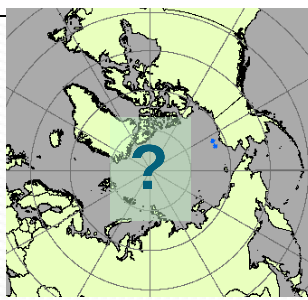

Maximal $T_{AW}$ in the Arctic Basin

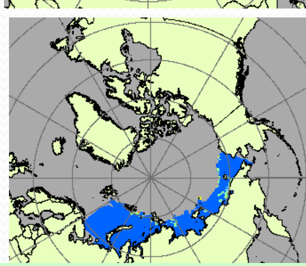
# AARI: Arctic climate monitoring

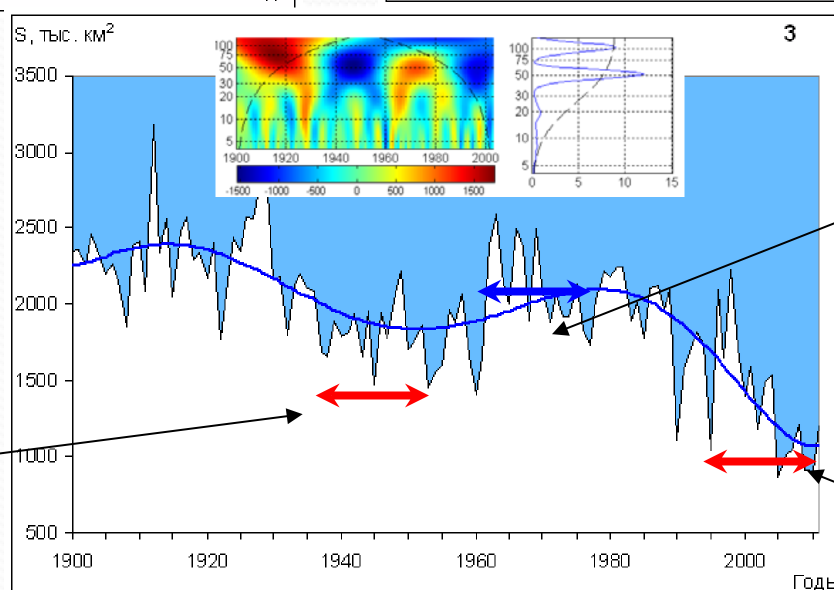
## Changes in August 3rd 10-days period sea ice extent for the Western Eurasian (Greenland, Barents, Kara), Eastern (Laptev, Eastern-Siberian and Chukchi) and total Eurasian Seas

