The Eleventh Session of the East Asia winter Climate Outlook Forum (EASCOF-11)
Tokyo, Japan
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Executive summary

The Eleventh Session of the East Asia winter Climate Outlook Forum (EASCOF-11) took place in Tokyo, Japan for the period from 6 to 8 November 2023. It was held face-to-face for the first time in six years since the lifting of the restrictions to the COVID-19. Experts from China, Japan, Mongolia and Republic of Korea participating in the Forum discussed outlook for winter 2023/2024 and summarized that the coming East Asian winter monsoon (EAWM) is likely to be weaker than normal. In response to the World Meteorological Organization (WMO) policy, they discussed the introduction of the Objective Seasonal Forecast and agreed to its experimental introduction into the EASCOF. Through the whole discussions it was reconfirmed that EASCOF was a valuable opportunity for NMHSs in East Asia to exchange knowledge and experiences about understanding of climate system such as the East Asian monsoon.

1. Introduction

The EASCOF-11 was held at the headquarters of the Japan Meteorological Agency (JMA) in Tokyo, Japan for the period from 6 to 8 November 2023. More than 30 experts from China Meteorological Administration (CMA), Japan, Mongolia National Agency for Meteorology and the Environmental Monitoring (NEMAM), Korea Meteorological Administration (KMA) and Dr.Moufoum Okia from WMO attended EASCOF-11, sharing recent understanding of phenomena related to seasonal prediction on the EAWM. The meeting

started with a welcome address from Mr. NOMURA Ryoichi, Director-General of the Atmosphere and Ocean department, JMA and a video message from Mr. Ben Churchill, Head of the Regional office for Asia and the South-West Pacific of WMO. In session 1, the current status of RCOF and development of forecast system in China and the latest research results are presented. In sessions 2, the reviews of recent climatic features in East Asia including those for summer 2023, and in section 4, development and verification of seasonal prediction system used in NMHSs in East Asia and in section 6, seasonal outlooks for winter 2023/2024 were discussed and summarized in summary session. In session 3, to enhance use of climate information in user sectors, good practices of utilization of climate information were presented with invited speakers from research institutes. Finally, the place of the next EASCOF-12 was agreed among participating countries.

2. Research and Development of climate variations associated with the East Asian monsoon (session 1)

This session began with a comprehensive presentation about RCOFs by Dr. Wilfran MouFoum Okia (WMO). He reported on the status of RCOF activities in the world introducing successful examples of RCOFs. Dr.TAKAYA Yuhei (Meteorological Research Institute: MRI) presented the relationship between the snow cover area over the Eurasia continent and the surface temperature in East-Asia using causality analysis method, simplified transfer entropy and showed it would be useful for the seasonal prediction based on the S2S model experiments. Dr. WU Jie (CMA) introduced the recent development projects of weather/climate forecast systems in China. He stressed on the introduction of CMMEv2.0 (China Multi-model Ensemble Predicting System v2.0) and also introduced their recent development, Artificial Intelligence or Machine Learning techniques.

3. Review of recent climatic features in East Asia (Session 2)

In summer 2023, a wide area in the world experienced significantly above-normal temperature. Consequently, surface temperature over the world in summer 2023 have reached the highest levels in the recorded history since 1891. There is the long-term rising temperature trend in this time series, likely to act as a background of the significantly high temperature.

East Asia also has experienced significantly above-normal summer temperatures. Overviews of these climate conditions including characteristic climate events in 2023, reported by participants from each country in East Asia, are briefly summarized as follows.

CMA:

Mean temperature anomalies averaged from January to October 2023 was +0.9℃, the highest value compared with annual mean temperatures since 1961. Significantly above-normal temperatures were observed over northern to eastern China. Monthly mean temperatures in 2023 were above-normal except in April and May, and that in September is the highest (+1.3℃) since 1961. Total precipitation

amount in China from January to October 2023 was smaller than normal. The precipitation was more in northeastern to eastern China and less in northwestern China, compared to the normal. Start dates of the main rainy season were generally later than normal.

