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Evaluation of a new Japanese reanalysis (JRA-3Q) in a pre-satellite era

Hiroaki Naoe¹, Shinya Kobayashi², Yuki Kosaka², Jotaro Chiba², Takayuki Tokuhiko², and Yayoi Harada¹

¹Meteorological Research Institute / Japan Meteorological Agency, Tsukuba, Japan (hnaoe@mri-jma.go.jp)

²Office of Earth System Modeling / Numerical Prediction Division / Japan Meteorological Agency, Tsukuba, Japan

This study evaluates the latest Japanese Reanalysis for Three Quarters of a Century (JRA-3Q) conducted by the Japan Meteorological Agency (JMA), focusing on a semi-period of pre-satellite era (1960s and 1970s). The reanalysis is the third Japanese global atmospheric reanalysis covering the period from late 1940s onward, which is produced with the JMA's operational system as of December 2018. The atmospheric model has a TL479 horizontal resolution and 100 vertical layers up to 0.01 hPa, and the core component of the JRA-3Q data assimilation system is the 6-hourly 4D-Var of the atmospheric state with a T319-resolution inner model. Because there are only few global-covered observational datasets during the pre-satellite era, evaluation of the JRA-3Q is mainly to conduct an intercomparison of other reanalysis datasets such as representation Japanese 55-year Reanalysis (JRA-55), a JRA-55's subset of atmospheric reanalysis assimilating conventional observations only (JRA-55C), and version 3 of the Twentieth Century Reanalysis (20CRv3), and also an intercomparison of JRA-3Q between the pre-satellite and satellite eras. Emphasis of this evaluation during the non-satellite era is placed on the representation of tropical circulation, the consistency in time of the reanalysed fields, detection of tropical cyclones, and the quality of the stratospheric water vapor and ozone. For example, the surface circulation over the tropical Africa is improved by means of reducing spurious anticyclonic circulation anomalies that were found in JRA-55. Although the atmospheric model can produce self-generated quasi-biennial oscillation (QBO) by introducing non-orographic gravity wave drag, the evaluation reveals that JRA-3Q has a shorter period of around one year in the middle stratosphere and diminished QBO amplitude in the lower stratosphere, indicating that representation of the QBO in JRA-3Q is not as good as that in JRA-55.