CU-Boulder Unmanned Aircraft Buzz Over Gigantic Holes in Antarctic Sea Ice

September 10 2009

Aerosonde on launch vehicle at Pegasus runway (5 September 2009).

A series of record-setting unmanned research flights are providing University of Colorado at Boulder researchers with some of the first 3-D observations of gaping holes in the Antarctic sea ice known as polynyas and the blasting winds that help form them.

Using unmanned planes roughly 9 feet across, CU-Boulder faculty members John Cassano and James Maslanik are gaining a unique glimpse into the Terra Nova Bay polynya, a yawning stretch of open water that at times reaches 2,000 square miles in area, nearly twice the size of Rhode Island. The CU-Boulder team made its first flight Sept. 7, believed to be the southernmost flight ever of any unmanned aircraft.

"These will be some of the longest flights on record for science applications, and certainly the longest in Antarctica," said Maslanik, a research professor in the aerospace engineering sciences department and an affiliate of the university's Cooperative Institute for Research in Environmental Sciences, or CIRES.

Earlier this year, Maslanik led a NASA-funded project known as the Characterization of Arctic Sea Ice Experiment, or CASIE, which made some of the most extensive unmanned aerial measurements to date of sea ice in the Arctic. Together, the two CU-Boulder-led field campaigns will include some of the highest latitude research flights ever conducted with unmanned planes in both the Northern and Southern hemispheres, he said.

The goal of the Antarctic mission is to measure moisture and heat exchanges between the ocean and atmosphere and to eventually unravel the effect of polynyas on global climate, said Cassano.

"In polar regions, sea ice often reduces interactions between the ocean and atmosphere, but in polynyas, open water persists even in the heart of winter," said Cassano, an assistant professor in the atmospheric and oceanic sciences department and CIRES Fellow. "It's in these areas that large amounts of heat and moisture are lost from the ocean to the atmosphere. Instruments aboard the unmanned planes will provide some of the first direct measurements of this heat loss in winter."

Sea ice formation in polynyas also leaves cold and salty water behind, he said. Because the cold and salty water is denser, it sinks, affecting global currents like the thermohaline circulation, said Cassano. The thermohaline circulation works much like an oceanic conveyer belt, moving seawater around the globe through changes in salinity and water temperature. In places where the thermohaline circulation emerges at the ocean surface, it substantially influences weather and climate, said

Cassano.

The planes will also measure airflow above Terra Nova Bay -- which lies between West Antarctica and East Antarctica in the southern part of the continent -- to help researchers understand the interaction between the polynya and the severe winds that whip over the Antarctic continent.

The winds, called katabatic winds, form as air slides down from the high plateau of Antarctica's interior and funnels into small drainages near the coast. During the month of September, near the end of the austral winter, these winds can exceed hurricane strength.

The constant blasting of the katabatic winds helps keep the Terra Nova Bay polynya free of new sea ice and open throughout the winter, said Cassano. He said he suspects the polynya influences local wind patterns by creating a low pressure area that can spin off small but intense cyclones.

"There have been a lot of models and theory-based studies describing polynyas and their climate feedbacks, but we can't fully understand them until we measure them," said Cassano.

Provided by University of Colorado