1. background

- Meteorological Research Institute (MRI) of JMA started a global atmospheric reanalysis, called JRA-55C.
- This subproject assimilates only the conventional surface and upper air observations, without satellite observations, using the same assimilation system as JRA-55 (Ebita et al., 2011).
- The JRA-55C aims to produce a more homogeneous dataset for a longer period. To avoid the inhomogeneities caused by the changes in satellite observation systems, the JRA-55C does not assimilate satellite observations. This makes the product a suitable dataset for studies of climate change or multi-decadal variability.
- The JRA-55C will provide reanalysis data from 1958 to 2012, which consists of using the pre-satellite data of JRA-55 (1958-1972) and the reanalysis of JRA-55C from 1973-2012.
- We are also providing an AGCM simulation, called JRA-55AMIP, to examine the effect of surface and upper air observations. The JRA-55AMIP uses the same boundary condition of JRA-55 and JRA-55C without data assimilation.
- Comparing three datasets, JRA-55, JRA-55C and JRA-55AMIP, it is expected to clarify how and why the meteorological variables change for the last 55 years.

2. Assimilation system and boundary forcing

- Assimilation system and boundary forcings are same as JRA-55 (Onogi, Oral presentation 7 May) except for only using SYNOP, SHIP, BUOY, TEMP, PILOT and TCR.
- The scaling factor for background error covariance matrix is 1.8 times that of JRA-55 satellite era (same value used in pre-satellite era of JRA-55).
- The JRA-55 series and ERA-40 indicate negative trends over upper stratosphere (10-3hPa) in the pre-satellite era. All the JRA-55 series are using monthly mean climatology of ozone concentrations as boundary forcing in the pre-satellite era. The negative trend may be caused by CO2 changes. (Additional model simulation will help clarify this.)

3 Difference between JRA-55C and JRA-55

- 5-yr mean (1980-1984) seasonal mean field (JRA-55C systematic error from JRA-55)
- Small differences in NH.
- Differences between JRA-55 and JRA-55C are small in the troposphere and lower stratosphere except for the southern extra-tropics.
- JRA-55C indicates negative anomalies in the troposphere and positive anomalies in the stratosphere during the pre-satellite era.
- JRA-55C represents lower stratospheric volcanic eruptions. They last about 2 yr.
- JRA-55C series and ERA-40 indicate negative trends over upper stratosphere (10-3hPa) in the pre-satellite era. All the JRA-55 series are using monthly mean climatology of ozone concentrations as boundary forcing in the pre-satellite era. The negative trend may be caused by CO2 changes. (Additional model simulation will help clarify this.)
- Better agreement with GPCP in JRA-55C.
- Both JRA-55 and JRA-55C overestimate in Tropics.

4. Performance of JRA-55C

4.1 Year-to-year variation of global mean temperature anomalies

- JRA-5 clear discontinuous change in 1998 caused by TOVS-ATOVES transition.
- JRA-55 is more homogeneous than JRA-25.
- Previous reanalysis using all available observations have inhomogeneities caused by the time-changing observations mainly caused by satellite.

4.2 QBO

- QBO is properly represented in JRA-55C, which is not appeared in JRA55AMIP.
- JRA-55 assimilation system using only conventional observation data can produce QBO.

4.3 Large scale equatorial velocity potential at upper troposphere

- Large scale divergence area shifted eastward during ENSO warm phase from 1982-1983. The shift is properly represented in JRA-55C.
- Although JRA-55AMIP has a potential to represent MJO, the timings are different.

5. Summary

- We started JRA-55C to produce a more homogeneous dataset for climate research, which assimilates only conventional observations, without satellite observations.
- The early results indicate good performance in the troposphere and the lower stratosphere except for the southern extra-tropics.
- We expect the entire JRA-55C will contribute to the understanding of the impact of observation changes on the representation of climate trends and variability in JRA-55.

Reference

2.1 JRA-55 Reanalysis system

- **JRA-25**
  - Reanalysis years: 1979-2004 (26 years)
  - Equivalent operational NWP system: As of Mar. 2004
  - Time integration: Eularian
  - Assimilation scheme: 3D-Var

- **JRA-55**
  - Reanalysis years: 1958-2012 (55 years)
  - Equivalent operational NWP system: As of Dec. 2009
  - Time integration: Semi-Lagrangian
  - Assimilation scheme: 4D-Var
  - Bias correction: Correct temperature bias

**Radiatively active gases**

- H2O, CO2, O3, CH4, N2O, CFC-11, CFC-12, HCFC-22
- Annual mean data are interpolated to daily data (CO2, CH4, N2O)

**Daily 3-D ozone**

- (-1978)

**Monthly climatology**

- (produced by AED/JMA)

**New daily 3-D ozone**

- (produced using a revised CTM)

**Aerosols**

- Annual climatology for continental and maritime aerosols
- Monthly climatology for continental and maritime aerosols

**SST**

- COBE SST

**Sea ice**

- Ishii et al., 2005, I.J.Clim. (ver. 1.5)

**Ozone**

- Radiatively active gases
- GHG concentrations
  - Constant at 375 ppmv (CO2)

**2.2 Boundary and forcing fields**

- **JRA-25**
  - Radiatively active gases
  - GHG concentrations
  - Ozone
  - Aerosols
  - SST

- **JRA-55**
  - Radiatively active gases
  - GHG concentrations
  - Ozone
  - Aerosols
  - SST

**2.3 Observational data used in JRA-55**

**Supplement**

- The quality of JRA-55C is approximately that of half-day forecasts.