JRA-25 and plans

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1. Introduction

Japanese 25-year reanalysis JRA-25 has been completed in March 2006. It had been conducted as a joint research project of JMA and CRIEPI (Central Research Institute of Electric Power Industry) since 2001. The reanalysis period of JRA-25 is 26 years from 1979 to 2004. The global forecast model used in JRA-25 has a spectral resolution of T106 (equivalent to horizontal grid size around 120km) and 40 vertical layers with the top level at 0.4hPa. Data assimilation is performed with 3D-Var. The global model used in JRA-25 is a low-resolution version of the JMA operational model.

2. Observational data

JRA-25 introduced some new historical observational data which had not been used in other reanalyses. Wind profile retrievals surrounding tropical cyclones (TCR) were supplied by Dr. M. Fiorino. The Meteorological Satellite Center of JMA (MSC/JMA) reprocessed GMS-AMV wind. Chinese daily snow depth data in "Monthly Surface Meteorological Data in China" published by the Chinese Meteorological Academy were digitized. Precipitable water (PW) retrieved from SSM/I brightness temperatures were assimilated from June 1987 onward, which appeared to produce more precise precipitation over the ocean. The distribution of snow coverage was also retrieved from the SSM/I data and used in the snow depth analysis. A new daily SST and sea-ice dataset named COBE (Ishii et. al 2005) produced by JMA were used as a lower boundary condition. Three-dimensional daily ozone concentration produced by JMA for JRA-25 was used in the global forecast model.

3. Performance of JRA-25

Precipitation of JRA-25 performs well. Global mean precipitation is most stable among the reanalyses around 3mm/day without evident increase in the recent years nor suffering by volcanic eruptions, while the amount is larger than 'observational' precipitation data GPCP and CMAP. Precipitation in most of reanalyses is more than GPCP. Correlation with GPCP / CMAP data of JRA-25 is the best of the reanalyses (Figure 1). Analysis of tropical cyclone has advantage owing to use TCR data. JRA-25 provides consistent data particularly for a climate research of tropical cyclones (Figure 2). Forecast scores are good and stable throughout the reanalysis period (Figure 3). However, there is a problem in the land surface procedure. Precipitation in the Amazon basin is less then those of the other reanalysis. In the stratosphere, temperature is sensitive to changes of satellite because the data was assimilated with the biased model background.

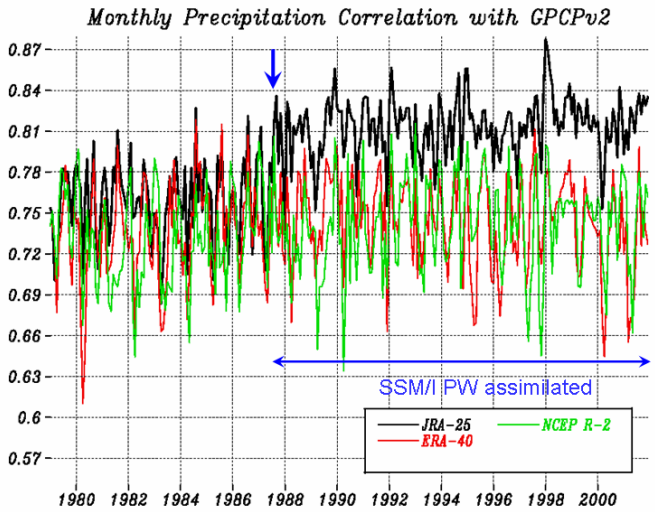
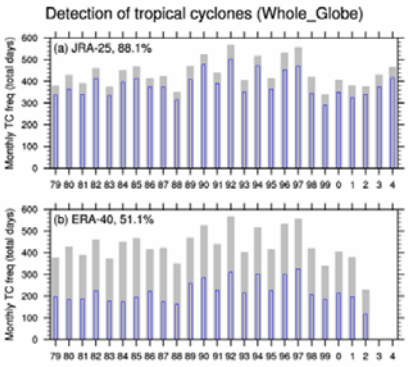


Figure 1 Correction of precipitation with GPCP v2. JRA-25 has the best correlation particularly for the period with the assimilation of SSM/I PW after 1987.