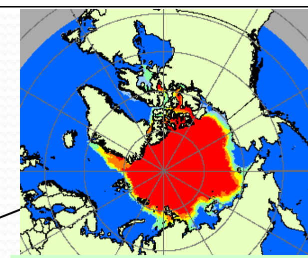


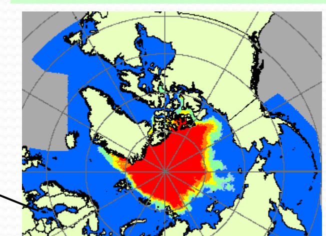





September, 1936 – 1943





September, 1971-1980

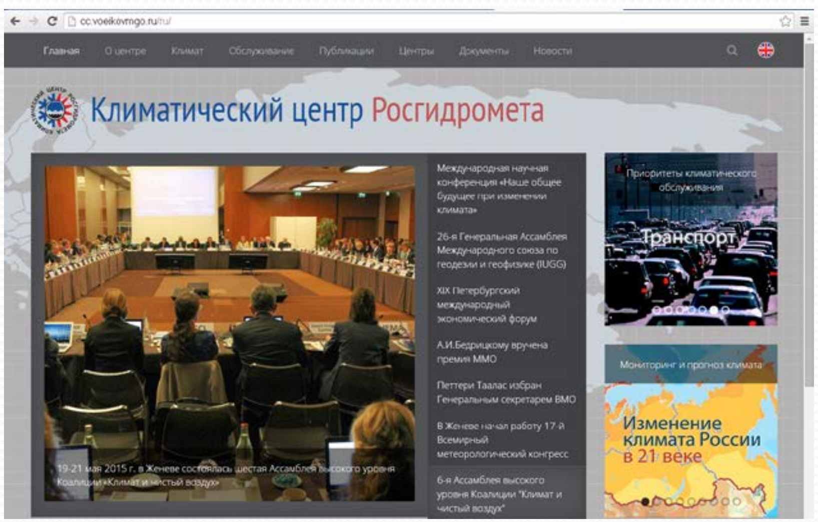

September, 2006 – 2012

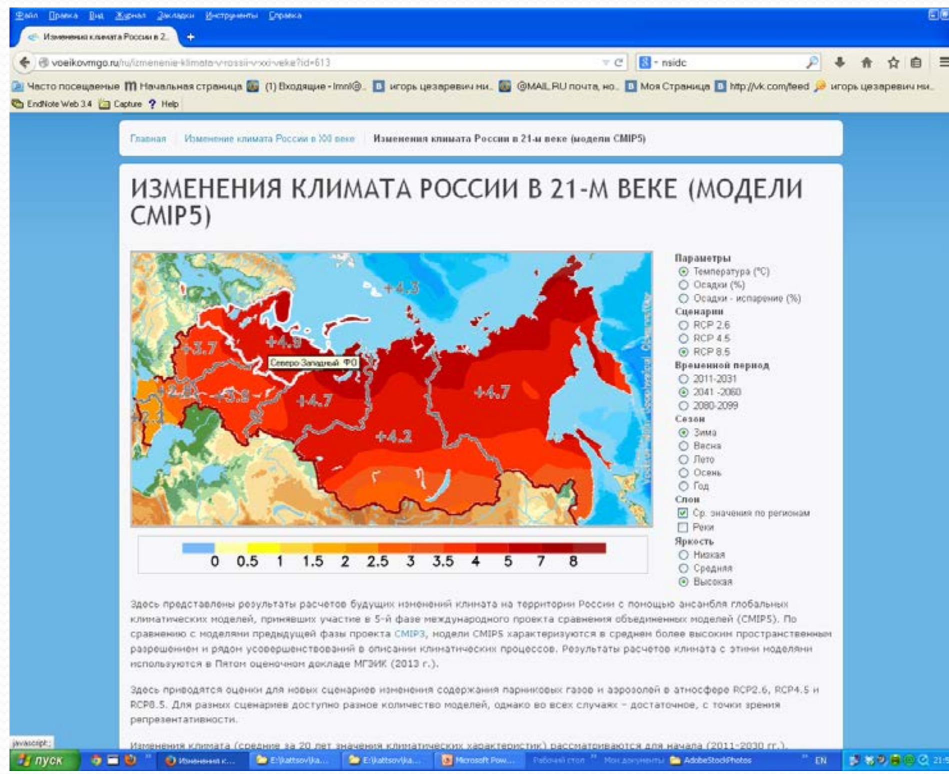
# Existing infrastructure on Polar climate services: MGO

ГЛАВНАЯ ГЕОФИЗИЧЕСКАЯ ОБСЕРВАТОРИЯ им.А.И.ВОЕЙКОВА


- MGO is coordinating and supporting Roshydromet Climate Center, including support for the national segment of GFCS

