Cheng, C. T., and K. Suzuki, 2021: Size-resolved aerosol microphysics in a global nonhydrostatic atmospheric model: Model description and validation. *J. Meteor. Soc. Japan*, **99**, https://doi.org/10.2151/jmsj.2021-031.

Plain Language summary: Particle size determines the aerosol transport and removal processes, as well as how aerosol interacts with clouds and climate. In this study, we develop a sectional aerosol scheme for Spectral Radiation-Transport Model for Aerosol Species (SPRINTARS-bin) which explicitly simulates the variations in size distributions due to microphysical processes. SPRINTARS-bin is implemented in NICAM (Nonhydrostatic ICosahedral Atmospheric Model) as an alternative to the original mass-based SPRINTARS-orig aerosol module. Both schemes are evaluated by comparing year-long simulation results to ground-based measurements and satellite observations to find that the sectional scheme with better representations of ultra-fine particles largely alleviates underestimates of the aerosol number concentration in the original scheme.

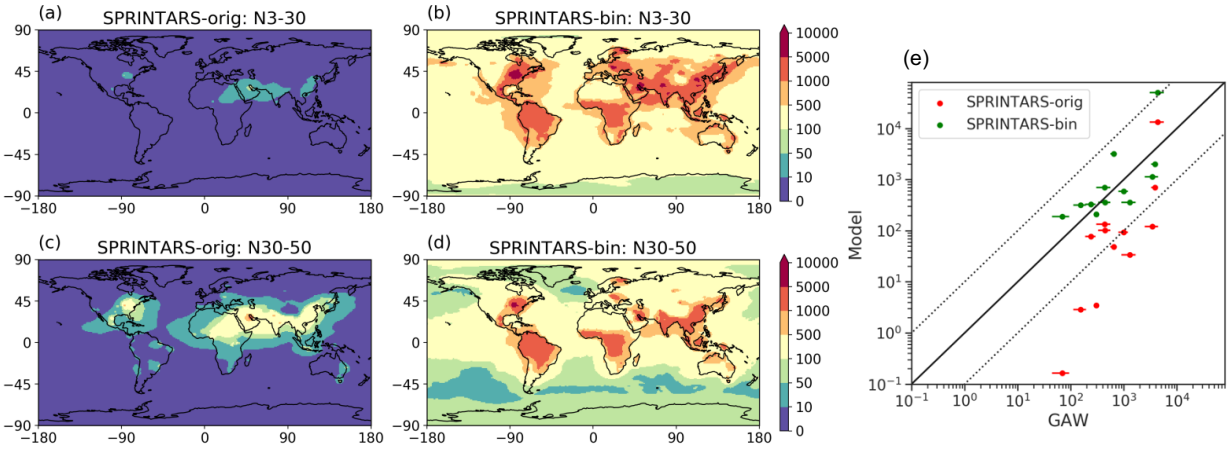

Figure 1. Annual averages of the predicted surface number concentrations (cm^{-3}) of particles with dry diameters (a) & (b) between 3 to 30 nm; (c) & (d) between 30 to 50 nm; SPRINTARS-orig and SPRINTARS-bin refer to the original mass-based SPRINTARS model and the new microphysical scheme developed based on SPRINTARS, respectively. Comparison to the total number concentrations observed at Global Atmospheric Watch (GAW) stations is shown in (e), with dotted lines indicating the range of model-observation values within one order of magnitude.

- NICAM-SPRINTARS-bin demonstrates the long-range transport of ultra-fine particles to high latitudes, as found in surface number concentrations.
- The differences can be explained by the new capability of NICAM-SPRINTARS-bin to resolve microphysical processes that determine the particle concentrations of ultra-fine aerosol particles, in contrast to the prescribed size distributions in NICAM-SPRINTARS-orig.
- The sectional scheme predicts higher Angstrom Exponent and total number concentrations, and better agrees with ground-based measurements in terms of annual averages. Seasonal variations are also reproduced at several sites.