In winter to spring 2023, southwestern China experienced a persistent drought. From late July to early August, heavy rainfall caused floods over northern and northeastern China and brought serious impacts. From July to September, southeastern China experienced heavy losses due to the landing typhoons.

In summer, the mean high temperature days over China was 11.9 days, 3.9 days more than the normal, resulting in the second hottest summer mean temperature (+0.8℃) on record. China experienced 14 events of high temperatures during this summer. Daily maximum temperatures at 201 observation stations exceeded 40℃, and 26 stations broke their historical records of temperatures.

JMA:

Surface temperature in Japan also have reached the highest levels in the recorded history since 1898. Especially northern and eastern Japan experienced an intense heat from late July to August, accompanied by increased number of significantly hot days and many fatalities due to heat stroke.

In July, SST anomalies were higher than normal in the western equatorial Pacific despite the developing El Niño, possibly in associated with a remnant impact of long-lasted La Niña ended in preceding winter. SSTs around Japan was significantly above-normal, possibly affecting above-normal surface temperatures in Japan. Enhanced convection including a series of typhoon formation was seen over the western equatorial Pacific associated with positive SST anomalies, and significantly migrated northwestward toward the Philippines with a typical period of bi-week. In late July, the Pacific–Japan pattern was significantly intensified in the end of July, contributing to an extension of the North Pacific subtropical high (NPSH) toward Japan.

Intensified warm air advection toward northern Japan with the periphery of NPSH, adiabatic heating due to anomalous descent and the downward short wave radiation anomalies near the NPSH contributed to significantly above-normal surface temperatures in Japan.

KMA:

In summer 2023, mean temperature anomalies in summer 2023 in South Korea was +1.0oC, which was 4th highest on record. Precipitation amount was more than normal.

Geopotential height at 500-hPa averaged in summer 2023 was positive anomalies to the east of Korea, indicating slightly expanded subtropical high than normal. In late June to early July, inflow of warm and moisture with the periphery of the North Pacific subtropical high (NPSH) was dominant, causing high temperatures and heavy rainfall in Korea. In early August after Jangma season, high temperatures were observed in association with expansions of the Tibetan high and the NPSH, indirect effects of typhoon and intensified descent. In late July to middle September, the positive Pacific-Japan pattern was seen, contributing persistent inflow of warm and wet air inflow over South Korea.

During Jangma season, several cases of heavy rainfall were observed in association with the significantly intensified stationary fronts due to southwesterly warm and moist air inflow with the periphery of NPSH and cold air inflow from the upper-level trough. In 9–10 August, typhoon “Khanun” passed through the Korean peninsula, bringing heavy rainfall and strong winds. The typhoon exhibited an unusual path and moved northwestward in association with the developed NPSH east of Korea.

NAMEM:

On the basis of the in-situ observation data, summer temperature in Mongolia has increased by +0.12℃ during the last three decades. An increasing frequency of heavy rain has been significant during the last decade. Furthermore, nearly 60% of Mongolia observes increasing number of days with snow cover.

Summer temperature anomalies in 2023 has reached the 5th highest (+1.01℃) since 1991. During this summer, warm and dry conditions were observed, particularly in June and August over western and southern Mongolia, accompanied by the record-high daily maximum temperatures. Summer precipitation was above normal in central Mongolia and below normal from western to southern Mongolia. Particularly in July, significantly wet conditions were observed in central Mongolia, and daily precipitation records were broken several times at most of the region.

4. Good practices for the engagement between producers and users of climate services (session 3)

To enhance utilization of climate information and services in East Asian countries, engagement between producers and users of climate services is one of crucial issues to be accelerated, in order to understand and meet user needs and requirements, which is in line with the User Interface Platform under the Global Framework for Climate Services (GFCS). In this regard, a session entitled “Good practices for the engagement between producers and users of climate services” was organized at the Forum, including two invited speakers from agrometeorological community who provided talks about their efforts how to utilize climate information and services in their professional fields. It is noted that the session was chaired by Dr. Nobuyuki Kayaba (TCC).

