

The Japanese 55-year Reanalysis (JRA-55): Progress and Status

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The Japan Meteorological Agency (JMA) is conducting the second Japanese global atmospheric reanalysis named the Japanese 55-year Reanalysis (JRA-55). It covers 55 years, extending back to 1958. It aims at providing a comprehensive atmospheric dataset that is suitable for studies of climate change or multi-decadal variability, by producing a more time-consistent dataset for a longer period than JRA-25. Computations for more than 26 years have been completed as of January 2012. The entire JRA-55 production will be completed in early 2013 and thereafter JRA-55 will be continued as a new JCDAS on real time basis.

The table summarizes the major points of data assimilation system and boundary conditions of JRA-55 together with those of JRA-25 for comparison. It is based on the JMA operational NWP system as of December 2009, into which many improvements have been implemented since the time of the JRA-25 production, including higher spatial resolution, introduction of the new radiation scheme, and 4D-Var with VarBC (Variational Bias Correction) for satellite radiances. Long term quality of JRA-55 is expected to be improved by introduction of green house gases with time varying concentrations. In addition to the data assimilated into JRA-25, newly obtained observational data are assimilated. Atmospheric Motion Vector (AMV) data from GMS, MTSAT and METEOSAT are newly reprocessed after JRA-25. Clear Sky Radiance (CSR) data from GMS and MTSAT reprocessed at MSC/JMA will be used for the first time in reanalyses.

Early results of quality assessment have suggested that many of deficiencies in JRA-25 have been diminished or reduced in JRA-55. Specifically a large temperature bias in the lower stratosphere was significantly reduced by introduction of the new radiation scheme to the forecast model. The VarBC contributes to the diminution of unrealistic temperature variations found in the lower-stratospheric time series based on JRA-25. The dry land surface problem in the Amazon basin in JRA-25 was mitigated. Overall quality of JRA-55 is much improved compared with those of JRA-25 for the completed years, owing to continuous development of the JMA operational NWP system as evident from the improvement in the operational scores in recent years. Global precipitation in JRA-55 is, however, still overestimated compared to GPCP as well as in JRA-25, which requires further improvement. The entire JRA-55 production is expected to be completed in early 2013. Thereafter, JRA-55 will be continued as a new JCDAS on real time basis and replace the current JRA-25-based JCDAS. Details can be referred from an interim report (Ebita et al. 2011; http://www.jstage.jst.go.jp/article/sola/7/0/7_149/_article).

While JRA-55 will use as many types and numbers of observational data as possible to give the best instantaneous field estimate, we produce JRA-55 subset products without assimilating any satellite data (JRA-55C). It aims at retaining consistency for long years, even if its analysis quality may be inferior to JRA-55. This set of reanalyses is expected to contribute to addressing some of the issues of the current reanalyses such as impact of changing observing systems on representation of long-term climate trends and variability.

Table: Comparison of JRA-25 and JRA-55

	JRA-25	JRA-55
Years	26 years (1979-2004)	55 years (1958-2012)
Model version	as of Mar. 2004 operational	as of Dec. 2009 operational
Resolution	T106L40 (top at 0.4 hPa)	TL319L60 (top at 0.1 hPa)
Assimilation	3D-Var	4D-Var
Bias correction	(radiosonde) Andrae et al. (2004) (sat. rad.) Sakamoto and Christy (2009)	(radiosonde) RAOBCORE v1.4 (sat. rad.) VarBC
Green house gases	CO ₂ (constant at 375 ppmv)	CO ₂ , CH ₄ , N ₂ O, CFC-11, CFC-12, HCFC-22 (daily interpolation of annual values)

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