Sekiyama, T. T. and M. Kajino, 2025: Dispersion simulation using the 1-km gridded wind fields constructed by super-resolution surrogate downscaling. *J. Meteor. Soc. Japan*, **103**, http://doi.org/10.2151/jmsj.2025-016.

Plain Language Summary: Deep neural network models can construct 1-km gridded winds from 5-km gridded weather forecast data at a much lower computational cost than 1-km gridded physics-based weather forecast models. The purpose of this study is to demonstrate how accurately a dispersion simulation reproduces air pollution over complex terrain when driven by the high-resolution winds constructed by the deep neural networks.

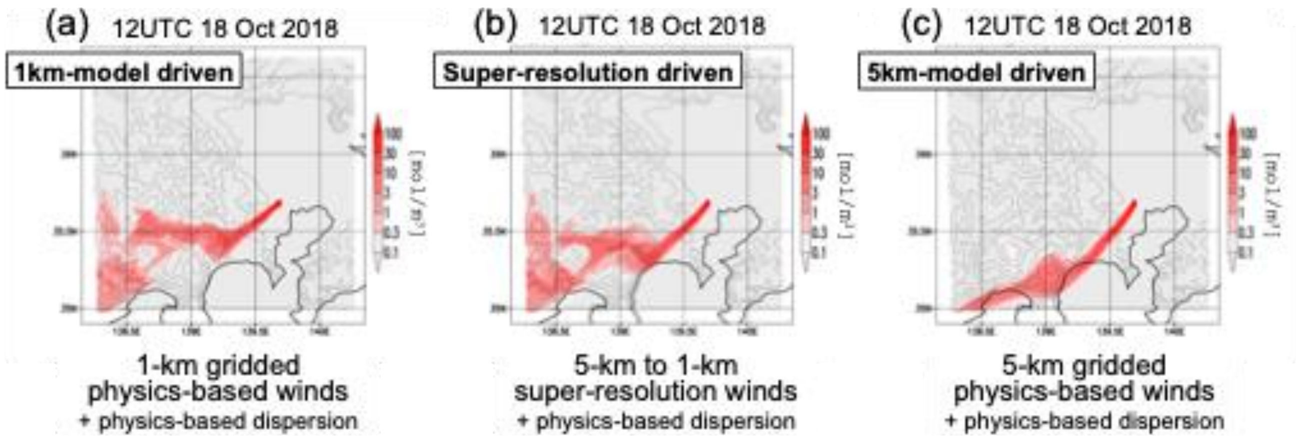

Figure 1. Snapshots of the surface air pollution distribution at the same time/date driven by the wind fields generated by (a) a 1-km gridded physics-based model, (b) a 5-km-to-1-km super-resolution deep neural network model, and (c) a 5-km gridded physics-based model. The virtual air pollution is emitted from a single point source in Shinjuku, Tokyo. The 1-km model-driven plume is diverted and blocked around steep terrain and mountains near Hakone and Mt. Fuji. However, the 5-km model-driven plume is not because the terrain is low-resolution in the model. In contrast, the super-resolution-driven plume behaves as if it were a 1-km gridded simulation, even though its input is 5-km gridded.

- We confirmed that the wind fields constructed by super-resolution surrogate downscaling (SRSD) were able to drive a physics-based plume dispersion model robustly.
- The SRSD-wind-driven dispersion model performed intermediately on average between the 1-km gridded physics-based target fields and the 5-km gridded physics-based input fields.
- Our dispersion simulation system should benefit environmental emergency responses because the SRSD model runs three orders of magnitude faster than physics-based models.