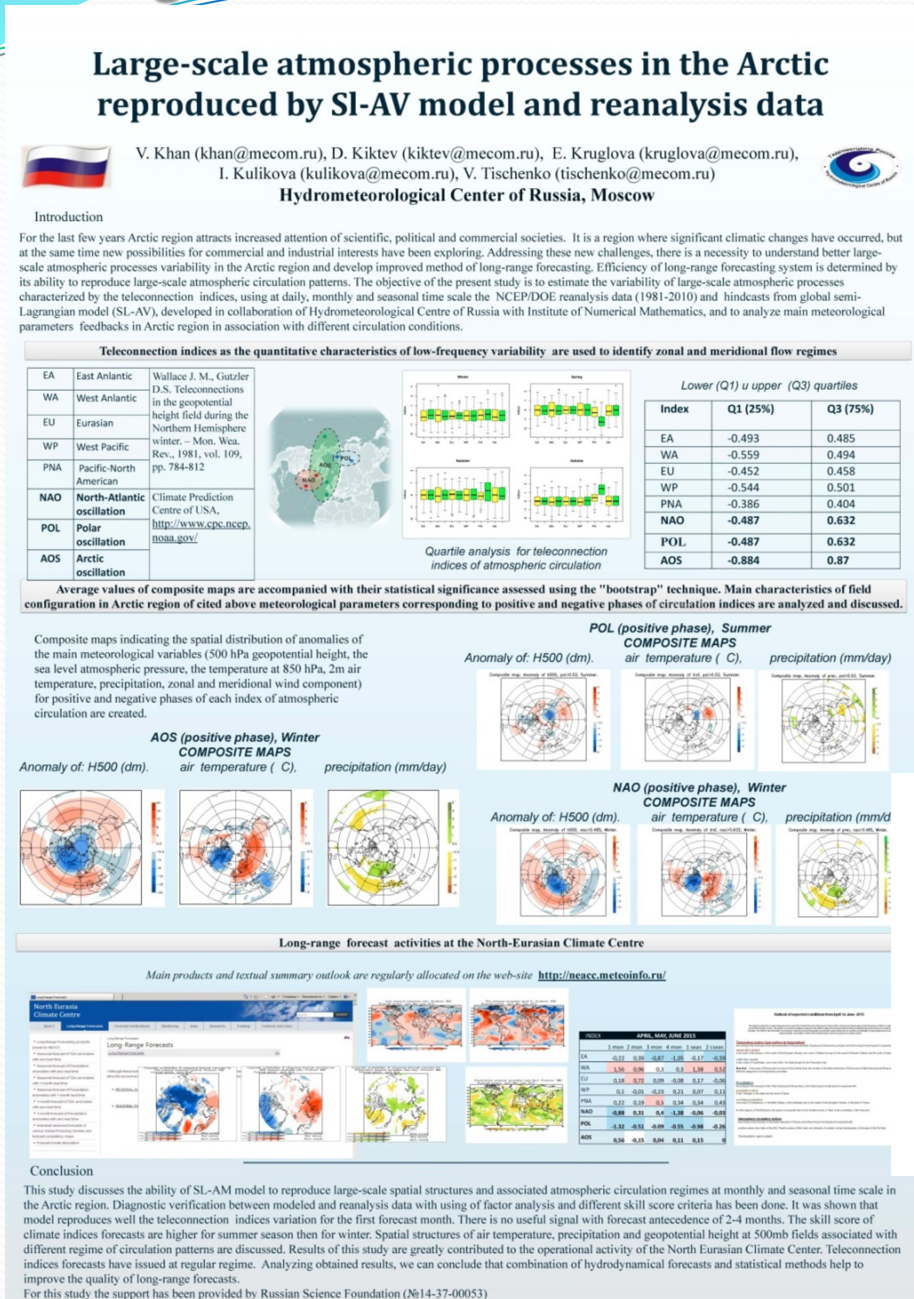
http://cc.voeikovmgo.ru



# Existing infrastructure on Polar climate services: HMC Moscow





## Large-scale atmospheric processes in the Arctic reproduced by Sl-AV model and reanalysis data

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**Hydrometeorological Center of Russia, Moscow**

Introduction

For the last few years Arctic region attracts increased attention of scientific, political and commercial societies. It is a region where significant climatic changes have occurred, but at the same time new possibilities for commercial and industrial interests have been exploring. Addressing these new challenges, there is a necessity to understand better large-scale atmospheric processes variability in the Arctic region and develop improved method of long-range forecasting. Efficiency of long-range forecasting system is determined by its ability to reproduce large-scale atmospheric circulation patterns. The objective of the present study is to estimate the variability of large-scale atmospheric processes characterized by the teleconnection indices, using at daily, monthly and seasonal time scale the NCEP/DOE reanalysis data (1981-2010) and hindcasts from global semi-Lagrangian model (SL-AV), developed in collaboration of Hydrometeorological Centre of Russia with Institute of Numerical Mathematics, and to analyze main meteorological parameters feedbacks in Arctic region in association with different circulation conditions.

**Teleconnection indices as the quantitative characteristics of low-frequency variability are used to identify zonal and meridional flow regimes**

| | | |
|---|---|---|
| EA | East Anlantic | Wallace J. M., Gutzler D.S. Teleconnections in the geopotential height field during the Northern Hemisphere winter. – Mon. Wea. Rev., 1981, vol. 109, pp. 784-812 |
| WA | West Anlantic | |
| EU | Eurasian | |
| WP | West Pacific | |
| PNA | Pacific-North American | |
| NAO | North-Atlantic oscillation | Climate Prediction Centre of USA, http://www.cpc.ncep.noaa.gov/ |
| POL | Polar oscillation | |
| AOS | Arctic oscillation | |

