JMA/MRI Aerosol Reanalysis Product

*弓本 桂也[1,2]、田中 泰宙[2]、眞木 貴史[2]

*Keiya Yumimoto[1,2], Taichu Y Tanaka[2], Takashi Maki[2]

1. 九州大学、2. 気象研究所
1. Kyushu University, 2. Meteorological Research Institute

A global aerosol reanalysis product covering the period 2011–2015 was constructed by the Meteorological Research Institute (MRI) of Japan Meteorological Agency (JMA). The reanalysis employs a global aerosol transport model developed by MRI (MASINGAR mk-2) and a 2-dimensional variational method, assimilates maps of aerosol optical depth (AOD) from the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard Terra and Aqua satellites every 6 hour, and has horizontal resolution of TL159 (approximately $1.1° × 1.1°$). In this presentation, we overview setup of the reanalysis as well as indication of its quality.

Comparing with the MODIS AOD shows that the reanalysis improved the under- and overestimates in the free run and exhibits much better agreement than the free run of the aerosol model confirming a sanity of the data assimilation system. The reanalysis obtains root mean square error (RMSE) = 0.05, correlation coefficient (R) = 0.96, mean fractional error (MFE) = 23.7%, mean fractional bias (MFB) = 2.8%, and index of agreement (IOA) = 0.98. The better agreement of the first guess comparing with the free run indicates that aerosol fields obtained by the reanalysis can improve the short-term forecasting.

AOD fields from the reanalysis agree well with monthly averaged AODs from the Aerosol Robotic Network (AERONET) with RMSE = 0.08, R = 0.90, MFE = 28.1%, MFB = 0.6% and IOA = 0.93 over the globe. Site-by-site comparison shows that the reanalysis is considerably better than the free run and achieves RMSE < 0.10, R > 0.90, and IOA > 0.90 at 86.4%, 40.7%, and 43.4% of the 181 AERONET sites, respectively. However, the reanalysis tends to have negative bias at urban sites (particularly megacities in industrializing countries) and positive bias at mountainous sites possibly due to insufficient anthropogenic emission, the coarse model resolution, and difference of representativeness between the satellite and ground-based observations.

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