# Evaluation of the latest Japanese Reanalysis for three quarters of a century (JRA-3Q) during a pre-satellite era

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This study evaluates the Japanese Reanalysis for Three Quarters of a Century (JRA-3Q), focusing on a period of pre-satellite era in 1960s to 1970s. The JRA-3Q is the latest third generation of global atmospheric reanalysis spanning late 1940s onwards, and it is based on the Japan Meteorological Agency (JMA)’s operational system using an atmospheric model with a reduced horizontal resolution of TL479 and 100 vertical layers up to 0.01 hPa with 6-hourly 4D-Var data assimilation as of December 2018. The global-mean precipitations of JRA-series (JRA-55, -55C, and -3Q) are on average biased high by about 0.4-0.6 mm/d, compared with that of Global Precipitation Climatology Project (GPCP). Although the global-mean precipitation shows small differences between JRA-55 and JRA-3Q before early 1990s, JRA-3Q precipitation is fairly consistent in time and much improved especially after the late 1990s with a reduced mean bias of up to 0.1 mm/d from the JRA-55 precipitation. The global-mean outgoing longwave radiation (OLR) of JRA-3Q is improved by 2-3 W/m2 in comparison with that of JRA-55, although the JRA-series global-mean OLRs are in general much higher at 250-253 W/m2 than that of the Clouds and the Earth’s Radiant Energy System (CERES) at 240 W/m2 and that of ERA5 reanalysis at 242 W/m2. The representation of surface circulation over the tropical Africa is improved by reducing spurious anticyclonic circulation in JRA-55. Stratospheric ozone is also improved by a using state-of-the-art ozone chemistry model as well as incorporating adequate ozone depletion substances and sea-surface temperature. The quasi-biennial oscillation of the JRA-3Q is not as good as that in JRA-55 with a shorter period of around one year in the middle stratosphere and diminished amplitude in the lower stratosphere before the late 1960s. It is noted that the JRA-3Q model has an ability to produce self-generated-QBO while the JRA-55 atmospheric model do not produce QBO-like oscillation. However, because the JRA-3Q model’s QBO is due to a lack of consistency to observational QBO, representation of the assimilated QBOs with much less sonde observations for the JRA-3Q is not good as that for the JRA-55.

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