26 May 2025 - Agreed by All EASCOF Members

Recommendations on Objective Seasonal Forecasts for EASCOF

Summary

In accordance with the agreement on objective seasonal forecasts (OSF) at the 11th Session of the East Asia winter Climate Outlook Forum (EASCOF-11) in November 2023, the Tokyo Climate Center (TCC) considered an optimal style of OSF for EASCOF as follows.

It is recommended to:

1. Enhance the explanation of seasonal outlook in summary reports of EASCOF meetings to include a clear indication about what climate drivers are reliable or not in numerical models' predictions, which can ensure a certain level of traceability and reproducibility necessary for OSF;
2. Include forecast maps based on numerical models into summary reports of EASCOF meetings as reference materials
3. Review the outlook for the previous winter with a comparison of the outlook with observations to ensure a certain level of quality evaluation of the outlook necessary for OSF, where each Member should be allowed to decide on the most appropriate evaluation method for their own circumstances. It is also recommended to assess the predictions of climate drivers and alternations of models' output by forecasters, if possible;
4. Enhance the explanation of the verification of numerical model's predictions, including important sources of predictability for East Asia winter monsoon;
5. Reiterate the importance of enhancing the user engagement into EASCOF.

1. Background

In accordance with Decision 9 at WMO EC-72 (the 72nd session of WMO Executive Council) and Decision 5 at RA II-17 (the 17th session of WMO Regional Association II), the implementation of Objective Seasonal Forecast (OSF) into EASCOF was discussed at the EASCOF-11 in November 2023 for the first time and following actions were 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

After the EASCOF-12 in November 2024, TCC proposed the following recommendations toward the implementation of OSF for EASCOF.

2. Recommendations

2.1. Enhancement of the explanation of the seasonal outlook

To ensure a certain level of traceability and reproducibility of seasonal outlook, it is recommended to clearly show what climate drivers are reliable or not in numerical models' predictions and, if possible, to indicate the details of modifications of numerical predictions by forecasters.

For instance, the following additional explanations would be effective:

- Reliable signals of the tropical oceanic variations and the associated modulation of large-scale atmospheric circulation which exerts remote influences on winter's climate in East Asia
- Large uncertainties in the extratropical seasonal variability

Appendix 1 shows an example of how the EASCOF-11 summary report could be revised in line with this recommendation.

2.2. Including forecast maps based on numerical models

To make forecasts more traceable, it is recommended to include numerical prediction maps that serve as the foundation for the forecasts by each country into the summary report of EASCOF as reference materials. For instance, the following options would be informative; probabilistic forecast maps for surface air temperature and precipitation, and deterministic forecast maps of 500hPa-height, etc.

2.3. Review the outlook for the previous winter season

To ensure a certain level of evaluation of seasonal outlook necessary for OSF, it is recommended that EASCOF Members review the outlook for the previous winter season.

Regarding the evaluation methods, it would be more practical to allow each Member to determine the most appropriate method for their own circumstances, rather than standardizing them. Still, it would be beneficial to compare the characteristics of the previous winter's climate (in terms of surface air temperature and precipitation) with the corresponding outlook and numerical models' prediction. Furthermore, if possible, it would also be recommended to assess the predictions of climate drivers and alternations of numerical models' predictions by forecasters, and to share some case studies of successful or challenging forecast examples. Such a review would also help to enhance seasonal forecasting skills. Appendix 2 provides an example of a brief review of a case for winter 2023/24 in which numerical predictions were altered with a clear reason as well-documented in the summary report.

2.4. Enhancement of the explanation of the verification of numerical models

Towards the implementation of OSF, it is also important to enhance the explanation on the verification of the numerical models' predictions. With regard to the predictability of the East Asian winter monsoon, it would be beneficial to present models' performance in terms of climate drivers that have a significant impact, including El Niño-Southern Oscillation, the Arctic sea ice extent, etc. with basic verification indices such as the anomaly correlation coefficient (ACC), the root mean square error (RMSE), etc.

2.5. Reiterate the importance of enhancing the user engagement into EASCOF

EASCOF has involved users of seasonal outlook to share and discuss their needs. Given that OSF has emerged in response to the needs of users, it should be reiterated that it is of great importance to maintain to enhance the user engagement into EASCOF.

Appendix 1. Example: Enhancement of the explanation of seasonal outlook

The following shows an example of revision of EASCOF-11 in line with the proposed recommendations in terms of enhancement of explanation of seasonal outlook (in red) and some supplementary information (in blue).

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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 East Asian Winter Monsoon (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.

・ Most dynamical models predict that the current El Niño conditions in the Pacific and positive Indian Ocean Dipole (IOD)-like sea surface temperature anomalies in the Indian Ocean are likely to continue through the coming winter, which gives the basis of the seasonal outlook in East Asia. *[Describing reliable climate drivers in the dynamical models' output]*

・ 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. Such uncertainty was considered for the seasonal outlook.

[Describing that the high uncertainty regarding the impact of Arctic sea ice has been taken into account in the outlook]

[…]

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 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.

