Madison researchers field volcanic ash warning system

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(PhysOrg.com) -- From a workstation in Madison, Mike Pavolonis hopes to lay eyes - satellite eyes, that is - on every natural chimney around the globe.

"Our eventual goal is a fully-automated global ash monitoring system," said Pavolonis, a researcher from the National Oceanic and Atmospheric Administration (NOAA) working at the University of Wisconsin-Madison's Cooperative Institute for Meteorological Satellite Studies. "Satellites will supply data that will be processed and all of it will be operational. Every volcano will be automatically monitored. Satellite data will be used in models to predict where the ash will go."

The importance of those predictions to organizations like the London Volcanic Action Advisory Centre — which uses Pavolonis' data — has rarely been more obvious. The center monitors ash over the United Kingdom, Iceland and the northeastern Atlantic Ocean. It's a relatively small area, but home to some of the world's busiest air routes and was recently shut down by ash from the Icelandic volcano Eyjafjallajökull.

NOAA has been working with UW-Madison for 15 years to develop accurate ash monitoring methods for areas with active volcanoes. While the mountains may seem remote, they often lie along well-worn pieces of sky. For example, Alaska's sparsely populated Aleutian Islands are on the great circle route between Asia and North America. Over 50,000 aircraft a year fly through the area, which has 40 volcanoes that have been active in recent time.

Satellite observation is often the only way to collect data from such remote areas, but simple pictures are not enough to guide safety decisions.

"Satellite imagery alone doesn't give you the quantitative information you need," Pavolonis said. "We need to go beyond the visual and determine the characteristics of the ash cloud. How high is it? How much ash is in the cloud? What direction will it travel?"

As the Iceland eruption made clear, ash plumes can cause problems over wide swaths of the sky. Air traffic control organizations need to react quickly to fresh predictions from outlets like the London VAAC to divert planes around clouds or ground them to avoid engine damage from the large particles in the air.

Pavolonis and his group began developing an algorithm to boost the utility of satellite images five years ago. Their computational instructions tap satellites in geostationary orbit for data to help determine the presence, altitude and density of ash clouds, as well as the size of the ash particles in the cloud.

Their algorithm works, but is best handled by the experts that created it.

"Right now, it takes a good deal of training to get the best information," Pavolonis said. "We have to be very careful of the flow of information because this has real impact. With the stakes this high, there is little room for error."

The hope is the Eyjafjallajökull eruption has focused attention on the problems planes encounter in ash clouds and will help drive the program's development into a widely-used ash monitoring system.

"The algorithm is still in the experimental stage. We are working to

make it operational," Pavolonis said. "In other words, to advance to a fully supported program, maintained 24/7, with a distribution system."

Provided by University of Wisconsin-Madison

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