

Icelandic volcano: The impact is broad, but could be worse

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By Halldor Kolbeins, AFP/Getty Images

This aerial view shows the Eyjafjallajokull volcano bilowing smoke and ash during an eruption.

Despite some airspace being reopened after volcanic ash forced its closure, millions of passengers worldwide are still stuck because of the ongoing cancellations. The only thing murkier than the plume of ash spewing from Iceland's Eyjafjallajökull volcano may be its long-term implications to the planet, its climate and public health.

The eruption, which began Wednesday, already is causing massive dislocation across Europe. By late Sunday, more than 63,000 flights had been canceled in 23 European countries, stifling the lifeblood of the continent's economy. Because few planes are flying, travelers can't travel, machinery parts can't get to factories, food sellers can't transport their goods, and businesses are finding business increasingly difficult to conduct.

The economic ripples are being felt worldwide. In the USA, air carriers canceled 310 flights to and from Europe on Sunday, according to the Air Transport Association, which represents most major U.S. airlines. Because of the volcano, Kenya's hothouse flowers — responsible for 20% of that African nation's exports — are rotting in w arehouses rather than winging their way to Europe.

MAP: Ash cloud disrupts air traffic

PHOTOS: Eyjafjallajokull's effect on travelers

How long will the chaos continue? It's unclear, despite weather forecasts indicating that prevailing winds today could break up some of the massive ash cloud over Europe.

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Geologists in Iceland said Sunday that the volcano is continuing to erupt with about the same force it had Wednesday. The last time Eyjafjallajökull (pronounced ay-yah-FYAH-plah-yer-kuh-duhl, according to the Associated Press) began spewing ash and lava, in 1821, it went on until 1823.

In one significant episode in Iceland, the Laki volcano erupted in 1783, sending massive amounts of lava, ash and poisonous gases into the air for eight months. Much larger than Eyjafjallajökull's eruption, the Laki blast killed half of Iceland's livestock and triggered a famine that, along with fluorine poisoning, killed one-quarter of Iceland's population.

The ash and gases released caused extreme weather across Europe and contributed to a continent-wide rise in deaths from respiratory diseases. If this eruption lasts anywhere near that long, scientists say, there is a risk it could melt glaciers that now cap the nearby Katla volcano, allowing it to blow its top and potentially pump enough ash into the atmosphere to lower temperatures worldwide.

The good news is that despite the difficulties caused for air traffic and commerce, volcanologists at this point don't seem overly worried about the chances that the eruption of Eyjafjallajökull will have longterm repercussions for climate or health.

Here's what scientists know:

The best-case scenario

The volcano is producing eruptive pulses that are sending ash and gases up to about 25,000 feet. The prevailing winds are westerly, so the ash cloud is being pushed east toward Scandinavia and down toward the United Kingdom.

That's typical for volcanoes in Iceland, says volcanologist Michael Bursik of the University of Buffalo. Eruptions "happen all the time, and usually the planes just divert around them," he says.

Volcanologists have worked with airlines for more than a decade to handle eruption diversions, since i ncidents in 1982 and 1989 in Indonesia and Alaska, respectively, in which jets flying through ash clouds had their engines shut down. In both cases, the engines restarted when the jets got out of the ash clouds. "It's a serious business," Bursik says. "You don't want that to happen."

Geologically, Iceland springs from a spreading ocean ridge in the middle of the Atlantic Ocean. The ash from the volcano is recycled ocean floor and grit from deeper down in the Earth's mantle.

The best-case scenario is that Eyjafjallajökull starts to peter out in the next few days and quietly goes back to sleep.

Barring that, the volcano might "go on at a fairly low level for a whole year. With phases of higher activity, it could shut down in a few days," says Simon Carn, a volcanologist at Michigan Technological University in Houghton, Mich.

That might allow air traffic to start up again, at least during the lulls.

Working around the problem

Alaska has learned to live with such volcanoes and work its air traffic around them, says Peter Webley, a professor at the Geophysical Institute at the University of Alaska-Fairbanks. "We'll have an explosive event, then lava on the ground, then another explosion."

But even when the lulls occur, there will be several days of anxious monitoring by the International Civil Aviation Organization's Volcanic Ash Advisory Centers, created in the aftermath of the two air mishaps in the 1980s. As the ash cloud gets more

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dispersed, it becomes harder to track, says Webley, who is trapped in Paignton, England, and unable to get home. Using ground- and plane-based air monitors and satellite data, the centers watch the increasingly invisible cloud of ash, adjusting airspace corridors to ensure that no planes fly through it.

"It's dependent on wind direction and wind speed," says Webley, one of several scientists who help make similar decisions in Alaska, which has had four major volcanic events in the past two years.