*Quartile analysis for teleconnection indices of atmospheric circulation*

*Lower (Q1) u upper (Q3) quartiles*

| Index | Q1 (25%) | Q3 (75%) |
|---|---|---|
| EA | -0.493 | 0.485 |
| WA | -0.559 | 0.494 |
| EU | -0.452 | 0.458 |
| WP | -0.544 | 0.501 |
| PNA | -0.386 | 0.404 |
| NAO | -0.487 | 0.632 |
| POL | -0.487 | 0.632 |
| AOS | -0.884 | 0.87 |

**Average values of composite maps are accompanied with their statistical significance assessed using the "bootstrap" technique. Main characteristics of field configuration in Arctic region of cited above meteorological parameters corresponding to positive and negative phases of circulation indices are analyzed and discussed.**

Composite maps indicating the spatial distribution of anomalies of the main meteorological variables (500 hPa geopotential height, the sea level atmospheric pressure, the temperature at 850 hPa, 2m air temperature, precipitation, zonal and meridional wind component) for positive and negative phases of each index of atmospheric circulation are created.

*POL (positive phase), Summer COMPOSITE MAPS*
*Anomaly of: H500 (dm). air temperature ( C), precipitation (mm/day)*

*AOS (positive phase), Winter COMPOSITE MAPS*
*Anomaly of: H500 (dm). air temperature ( C), precipitation (mm/day)*

*NAO (positive phase), Winter COMPOSITE MAPS*
*Anomaly of: H500 (dm). air temperature ( C), precipitation (mm/d*

**Long-range forecast activities at the North-Eurasian Climate Centre**

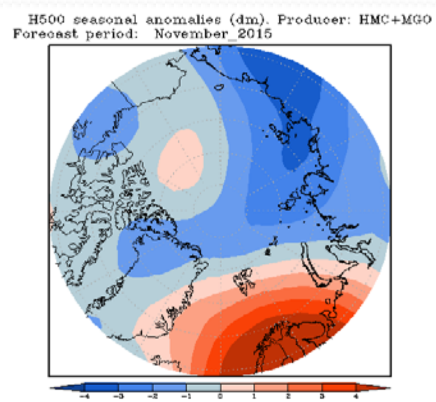
*Main products and textual summary outlook are regularly allocated on the web-site* http://neacc.meteoinfo.ru/

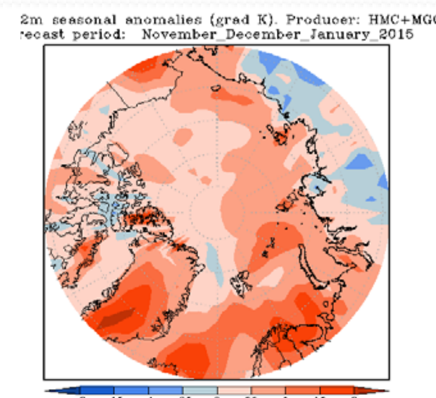
Conclusion

This study discusses the ability of SL-AM model to reproduce large-scale spatial structures and associated atmospheric circulation regimes at monthly and seasonal time scale in the Arctic region. Diagnostic verification between modeled and reanalysis data with using of factor analysis and different skill score criteria has been done. It was shown that model reproduces well the teleconnection indices variation for the first forecast month. There is no useful signal with forecast antecedence of 2-4 months. The skill score of climate indices forecasts are higher for summer season then for winter. Spatial structures of air temperature, precipitation and geopotential height at 500mb fields associated with different regime of circulation patterns are discussed. Results of this study are greatly contributed to the operational activity of the North Eurasian Climate Center. Teleconnection indices forecasts have issued at regular regime. Analyzing obtained results, we can conclude that combination of hydrodynamical forecasts and statistical methods help to improve the quality of long-range forecasts.