Global Detection rate of Tropical Cyclones



Grey: Observed TC (Best track)
Blue : Detected TC

The detecting method is based on relative vorticity, sea level pressure (SLP) and middle to upper tropospheric thickness.

Figure 2
Top : JRA-25
Bottom : ERA-40

Forecast Score (Z500 FT=24 RMSE)

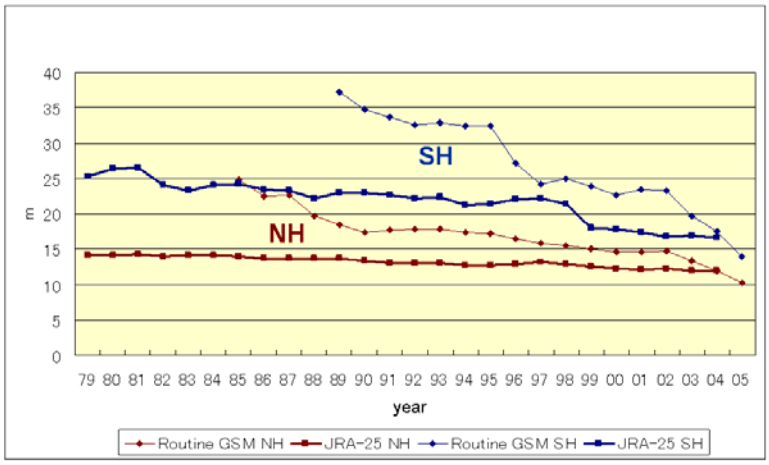


Figure 3 Z500 RMSE of 24 hours forecast of JRA-25 and JMA historical GSM

4. Use of JRA-25 data

The JRA-25 data is expected to be used for various meteorological application, JMA's operational work and research as shown in Figure 4. The data will be used to monitor and analyze an extreme events compared with similar events in the past. Consistent initial field must be taken for hindcast experiments for development of seasonal forecast model, and the results of the experiment should be verified with JRA-25 reanalysis field. For environmental services, JRA-25 data can be reference data for reanalysis of carbon circulation in the past decades or forcing data for a chemical transport model. From JRA-25 data, climate information such as JRA-25 Atlas and time series can be produced. Needless to say, JRA-25 data will be used for various researches of climatology and meteorology and many kind of application. While the resolution of JRA-25 is not sufficient to analyze small scale phenomena such as heavy rain event in a locally limited region directory, synoptically consistent initial field and boundary condition can be supplied to a meso-scale very fine meshed model so as to perform an experiment to revive a severe event accurately.