Typically, volcanic ash disperses within 48 hours after an eruption. But the air cordon for planes has to be set 12 to 24 hours in advance to ensure longhaul flights have sufficient time and fuel to get where they need to go. "If I'm flying from Seattle to Europe, I need to know what's going to be happening eight hours later, when I'm over Greenland. I might have to add an hour onto the flight and another hour of fuel," Webley says.

What's unlikely from the Eyjafjallajökull eruption is any major climate effect, says climate scientist Caspar Ammann of the National Center for Atmospheric Research in Boulder, Colo. "Right now, the magnitude and explosiveness of the Icelandic eruption is not enough to have significant climate effects."

Eyjafjallajökull's ash doesn't contain much sulfur, which can generate sulfuric acid droplets that could linger in the upper atmosphere and have a cooling effect, Ammann says. Its explosive bursts lack the pop to carry much ash above 30,000 feet, where it would need to reside in the atmosphere for years to have a significant cooling effect. If the droplets don't get that high, they can't reflect the sun's warmth away from Earth.

"Unless the eruption changes, the climate effects don't look significant," Ammann says.

In 1991, the eruption of Mount Pinatubo in the Philippines, the second-largest eruption of the 20th century (much larger than Eyjafjallajökull), sent a sulfuric acid haze into the stratosphere, reducing global average temperatures about 0.9 degree Fahrenheit over the next year.

The flow of ash

If the eruption continues, meteorologists will

closely monitor the prevailing winds blowing toward Scandinavia and Europe, Webley says. If the winds were to turn, the ash cloud could be pushed west toward the south of Greenland.

While unlikely, that would have the effect of cutting off the shortest air route from North America to Europe, as most jets fly over southern Greenland, then south of Iceland, he says.

The good news is that even if the eruptions last for months, Icelandic eruptions generally don't affect the rest of the world, says Stefan Wastegård, a professor of geology at Stockholm University who studies ancient ash deposits from Iceland. The ash typically doesn't get too far, mostly only to Iceland, Greenland and sometimes Scandinavia.

Long term, the health effects of the eruption shouldn't be too bad if it stays at current levels, says Bernadette Longo, a nursing professor at the University of Nevada-Reno, who researches the health effects of volcanic pollution.

That's because volcanoes tend to either have explosive or effusive activity, Longo says. Explosive volcanoes such as Eyjafjallajökull eject their gases and particulates high up into the stratosphere. Effusive volcanoes, such as Hawaii's Kilauea, are more at the troposphere, the lowest level of the Earth's atmosphere, putting out gases and ash where people are living and breathing.

Unless the levels of material Eyjafjallajökull is sending up increase massively, it most likely will get





dispersed in the stratosphere, high above Earth.

The worst-case scenario

The worst-case scenario is that the Eyjafjallajökull eruption intensifies, causing the nearby Katla volcano to erupt.

"When Katla went off in the 1700s, the USA suffered a very cold winter," says Gary Hufford, a scientist with the Alaska Region of the National Weather Service. "The Mississippi River froze just north of New Orleans, and the East Coast, especially New England, had an extremely cold winter. Depending on a new eruption, Katla could cause some serious weather changes."

Scientists say history has shown that whenever Eyjafjallajökull erupts, Katla follows. The only question is when.

"If it (Eyjafjallajökull) continues to belch, then you worry," Hufford says.

There's precedent for massive eruptions. From 1783 to 1784, the Laki fissure and nearby Grímsvötn volcano poured out what's been estimated at 3.4 cubic miles of lava and poisonous gases.

No one's going to starve on Iceland: International shipping will keep the nation's 317,000 residents fed. But it could be a long, ugly experience, both on the island and in Europe, says Reno's Longo.

If the eruption ramps up significantly, it could affect health in a much larger area. Very large eruptions can cause a dry, sulfurous fog such as Europe experienced in 1793 with the eruption of the Laki volcano in Iceland. "That would be the worst-case scenario, but the potential exists," Longo says.

If Eyjafjallajökull were to create high levels of particulate and gas pollution in either Iceland or elsewhere, measures would have to be taken to protect the population from exposure. "You can't turn off the volcano," Longo says.

Her studies of those living near Hawaii's Kilauea volcano, which has been erupting since 1983, show that nearby residents often are significantly affected, with symptoms such as sore throat, chronic cough, asthma and eye irritation. Research on pollutants' penetration rates into homes, schools and hospitals found that a significant amount of particulate matter got inside. But air conditioners and air filters got rid of most of it.

Breathing in the ash is harmful to the lungs and airways. Composed of tiny shards of molten rock that's cooled to a glassy material, at a microscopic level it has sharp, jagged edges.

"If you breathe it in," Longo says, "it's very difficult to get out."

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