Recent developments in the JMA Sub-Seasonal and Seasonal Ensemble Prediction System

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Recent extreme seasonal events, such as Japan's record hot summers from 2023 to 2025, show that atmospheric extremes are closely linked to other parts of the Earth system, including the ocean. This has increased the need for seamless forecasts to better capture these interactions.

We first introduce the latest subseasonal-to-seasonal prediction system, JMA/MRI-CPS4 (CPS4), which became operational in January 2026. Compared to the previous system, CPS4 places greater focus on one-month and shorter timescale forecasts and improves the representation of associated physical processes and ensemble prediction methods. Key updates include the introduction of prognostic ozone with linear ozone photochemistry parametrization, improvements to convection, cloud, and land surface processes, as well as the introduction of SV + LETKF initial perturbation methods and the physics perturbation with the Stochastic Humidity Profile for Convective Parameterization (SHPC). In addition, the ocean model component has been upgraded to MRI.COM version 5 to improve computational efficiency and stability.

Reforecast experiments for the period 1991–2020 show that CPS4 generally reduces systematic biases in the lower-tropospheric parameters, including precipitation, 2-m temperature, 850-hPa zonal wind, and sea surface temperature (SST), while also improving the spread–skill relationship.

On the other hand, we also found persistent errors in the mid-latitude sea surface temperatures due to the insufficient representation of oceanic mesoscale eddies. This poster will also cover ongoing efforts to address this issue.