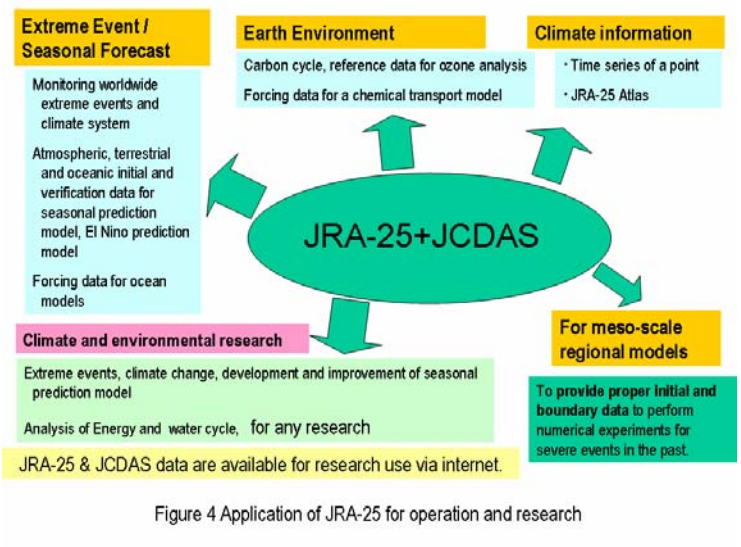


Figure 4 Application of JRA-25 for operation and research

5. JRA-25 streams

JRA-25 was conducted with 2 separate streams because of limitation of time and computer resources. A stream for the first half covered from 1979 to 1990 and the second stream for the latter half from 1991 to 2004. Discontinuities are found in some parameters at the connection of the streams. Furthermore, two re-calculations were required to fix problems caused by data quality and their assimilation. One is due to low quality of GMS-AMV data from January 1994 to December 1999, the other is Y2K problem of TCR data from January 2000 to January 2002. JRA-25 is transitioned to JMA CDAS for after 2005. Streams and re-calculations of JRA-25 are summarized in Figure 5.

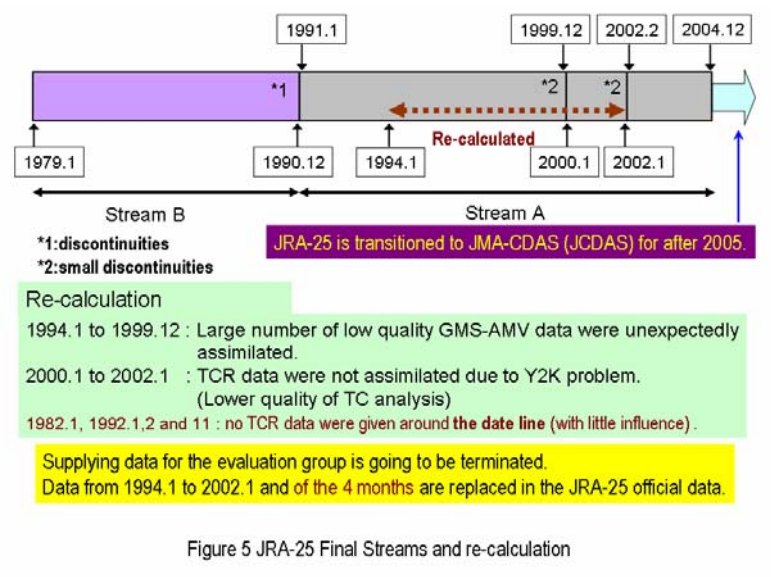


Figure 5 JRA-25 Final Streams and re-calculation

6. JRA-25 official data

JRA-25 data have been supplied to the "JRA-25 evaluation group". However, the data are not an official data of JRA-25, which did not reflect the two re-calculations. The JRA-25 official data is going to be made available for research in July 2006 from a new data server. The data for the re-calculated period are replaced.

The official data is available for research use with no charge via internet. A researcher who want to download the data are required to register the following:

- name
- affiliation
- purpose of use
- agree to conditions of the data provision.

JCDAS data will be released after the release of JRA-25 official data. The condition is as the same as for JRA-25 data. The provision of the former evaluation data is going to be terminated. Recently a comprehensive JRA-25 report titled '**The JRA-25 Reanalysis**' was submitted to **JMSJ, Journal of Meteorological Society of Japan.**

7. Next reanalysis plan

We have a next reanalysis plan, but before progress to the next stage, we have to evaluate JRA-25 carefully. Observation changes will be detected from our observation feedback file CDA and a more detailed blacklist can be made. Since we had no time before JRA-25 production to verify our model well, full investigation of the latest model's performance is required. Verification and development of assimilating past satellite data are essential as well. Probably the next reanalysis is 'JRA-50' from 1958 to 2010 with 4D-var, variational QC and variational bias correction. Change of greenhouse gases should be taken into account to contribute the reanalysis data to estimate global warming of the past decades.

Appendix

'The JRA-25 Reanalysis' authors

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