For this study the support has been provided by Russian Science Foundation (№14-37-00053)

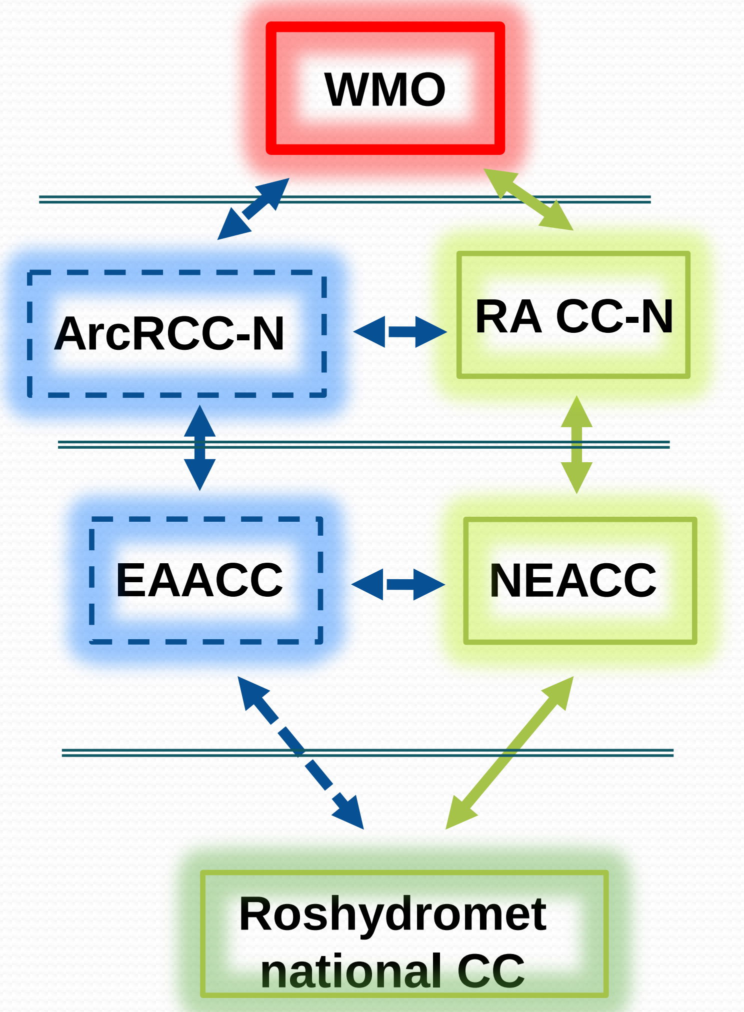
- Research activities focused on Arctic region are underway at Hydrometcenter of Russia within scientific project supported by Russian Science Foundation.
- Laboratory of Forecasting of Hydrometeorological Processes in Arctic region was created at Hydrometcenter of Russia in 2014.



# Proposed structure of Russian PRCC

- Based on current Roshydromet practices and potential development of operational marine services in the Eurasian Arctic and Antarctic the national **Eurasian Arctic and Antarctic Climate Centre** (**EACC**) is proposed as a node of multipurpose Arctic RCC - network (ArcRCC-N) and Antarctic RCC-network (AntRCC-N)
- Within the ArcRCC-N division of responsibilities of the prospective national polar RCC may be performed in accordance with the WMO Manual No.485 using
  - WMO RA sub-regions schema,
  - marine safety services zone of responsibilities (JCOMM METARIA I, IV, XII, XIII, XVII…XXI)
  - existing climate practices in the polar regions (WMO-No.558, No.574, etc)
- For AntRCC-N similar criteria may be used



# Implementation of proposed national EAACC

Implementation of the proposed EAACC is planned in accordance with the criteria of the WMO Manual No.485 and similar to existing NEACC as a consortium of 4 Roshydromet institutions:

- Arctic and Antarctic Research Institute (AARI), St.Petersburg, coordinator
- Main Geophysical observatory (MGO),St.Petersburg
- Russian Institute for Hydrometeorological information – World Data Center (RIHMI-WDC), Obninsk
- Hydrometcenter Moscow (HMC)

# Implementation of EAACC: AARI

- Mandatory functions:
  - Operational activities for LRF (elements – Arctic sea ice parameters (extent, area, CT, SoD, ice edge for the Barents and Arctic Ocean)
  - Operational activities for climate monitoring (elements – factual and anomalies of ice extent, CT, ice edge, drift schema, old ice area within the area of responsibilities, SLP, mean Tair, marine state (T,S profiles, sea level, occurrence of hazards)
  - Operational data services, to support operational LRF and climate monitoring (extent, CT, ice edge)
  - Training in the use of operational RCC products and services
- Recommended functions
  - Non-operational data services
  - Coordination of functions
  - Scientific research

