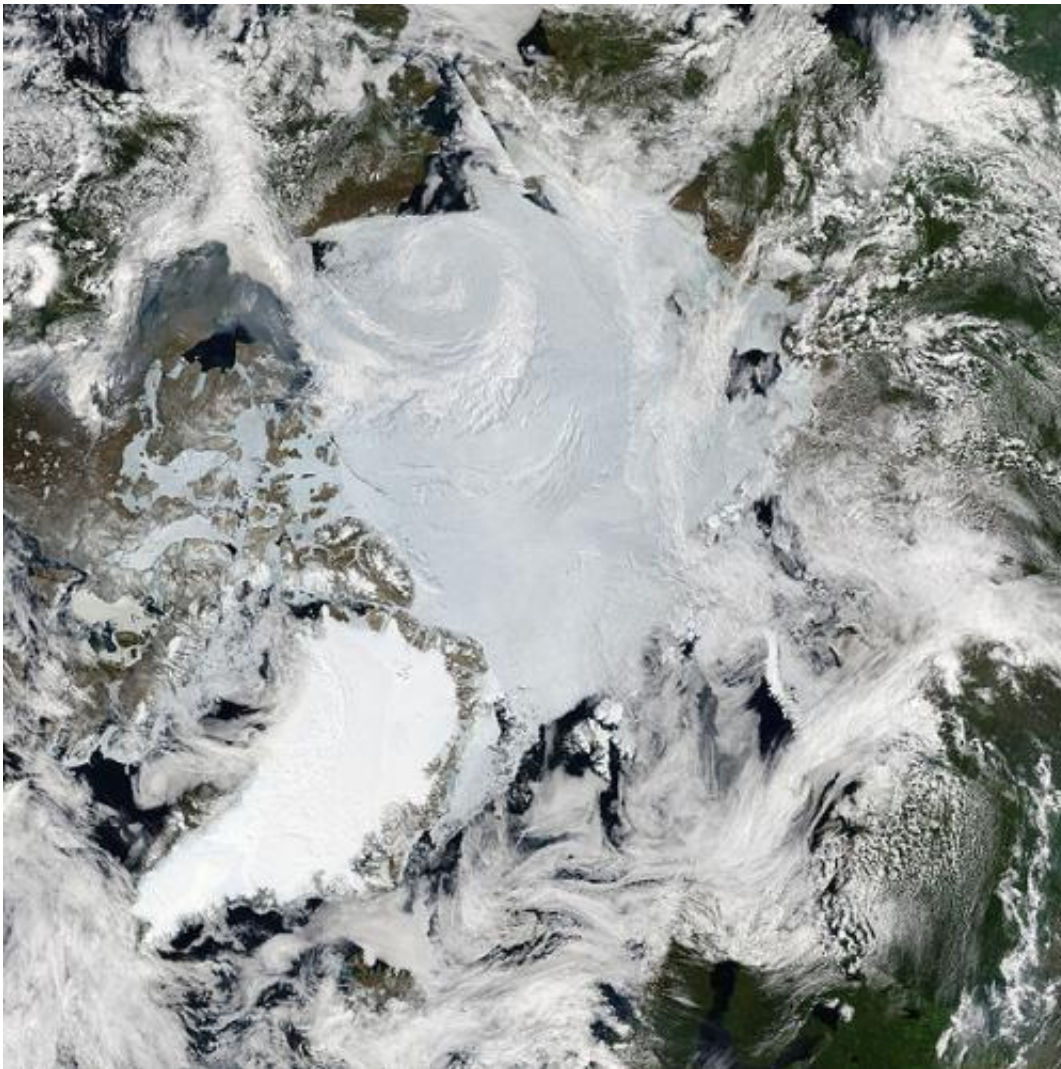


Current atmospheric models underestimate the dirtiness of Arctic air

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Mosaic of images of the Arctic by MODIS. Credit: NASA

Black carbon aerosols—particles of carbon that rise into the atmosphere when biomass, agricultural waste, and fossil fuels are burned in an incomplete way—are important for understanding climate change, as they absorb sunlight, leading to higher atmospheric temperatures, and can also coat Arctic snow with a darker layer, reducing its reflectivity and leading to increased melting. Unfortunately, current simulation models, which combine global climate models with aerosol transport models, consistently underestimate the amount of these aerosols in the Arctic compared to actual measurements during the spring and winter seasons, making it difficult to accurately assess the impact of these substances on the climate.

To find out if these inaccuracies could be mitigated, a team of scientists decided to use the Japanese K computer to perform fine-grained simulations of how black carbon [aerosols](#) are transported to and distributed in the Arctic region. By using smaller grids—with spacing of just a few kilometers rather than several tens of kilometers as in conventional current models—they were able to show that they could more realistically model the amount of black carbon aerosols, mitigating the underestimation in more coarse-grained models. Their finest model used 3.5 kilometer grids broken up vertically into 38 layers, so that it required 1.6 billion grids to cover the globe. The simulation, done on the 10-petaflop K computer, still required 17 hours to perform the two week [simulation](#).

According to Yousuke Sato of the RIKEN Advanced Institute for Computational Science (AICS), "this research shows that powerful supercomputers, by performing more fine-grained simulations, can help us to model weather and climate patterns in a more realistic way. We have to note, however, that while our model reduced the underestimation, it did not completely eliminate it. Further generations of even more powerful computers will allow us to run simulations that may be able to make even more [realistic simulations](#) and help us to

understand the mechanism through which these aerosols are transported."

"It is also known," continues Sato, "that current models do not realistically model the vertical distribution of the aerosols, and we believe that finer measurements could help there as well. Unfortunately there were no vertical measurements taken in November 2011, the time we chose to [model](#), so we plan in the future to do simulations for time periods for which actual measurement data exist."

The research is published in *Scientific Reports*.

More information: *Scientific Reports*, [DOI: 10.1038/srep26561](https://doi.org/10.1038/srep26561)

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