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**About Jason Gibson:**  
Jason has earned advanced degrees in Engineering and Physics, worked as a Rocket Scientist for NASA, and has a passion for teaching Science and Math!

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Icebreakers are becoming a more common sight at the top of the world. Soon, cargo ships will be, too.

### ENVIRONMENT

## A Sooty North Pole Ahead

Less ice will bring more drilling, more shipping—and even more melting

**Where there's oil,** there's a way. This summer the federal government showed that it is willing to approve drilling operations in U.S. waters off Alaska. In addition to legislation, other barriers to Arctic development are disappearing: summers at the North Pole could be ice-free as soon as 2020, reducing the need for ice-breaking vessels and opening the way for faster and cheaper trading routes. An increase in shipping across the top of the world, however, could have "significant regional impacts by accelerating ice melt," according to a recent government report by the Canadian Northwest Territories. And that aggravated melting could raise global sea levels.

Cargo ships on trans-Arctic voyages and other unprotected international waters typically take advantage of lax regulations and rely on some of the dirtiest fuel. Burning so-called heavy fuel oil is cheap but inefficient, and during the process some of the unburned fuel emerges as soot. Soot may be second only to carbon dioxide as a climate-changing agent: it bolsters the greenhouse effect by trapping more heat in air.

Researchers speculate that the Arctic's environment could amplify soot's negative effects. The substance darkens snow and sea ice, which may then absorb more solar radiation. As sea ice melts, larger swaths

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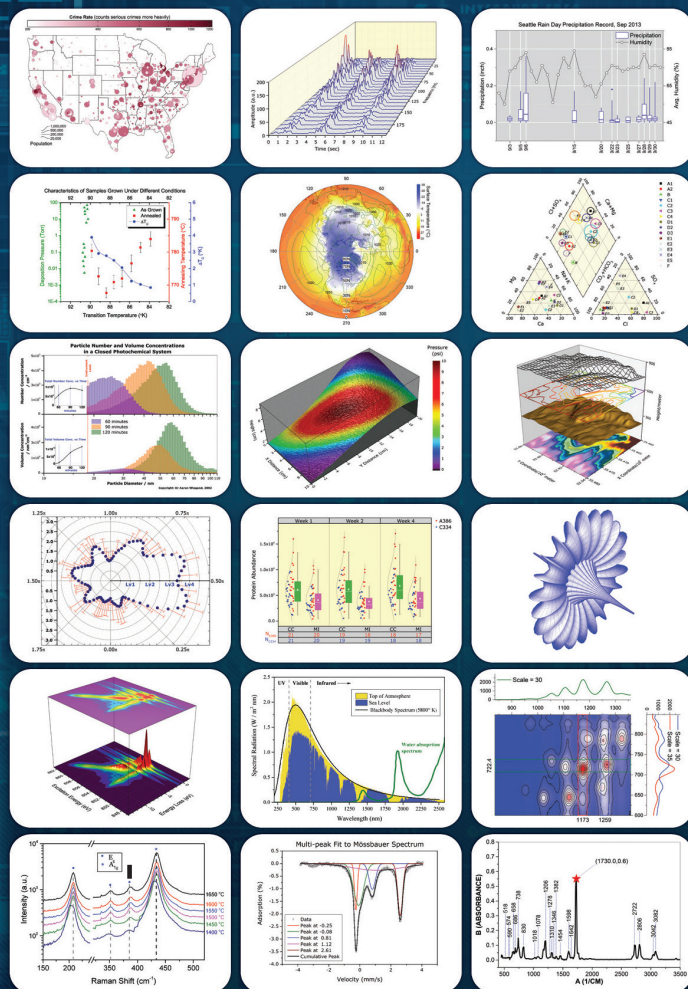
# Cargo ships on trans-Arctic voyages and other unprotected international waters typically take advantage of lax regulations and rely on some of the dirtiest fuel.

of water are left exposed and thereby soak up even more sunlight. The cycle could continue because the open sea would likely encourage additional soot-emitting shipping.

At best, attempts to quantify shipping's soot emissions are nascent but so are regional-scale studies of soot's environmental impact. "I think the biggest bottleneck is just that the Arctic is awfully big, and there are not a lot of people there and not a lot of measurements," says geochemist Jack E. Dibb of the University of New Hampshire. Dibb and others are working to collect information about the thermal effect of soot on ice cover. Along those lines, researchers in Finland sprinkled several concentrations of black carbon, a component of soot, on snow there from 2011 to 2013 and measured snowmelt over the course of each season. At press time, their results were under review at the journal *The Cryosphere*.

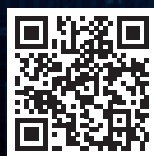
Political leaders are aware of the emerging problem of soot emissions from ships as well as from drilling operations, factories and wildfires. Shortly after approving the Alaskan drilling, President Barack Obama made a visit to the Arctic Circle to draw attention to climate change and melting ice there. His visit coincided with an international summit on Arctic issues whose attendees issued a statement noting the threat that soot poses to the Arctic and the importance of emissions reductions. Dibb and others say they hope that their work persuades politicians to take fast action against soot. If they do, as other climate researchers argued this summer in *Nature Climate Change*, policy makers stand a more credible chance of taking on larger problems, such as the more massive burden of carbon dioxide that is polluting many of the planet's habitats and ecosystems. —Lucas Laursen

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