Firstly, Ms. Nariko Kato (TCC) talked about our efforts based on the GFCS to promote the use of climate predictions in JMA. Ms. Nariko Kato introduced climate risk management (CRM) in Japan using the climate predictions such as 2-week temperature forecast, one-month forecast and data download tools. In particular, CRM for peach blooming date in Yamanashi is introduced as the best practice.

Dr. Yuji Masutomi (Center for Climate Change Adaptation, National Institute for Environmental Studies (NIES), Japan) described a comparison of forecast performance between dynamical and statistical seasonal climate forecasting system. Dr. Masutomi stressed that each system has its own advantages and disadvantages and it is advisable to use them appropriately depending on the application by the user. And Dr. Masutomi also introduced the recent research on the development of

CMIP6 data viewer and download portal, ClimoCast, and Global Crop Growth Monitoring and Yield Forecasting System, Crop-MoniCast.

Dr. Atsushi Maruyama (Institute for Agro-Environmental Sciences, National Agriculture and Food Research Organization (NARO), Japan) provided a talk the recent advances in agro-meteorological services for climate change adaptation in Japan. One of the services is an agro-meteorological grid square data (AMGSD) that is 1km-resolution grid meteorological data, which was developed by NARO in collaboration with JMA, to reduce the agricultural damage by cool and hot weather all over Japan. Dr. Maruyama also mentioned that AMGSD is used as the prediction of best harvesting time, prediction of crop yield, crop disease forecast. Dr. Maruyama also introduced a new thermometer, and it is 3-globe thermometer developed by NARO recently and mentioned the expectation of using the data to manage farming operations.

At the end of the session, Dr. Kayaba, chair of the session, summarized that presentations and discussions at the session were very meaningful to be able to introduce examples of the use of climate prediction in Japan. And he asked questions for participants about the use of climate prediction in their countries, finally. Some participants commented that they were providing commentary to those involved in agriculture, energy, and water sector.

5. Current Status and Future Plan of Seasonal Forecasting Service (Session4)

For the past four years, EASCOF has been held in an online format due to the Covid-19, so there was no opportunity to exchange information about each other's forecasting systems. In the sense this session was very informative for all participants.

Mr. HIRAHARA Shoji (MRI) presented the overview of the current version of the JMA Coupled General Circulation Model, which has been starting its operation since 2022 February, for operational seasonal forecasts/ENSO forecast and the future development plan. Dr. JIA Xiaolong (CMA) presented the overview of the current system for Chinese seasonal forecast system such as the CMMEv2.0 including the use in the Risk Managements.

Mr. WONSIL HA (KMA) presented the status of WMO Lead Center for Long-Range Forecast Multi-Model Ensemble operated by the KMA including its history and functions. He also introduced the recent improvements on the Web site useful functions.

6. Discussion about objective seasonal forecasts and future perspectives on EASCOF (Session 6)

At this session, EASCOF had a first opportunity of discussing objective seasonal forecast. As key objectives of this session were:

- To kick-off a discussion about seeking a possibility of implementing objective seasonal forecast (OSF) into EASCOF processes.

- To provide an opportunity for getting a better understanding of OSF (background, benefit, good practices, etc.).
- To seek the optimal style of OSF for EASCOF, taking into account the circumstances specific to EASCOF, like the inherent nature of the climate in East Asia and existing climate services operations by participating members in EASCOF, as well as the benefit of OSF.