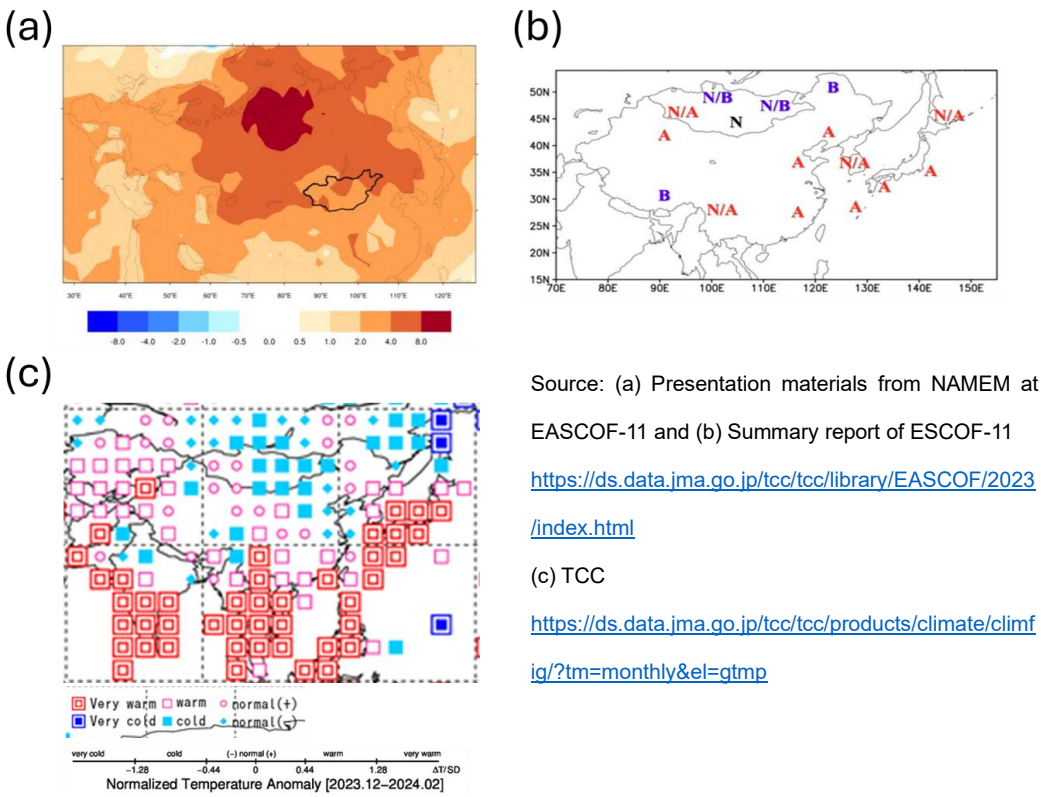
The convective activities would be enhanced over the western Indian Ocean and the central equatorial Pacific, while suppressed over the eastern Indian Ocean and the Maritime Continent. As a forced response to these anomalous convective activities over the tropical Indian Ocean and the Maritime Continent, 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).

These JMA's outlooks for winter over Japan are generally based on JMA's seasonal ensemble prediction system (JMA/MRI-CPS3) outputs, but they are modified as appropriate with consideration of what are reliable or not in the model's outputs. Reliable signals in the model's predictions are tropical oceanic variabilities such as the El Niño and IOD-like conditions and the associated modulation of the subtropical jet stream over Eurasia. It has been confirmed through hindcasts simulations that JMA/MRI-CPS3 has high enough prediction skills about such large-scale atmospheric circulation forced by tropical SSTs. On the other hand, there is still room for improvement in predicting large atmospheric internal variability inherent to the extratropics such as the Arctic Oscillation and the remote influences of anomalous Arctic sea ice concentrations on winter's climate in East Asia. *[Describing what are reliable or not in the dynamical models' output]*

Appendix 2. Example: Review of the outlook for winter 2023/24

Figure A1 shows a comparison between predicted and observed temperatures for winter 2023/24. The Mongolia National Agency for Meteorology and the Environmental Monitoring (NAMEM) predicted near or below-normal temperatures in the central and eastern parts of the country (Figure A1a) in contrary to predictions by numerical models (Figure A1b), considering lagged relationships between snow depth and surface air temperatures. In fact, the winter mean temperatures were below normal in these areas (Figure A1c).

NAMMEM/IRIMHE outlooks for winter considered the outputs of long-range forecast multi-models from leading WMO centres. However, we considered the regional climate feature and the statistical model of surface circumstances. The most reliable signal was the early formation of snow cover in Oct-Nov and its linkage with surface cooling for the coming winter outlook.



Source: (a) Presentation materials from NAMEM at EASCOF-11 and (b) Summary report of ESCOF-11 https://ds.data.jma.go.jp/tcc/tcc/library/EASCOF/2023/index.html

(c) TCC https://ds.data.jma.go.jp/tcc/tcc/products/climate/climfig/?tm=monthly&el=gtmp

Figure A1. Comparison of predictions and observation of the surface air temperature anomalies

(a) Prediction by MME (initial condition: October 2023), (b) outlook summarized at EASCOF-11 and (c) actual observation for winter 2023/24.