# Implementation of EAACC: MGO

- Mandatory functions:
  - Operational activities for LRF (numerical forecast of atmosphere for 1 month in advance on cooperation with HMC Moscow as a 2-ansamle forecasts)
  - Operational activities for climate monitoring (elements – carbon dioxide, methane, ozone, precipitation chemistry)
  - Training in the use of operational RCC products and services
- Recommended functions
  - Perspective estimates of climate change for different scenarios of external forcing – global and regional assessments for both hemispheres
  - Training and capacity building
  - Scientific research

# Implementation of EAACC: RIHMI-WDC

- Mandatory functions:
  - Operational data services, to support operational LRF and climate monitoring (integration of EAACC products and provision of interactive access to data and services, provision of web-service of interactive estimate of services and production using technical decisions from WMO WIS extent and Climate Services Information System - CSIS)
- Recommended functions
  - Non-operational data services (elements – monthly and extreme surface meteorology)
  - Management of regulatory material for monitoring of the surface and upper atmosphere climate for area of Russian Federation northward of 60N and non-operational data services for those elements
  - Scientific research

# Implementation of EAACC: HMC/NEACC

- Mandatory functions:
  - Tight collaboration between NEACC/HMC and EAACC is critical to exclude duplication in climate services for continental and marine areas of the Eurasian region, ensure harmonized services on national and international levels

# Geography

- As a part of this concept, 'Arctic region' refers to 1) the Arctic Ocean in its geographical boundaries and 2) the adjacent coastal part of the continents of Eurasia and the Americas north of the Arctic Circle.
  - The formal definition of the sub-Arctic region as a part of RA-II and RA-VI, as well as the sub-Antarctic region should be carried out in the framework of the present workshop or corresponding Technical Commission
- EAACC proposed area of responsibility includes areas of the Arctic seas adjacent to the continent of Eurasia (the Barents, Kara, Laptev, East Siberian and Chukchi Sea), part of the Arctic basin between meridians 30E and 170W northward of the stated seas and the coastal area of the seas southward to the Arctic Circle.

# Proposals for detailed criteria for the PRCC (WMO-No.485, APPENDIX II-11)

- Operational activity for LRF, additional elements:
  - interpretation and estimates: SLP, ice extent, ice area, concentration (CT), stage of development (SoD), edge position for the areas of Barents Sea and within the zone of EAACC responsibility; monthly or quarterly.
  - reparation of regional and sub-regional products: ice extent, ice massif areas, old ice position, type of ice conditions, wind waves and sea level; 10 days – 1 month
  - consensus statement: ice extent, area, CT, SoD, edge position, mean air temperature for region and subregions; semiannual-annual
  - Verification: ice extent, area, CT, SoD, edge position, mean air temperature for region and subregions
- Operational activity for climate monitoring, additional elements:
  - climate diagnosis: actual and anomaly values of ice extent, ice area, CT, ice drift schema, edge position within the zone of EAACC responsibility, SLP, Ta, marine environment parameters (Sal, Tw, Level, occurrence of hazards)
  - Development of historical climatology for region/subregion: ice extent, ice area, CT, ice drift schema, edge position within the zone of EAACC responsibility, SLP, Ta, marine environment parameters (Sal, Tw, Level, occurrence of hazards)

# Sea ice services: WMO regulations and a formal way to develop

- Terminology: WMO-No.259 (Sea-Ice Nomenclature)
- Manual and guide for services, including climatology: WMO-No.558/471 (Manual/Guide on Marine Meteorological Services, edition 2016)
- Best practices, including sea-ice climatology, atlases: WMO-No.574 ("Sea-ice information services in the World")
- Exchange formats: JCOMM-TR (SIGRID-3, S-411)
- Management: JCOMM ETSI, ETMSS and International Ice Charting Working Group (IICWG)

# Sea ice services: a practical way to develop

*International Ice Charting Working Group* http://nsidc.org/noaa/iicwg/

# NEWS RELEASE

## Variable Ice Conditions Impact Safe Navigation Globally

**Rostock, Germany, October 23, 2015** – The International Ice Charting Working Group (IICWG) convened its 16th annual meeting October 19-23 in Rostock. This year's meeting was hosted by the German Maritime and Hydrographic Agency in cooperation with the German Aerospace Center and the Alfred Wegener Institute. The theme for the meeting was "Relevant Ice Information for the Maritime Community".