Mr. SATO Hirotaka (TCC) explained the background of OSF, including a brief introduction, relevant situations in WMO RA (Regional Association) II and circumstances specific to EASCOF. Dr. Wilfran MOUFOUMA OKIA (WMO) delivered a comprehensive and distinguished keynote speech on the implementation of objective seasonal forecasts with country level delivery, including global and future perspectives and several good practices from the Greater Horn of Africa, the Caribbean and the Mediterranean regions. Mr. TAKAHASHI Kiyotoshi (TCC) talked about the prediction skills of seasonal forecast in East Asia by multi-model ensemble. After these presentations experts exchanged views on OSF. The Forum agreed:

- To continue discussions for seeking the optimal style of objective seasonal forecast for EASCOF, such as
  - Adding careful explanation about forecast (differences between issued forecasts and numerical predictions, why? How forecasters modified?)
  - Including MME results into our final report as reference materials
- TCC and the next hosting organization, namely KMA, discuss details towards the next EASCOF meeting

7. Seasonal outlook for winter 2023/2024 (Session 5 and 7)

7.1 Outlook for Winter 2023/2024

- Most parts of East Asia are likely to be warmer than normal except for northern part of Northeast China, northeastern part of Mongolia and the southern part of Tibet Plateau, which is consistent to situations of past El Niño events.
- The EAWM is likely to be weaker than normal.
- Cold spells are likely to have more chance to affect some parts of East Asia than normal.
- Prediction of Arctic Ocean sea ice concentration impacts on the EAWM was focused. In the current state, it is one of the important sources of uncertainty for prediction on EAWM.

CMA:

The Artic Oscillation (AO) would be in is positive phase and the Siberian high would be weaker than normal, especially in early winter.

Under the background of El Niño condition, western North Pacific anticyclone (WNPAC) would develop in the lower troposphere. Meanwhile, the western North Pacific subtropical high (WNPSH) is likely to be stronger than normal and extends westward. The position of WNPSH ridgeline

would displace northward in early winter and southward in late winter. The East Asian trough will be shallower, and the intensity of the EAWM will be weaker than normal in 2023/2024 winter.

Under such atmospheric circulation background, above normal temperatures are likely for most parts of China excludes parts of Northeast China, southern Tibet and Southwest China. The chances of above normal temperature for most parts of China are greater in early winter.

The greatest chances of above normal precipitation are indicated for most parts of southern China, northern part of North China and central Tibetan Plateau. The precipitation of northern part of Northeast China and Southwest China are expected to be below normal.

JMA:

The current El Niño conditions are likely to continue through the coming winter. SST is expected to be continuously above-normal over the central and eastern equatorial Pacific. A positive Indian Ocean Dipole (IOD) event appears to be currently occurring, and a positive IOD-like SST pattern (remnants of IOD) is expected to continue until at least early winter.

The convective activities would be enhanced over the western Indian Ocean and the central equatorial Pacific, while suppressed over the eastern Indian Ocean and the Maritime Continent. As a forced response to these anomalous convective activities over the tropical Indian Ocean and the Maritime Continent, stationary Rossby waves propagating along the subtropical jet stream (STJ) would be excited. The propagation of Rossby waves would cause the northward shift of the STJ around Japan. The weaker-than-normal winter monsoon is expected around Japan. Weaker-than-normal EAWM would result in wetter than normal situations on the Pacific side of Japan. The seasonal mean temperatures are expected to be above-normal (60% chance) nationwide except for northern Japan. In northern Japan, seasonal mean temperatures are equally expected to be above-normal or near-normal (40% chance). Seasonal snowfall amounts are expected to be below-normal (50% chance) on the Sea of Japan side of eastern and western Japan. These JMA's outlooks for winter over Japan is based on JMA's seasonal ensemble prediction system outputs.

KMA:

Most dynamical model results show above normal temperatures over Korea. Statistically, temperatures will be above normal in December and February, and no signal for January over Korea. KMA forecast temperature will be near or above normal this winter.

The model results also show precipitation will be near normal or above normal over Korea. KMA forecast precipitation will be near or above normal.

