CU-Boulder-led team to assess decline of Arctic sea ice in Alaska's Beaufort Sea

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CU-Boulder Research Professor James Maslanik, left, is shown here with CU-Boulder graduate student Ian Crocker, center, and NOAA researcher John Adler, right, with two small unmanned aircraft. Maslanik is heading up the NASA-funded MIZOPEX project to study declining sea ice in the Beaufort Sea north of Alaska. Crocker and Adler are MIZOPEX team members. Photo courtesy University of Colorado

(PhysOrg.com) -- A national research team led by the University of Colorado Boulder is embarking on a two-year, multi-pronged effort to better understand the impacts of environmental factors associated with the continuing decline of sea ice in the Arctic Ocean.

The team will use tools ranging from unmanned aircraft and satellites to ocean buoys in order to understand the characteristics and changes in

Arctic sea ice, which was at 1.67 million square miles during September 2011, more than 1 million square miles below the 1979-2000 monthly average sea ice extent for September -- an area larger than Texas and California combined. Critical ocean regions north of the Alaskan coast, like the Beaufort Sea and the Canada Basin, have experienced record warming and decreased sea ice extent unprecedented in human memory, said CU-Boulder Research Professor James Maslanik, who is leading the research effort.

The team will be targeting the Beaufort Sea, considered a "marginal ice zone" where old and thick multiyear sea ice has failed to survive during the summer melt season in recent years, said Maslanik of CU-Boulder's Colorado Center for Astrodynamics Research in CU's engineering college. Such marginal ice zones are characterized by extensive ice loss and a strong "ice-albedo" feedback.

"Sea ice is lost when the darker ocean absorbs more sunlight in the form of heat in the summers, resulting in potentially thinner sea ice that re-forms the following winter," Maslanik said. "This positive feedback between heat absorption by the ocean and accelerated melting becomes reinforcing in itself." Marginal ice zones also are characterized by significant human and marine mammal activity, he said.

There was a record loss of sea ice cover over the Arctic in 2007, he said. "In some areas of the Arctic Ocean the multiyear ice rebounded, but in the Beaufort Sea we did not see that kind of multiyear ice persistence like we used to see," said Maslanik, who also is a research professor in the aerospace engineering sciences department.

"The biggest question is whether places like the Beaufort Sea and adjacent Canada Basin have passed a 'tipping point' and now are essentially sub-Arctic zones where ice disappears each summer," he said. Such ice loss could be causing fundamental changes in ocean conditions, including earlier annual blooms of phytoplankton, which are microscopic plant-like organisms that drive the marine food web.

The vast majority of climate scientists believe shrinking Arctic sea ice in recent decades is due to rising temperatures primarily caused by human activities that pump huge amounts of heat-trapping gases like carbon dioxide into the atmosphere. The new $3 million study led by Maslanik, “The Marginal Ice Zone Observations and Processes EXperiment,” or MIZOPEX, is being funded by NASA.

The team will undertake extensive airborne surface mapping using a variety of Unmanned Aircraft Systems, or UAS, comparing the results with data collected by a fleet of satellites from NASA, the National Oceanic and Atmospheric Administration and the Japanese space agency. Unlike satellites, small, unmanned aircraft can fly below the clouds, observe the same location continuously for hours and make more precise measurements of sea ice composition and sea surface temperatures. Maslanik and his CU-Boulder team previously used unmanned aircraft to assess ice conditions both in the Arctic and in Antarctica.

The MIZOPEX arsenal also will include floating buoys that measure ocean temperatures. CU-Boulder engineering faculty members Scott Palo and Dale Lawrence and their graduate students are converting miniaturized versions of dropsondes -- standard weather reconnaissance devices designed to be dropped from aircraft and capture data as they fall toward Earth -- into the buoys that will be deployed by the UAS.

The modified dropsondes, which were developed at CU-Boulder for use in Antarctica, will be combined with CU-designed miniature unmanned aircraft that will land on the ocean near sea ice floes. Such floes are critical to several species of Arctic wildlife, including polar bears, walruses and seals.

The buoys and unmanned craft will collect sea surface and subsurface temperatures to about a meter deep, while the overflying unmanned planes and satellites measure temperatures at the surface, Maslanik said. "We want to know if the warming is just at the ocean surface or if there is additional heat getting into the mixed layers of the upper ocean, either from absorbed sunlight or from ocean currents, that could be contributing to sea ice melt."

The team plans to gather information over 24-hour cycles to determine how the ocean and ice are reacting to atmospheric changes. "Understanding what's happening in the water is critical to forecasting what will happen to ice in the near term, as well as in the decades to come," said MIZOPEX team scientist Betsy Weatherhead of CU-Boulder's Cooperative Institute for Research in Environmental Sciences.

"We've never had the data before," Weatherhead said. "With this new instrumentation, we'll be able to ask questions and test theories about the drivers of ice melt."

More information: ccar.colorado.edu/mizopex/index.html

Provided by University of Colorado at Boulder

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