Swedish Icebreaker Balder Viking breaking a track for the seismic vessel Akademik Shatskiy off the Northeast Greenland coast near latitude 79N. *(Courtesy Martin Nissen, Danish Meteorological Institute)*

While the volume of shipping in the Arctic varies from year to year, it is more a result of economic circumstances than ice conditions. Shipping is very much driven by commercial considerations and, despite the diminishing ice, Arctic navigation remains challenging and with significant risk. However, countries and companies with long term vision continue to invest in infrastructure, technology, research and policy in preparation for a future with routine ship traffic in the Arctic.

The IICWG issued the following statement:
"As polar ice conditions react to a changing climate, accompanied by increased interest in resources and new tourism experiences, accurate, timely analyses and forecasts of highly variable ice conditions are critical for safe and efficient navigation. The members of the IICWG are committed to improving their collective capabilities by sharing their information and expertise in the interest of marine safety."

**Significant events of 2015:**

- According to the National Snow and Ice Data Center, ice extent in the Arctic reached its minimum extent on September 11 at 4.4 million sq km. This was the 4th lowest minimum, after 2012, 2007 and 2011, recorded since 1978.
- The Antarctic sea ice extent tracked along record high levels through much of the first half of 2015, then abruptly returned to near average extent. It is notable that this marked change occurred coincidentally with the onset of a very strong El Niño.
  - For the second year in a row, the coastal ice did not break away from the shoreline at the French Antarctic station Dumont d'Urville forcing an extraordinary tractor-pulled resupply over 76 km of ice.
  - The International Ice Patrol (IIP) recorded a severe iceberg season again this year, tracking 1165 icebergs into the trans-Atlantic shipping lanes south of 48N latitude. 2015 was the 13th most severe iceberg season in the North Atlantic since 1900. The IIP also reports observing many more tabular icebergs this year than in the past.
- For the first time in many years, a large number of icebergs were reported in the northwest Barents Sea (Hopen island), the biggest being a 500 metre tabular berg.
- The Northern Sea Route (NSR) was free of drifting ice from September 7th to its close on October 17. By October 21, 677 vessels had navigated in the NSR including two Chinese bulk carriers, demonstrating China's interest in further utilizing this short cut route to Europe.
  - A significant concentration of icebergs and bergy bits was recorded in the Kara Sea posing a danger for unsupported navigation in Vilkitsky Strait. For the first time, this area was formally defined as bergy water.
- The main channels of the Northwest Passage were largely clear of ice, for at least a few days. While the Passage was not ice free, sea ice concentrations were low enough to permit navigation allowing 26 full transits between Atlantic and Pacific, over half of which were small boat adventurers. In total, 128 vessels operated in the Canadian Arctic, including 10 passenger ships.
- Despite the general reduction in Arctic sea ice, there were regional differences.
  - For the second winter in a row, ice conditions on the Great Lakes were much worse than normal.
  - The ice extent in the Baltic Sea was very low and the season was shorter than average, ending the first week of May, the earliest date ever recorded.
  - For the second year in a row, the East Coast of Canada experienced heavy sea ice. Around Newfoundland, ice was more extensive than normal creating difficulties for shipping.
  - Parts of the Hudson River near New York City froze over with ice up to 40 cm thick – the worst winter in 28 years.
  - The South Greenland sea ice season was 2 weeks longer than normal, the latest clearing since 2011. Several cruise ship voyages were delayed or cancelled.
  - The maximum sea ice extent in the Sea of Okhotsk for 2014-2015 was the lowest since 1970-1971.

In 2015, Russia, the United States and Norway commenced cooperative production of weekly Antarctic ice charts, which they had been doing separately, in an effort to standardize and ensure the continuing year-round availability of these essential ice information products. Additionally this year, the Argentine Naval Hydrographic Service commenced regular ice chart production.

The IICWG was formed in 1999 to promote cooperation among the world's ice services on all matters concerning sea ice and icebergs. This year, the IICWG welcomed the Argentine Naval Hydrographic Service as its newest charter member joining the operational ice services of Canada, Denmark (Greenland), Finland, Germany, Iceland, Norway, Poland, Russia, Sweden and the United States, as well as the British Antarctic Survey and the International Ice Patrol.

**For more information, please see regional contacts on the IICWG web site:** ***http://nsidc.org/noaa/iicwg/***

For up to date information on Sea Ice Services in the world see:
***http://wdc.aari.ru/wmo/docs/WMO574.pdf***

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Thank you for attention !