El Niño events are highly likely to continue during the coming winter. A positive IOD in the fall and an El Niño event in the winter are expected to suppress convective activity in the eastern Indian Ocean and the tropical western Pacific. This is expected to strengthen the anti-cyclonic circulation over eastern Japan, affecting the Korean Peninsula.

However, if the Barents–Kara Sea ice remains below normal, as expected to persist through

the winter, it could lead to Ural blocking and the development of a continental high. Consequently, a cold and dry air flow may enter the Korean Peninsula, potentially causing a decrease in temperatures and precipitation.

But there may be variations in weather patterns throughout the season.

NAMEM:

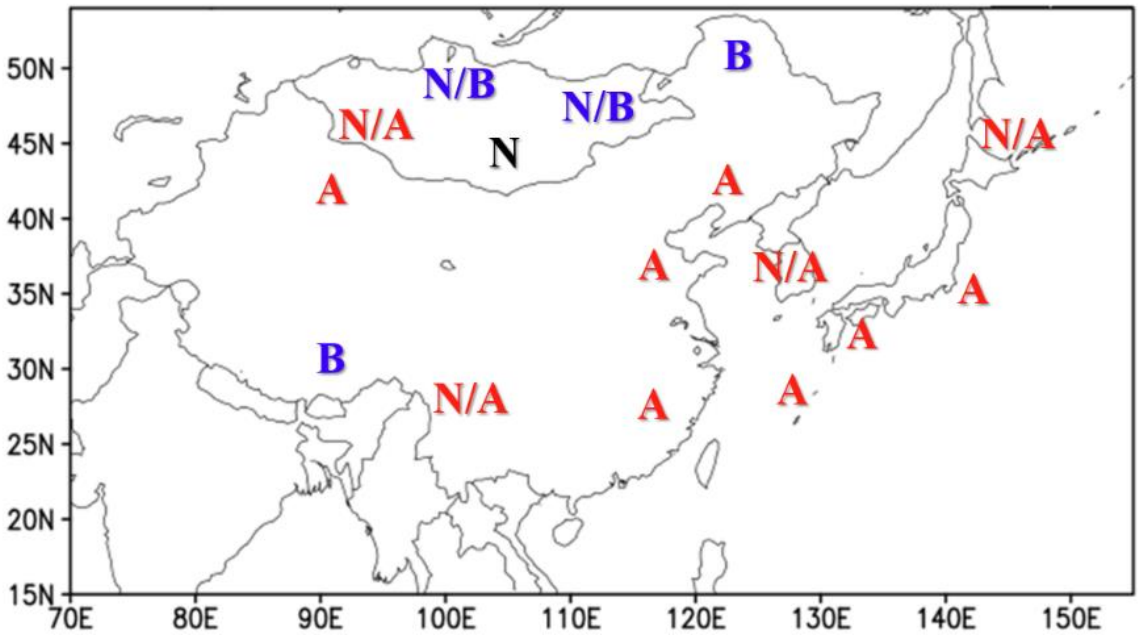
The Artic Oscillation (AO) would be in is positive phase during entire winter and the Siberian high would be weaker than normal, especially in early winter. But it will become a little bit stronger in mid-winter. Moreover, in Mongolia, snow depth is characterized by a maximum value of lag (1.5 month) correlation of -0.48 with air temperature.

Taking into such statistical considerations and dynamical model results, the air temperature in the western part of Mongolia is expected to be warmer than normal, and in central and eastern parts of Mongolia, it is expected to be near or below normal.

In terms of precipitation for the coming winter, it was expected to be above normal in Gobi region and near or above normal in eastern parts of Mongolia.

