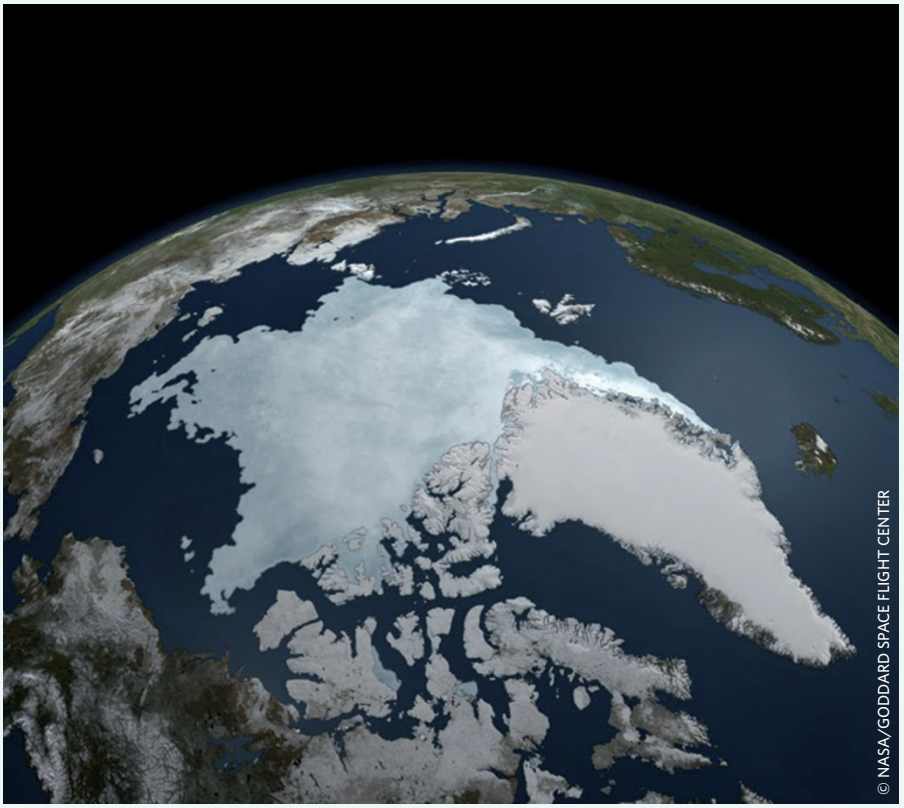
SNAPSHOT

Towards an ice-free Arctic



Arctic sea ice either hit a record low this year or came second behind the previous record holder of 2007 — depending on how the data is crunched. Either way, it is clear the ice is melting. The trend for summer sea-ice extent since 1970 has been downwards, with the past five years (2007–2011) being the lowest of the bunch. The Northwest Passage that links the Pacific Ocean to the Atlantic Ocean through the islands of northern Canada is now clear of ice and open to ships for weeks to months, as is the Northeast Passage that links northern Russia to the eastern side of Greenland.

The rate of ice disappearance is faster than models predicted: the last round of models from the Intergovernmental Panel on Climate Change predicted that the Arctic Ocean would be free of floating summer ice by 2070–2100, but in reality it looks likely to happen between 2030 and 2050. "2030 may be more realistic," says Walter Meier of the National Snow and Ice Data Center (NSIDC) in Boulder, Colorado. Perhaps half of the difference between models and reality may be due to natural variability, says Meier, but there are clearly some model deficiencies, he adds, for example, in describing how warmer water melts ice from underneath.

Arctic air continues to warm at about twice the rate of other parts of the world. The reasons for that include the lower albedo of open water and land compared with ice — the darker surfaces soak up more sunlight and accelerate local warming. Another contributor might be sun-absorbing black soot from industry and boat traffic in the region — a factor that could get worse as the clearing waterways attract more shipping.

A handful of organizations track the ice extent each year, using different satellites and data-analysis methods. The NSIDC, which uses the Special Sensor Microwave Imager/Sounder on board US Air Force satellites, put this year's summer minimum at 4.33 million km^2, plus or minus 50,000 km^2, on 9 September (the date wobbles around within September from year to year). That's slightly higher than their 2007 record low of 4.17 million km^2, and about a third below the 1979–2000 average. The Japanese Space Agency — which uses the Japanese microwave sensor AMSR-E on board the NASA Aqua satellite — agrees that 2007 remains the record-holding low. The University of Bremen, however, using the same Japanese sensor but a different analysis method, concludes that the sea ice hit a new low of 4.240 million km^2 on 8 September, below 2007's 4.267 million km^2. "Statistically it was a tie," says Meier.

These satellites detect microwave emissions — a measure that can be taken in the dark and isn't blocked by cloud cover. The Japanese sensor has a resolution of about 6 km, compared with 25 km at the NSIDC. This year, says Meier, there were a lot of small ice flows of 5–10 km in size, with open water in between, which the Japanese sensor would see better. "In some ways, their measure may be more accurate," says Meier, but it is more susceptible to errors from weather.

Sea-ice volume is much harder to track. A satellite that could detect ice thickness — NASA's ICESat — was retired in 2010; the next capable satellite, the European Cryosat 2, is still being tested. That leaves a gap in the record. Still, says Meier, there are hints from models and estimates based on ice age that this year was a record low. "If I had to put money on it, I'd say this year was the thinnest on record," he says.

The uncertainty over exact ice coverage is only going to get worse in coming years: all these satellites have a 'hole' in their vision right at the North Pole, so as the ice continues to melt it will become harder to see. "That's something we haven't had to deal with yet. In 2007 we were starting to get a little bit worried," says Meier.

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