Japanese 55-year Reanalysis (JRA-55): status and plans

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JMA has been conducting the second Japanese global reanalysis named JRA-55 (JRA go go) to provide a comprehensive atmospheric dataset that is suitable for studies of climate change and multi-decadal variability. It covers 55 years, extending back to 1958, when the regular radiosonde observations became operational on the global basis. The data assimilation system for JRA-55 is based on the JMA operational numerical weather prediction system as of December 2009, into which many improvements have been implemented since the time of the JRA-25 production. JRA-55 is the first global atmospheric reanalysis that applies four-dimensional variational assimilation (4D-Var) to the past half century including the pre-satellite era [1].

Improvement of long-term climate datasets is essential for the advancement of climate researches and services such as investigations of mechanisms of the climate system, studies of predictability and climate monitoring. Reanalysis of the past observations with a consistent, state-of-the-art data assimilation system has been used broadly for these purposes. It is due to the advantage that it can produce many kinds of meteorological variables, including those for which observations are rarely available, in a spatiotemporally regular manner. Reanalysis has especially been making great contributions to studies of synoptic and planetary scale phenomena such as storm tracks, blocking, MJO, ENSO and QBO.

However, there remain several issues that need to be resolved in order to make a broader use of reanalysis in the climate discipline. The top issue is varying quality that originates in changes of observing systems. Many of the existing reanalyses exhibit changes, which appear to be non-climatic, around the year 1979 when the full-blown satellite observing system became operational, and the year 1998 when the ATOVS observing system was introduced. It has been pointed out that care is needed in using the reanalyses to study climatic trends and low-frequency decadal variations. In addition to addressing this issue, we also aim at overcoming deficiencies identified in JRA-25 such as a cold bias in the stratospheric temperature during the TOVS period (from the 1980s to 1990s) and the dry land surface problem in the Amazon basin.

Early results of quality assessment have suggested that many of deficiencies in JRA-25 have been diminished or reduced in JRA-55. Specifically the cold bias in the lower stratospheric temperature was significantly reduced and the dry land surface problem in the Amazon basin was mitigated. Temporal consistency of the temperature analysis has also improved considerably from that of the existing reanalyses, though impact of changing observing systems is still detectable. The factors related to these quality changes will be discussed from the viewpoint of data assimilation.

The production of JRA-55 completed in March 2013, and the preparation for the data release in autumn 2013 and the start of the near real-time production in early 2014 is in progress. Alongside of JRA-55, MRI is currently conducting a conventional observation only reanalysis (JRA-55C) and an AMIP type run (JRA-55AMIP) with the same data assimilation system and forecast model as used in JRA-55. We hope that inter-comparison among the "JRA-55 family" will provide an opportunity for quantitative assessment regarding impact of changing observing systems and model biases on representation of climatic trends and low-frequency variations.

Reference

[1] A. Ebita et al. "The Japanese 55-year Reanalysis (JRA-55): an interim report," *SOLA*, vol. 7, pp. 149-152, 2011.