Summarized outlooks are shown in Figure 7.1.

a) Temperature



b) Precipitation

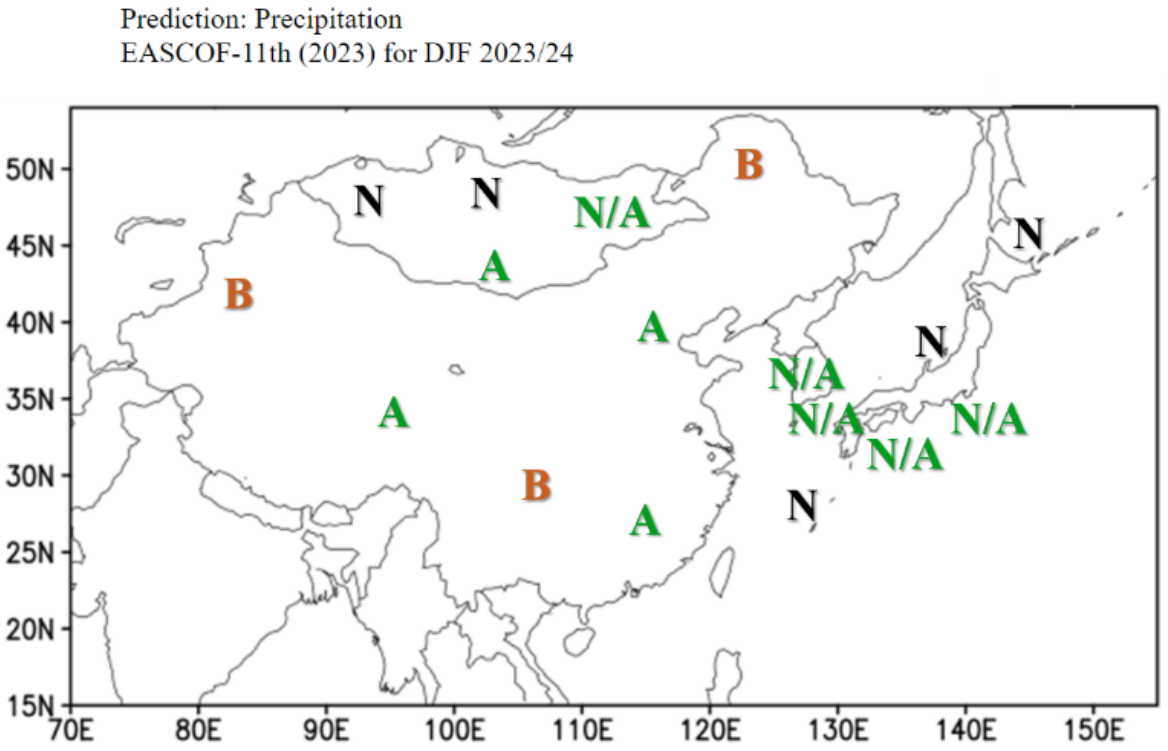


Figure 7.1 Outlooks of (a) temperature and (b) precipitation for winter 2023/2024 (December 2023 – February 2024)

A: probability of above-normal category is 50% or more (e.g., above-normal: 50%; normal: 30%; below-normal: 20%), or most likely category is above normal (deterministic forecast)

N/A: probabilities of above-normal and normal categories are both 40% (i.e., above-normal: 40%; normal: 40%; below-normal: 20%), or most likely category is above-normal or normal (deterministic forecast)

N: probability of normal category is 40% or more and above those of the other categories (e.g., above-normal: 30%; normal: 40%; below-normal: 30%), or most likely category is normal (deterministic forecast)

N/B: probabilities of below-normal and normal categories are both 40% (i.e., above-normal: 20%; normal: 40%; below-normal: 40%), or most likely category is below-normal or normal (deterministic forecast).

B: probability of below-normal category is 50% or less (e.g., above-normal: 20%; normal: 30%; below-normal: 50%), or most likely category is below normal (deterministic forecast)

8. Other issues

- It was agreed that the next session of EASCOF would be hosted by KMA.
- Providing opportunities for online participation was effective for sharing the discussions in the meeting among the member countries.