

8. Summary

A new ensemble prediction system, MRI-EPS, has been developed to promote the research activity of the MRI with respect to the predictability of climate and large-scale atmospheric motions. The BGM cycle, which is a key component of the MRI-EPS, can generate initial perturbations for the SH as well as for the NH and the TR. The fundamentals of the BGM method as well as the overview of the MRI-EPS have been described in this report. The BGM cycle system is based on the GSM, and we have confirmed that ensemble prediction experiments can be conducted flawlessly with the MRI-AGCM3.2 and the initial perturbations generated by the BGM cycle.

It is an important advancement for the MRI-EPS to be able to generate perturbations for the SH in addition to the NH and TR, which have already been generated by the operational one-month ensemble forecast system of the JMA. The skill of the Z500 ensemble forecasts for the SH made with ensemble predictions using the new SH initial perturbations has been found to be similar to those of NH predictions in the operational system.

We have also examined the spatio-temporal characteristics of the leading six bred modes during the period from 28 November to 20 December 2001, when a major SSW took place. Furthermore, we have conducted ensemble prediction experiments using two NWP models and two reanalysis datasets to examine the model dependency of the predictability of the SSW. The following results have been obtained with the foregoing examination:

1. The amplitude of geopotential height for the NH bred mode had two peaks at 300 hPa near 40–50°N and 80°N. The zonal wavenumber 6 component dominated the bred mode in the region around 40–50°N at 300 hPa.

2. The rate of amplification of the NH bred mode during the first day in the forecast was almost independent of the mode number. Although there were large day-to-day variations of the amplification rate, the bred mode increased its amplitude by about 40% on average during the first day.

3. The amplification rate of the NH bred mode was almost identical for the MRI-AGCM3.2 and GSM. Hence, bred modes generated by the BGM cycle of the MRI-EPS can also be used for initial perturbations of ensemble forecasts conducted by the MRI-AGCM3.2.

4. The temporal evolution of bred modes during the first day was also almost completely independent of the analysis dataset. Hence, although the bred mode of the MRI-EPS was generated based on the JRA25/JCDAS reanalysis dataset, the ERA interim reanalysis dataset can also be used to provide the unperturbed initial conditions for ensemble forecasts with the MRI-AGCM3.2.

5. With respect to the forecast of the SSW in 2001, ensemble predictions based on the ERA-interim reanalysis dataset outperformed those based on the JRA-25/JCDAS dataset. Hence, it

is useful to use the ERA-interim reanalysis dataset to provide the unperturbed initial conditions for ensemble predictions.