Acceptance speech

20 June 2024

Valérie Masson-Delmotte, awardee in the Climate Change category (16th edition)

Thank you for recognizing knowledge advances from the study of ice cores, and for highlighting the strong team work underpinning our science.

It is an honor to receive this award together with inspiring colleagues. I want to thank all the technicians, engineers, early career scientists and researchers with whom I have had the joy to work during the past 30 years. I also want to thank the French and European research institutions and funding agencies which have supported our projects.

As a high school student, in the late 1980s, advances in climate sciences through satellites, numerical modelling and ice core research stimulated my curiosity and shaped my scientific career choice.

Ice cores are amazing time machines. The analysis of the air trapped in ice cores has revealed that the magnitude and rate of the increase in atmospheric heat-trapping gas concentrations, unequivocally resulting from human activities, is unprecedented in the past 800,000 years.

In 2023, human-caused global warming has reached 1.3°C above the level of the late 19th century, and has occurred at a record pace in the last decade. At the global scale, the current magnitude and pace of warming is unprecedented in more than 2000 years – and this is also the case in Greenland, as documented by ice core records.

My research has been motivated by the constant desire to better quantify and understand past climate variations, and to learn from them to better understand current and future changes.

We have combined the monitoring of precipitation, surface snow and water vapour in polar regions with atmospheric modelling to better understand the climate signals recorded in ice cores, through the ratio between heavy and light water molecules. This has allowed us to better understand polar climate, as well as past variations in polar temperature and past variations in moisture transport towards polar regions.

We can use past climate variations as natural experiments on the Earth's system.

Understanding past climate variations implies understanding the same processes and interactions between the atmosphere, ocean, cryosphere, and land surface, including the water and carbon cycles, that have shaped past natural variations and have and will shape their responses to human influence.

We understand better and better how changes in the Earth's orbit and the response of the climate system have shaped ice ages and past warm periods. We still need to better understand the causes of past abrupt changes documented in the ice core records, and what they imply for future risks.

Obtaining ice core records spanning 1.5 million years – a major endeavor currently underway – is also critical to understand the shift in ice ages around one million years ago, when they became longer and colder. This has implications for how our greenhouse gas emissions will interact with slow changes in the Earth's orbit and shape the Earth's climate over the next tens of thousands of years.

We have used ice core records to evaluate the skills of climate models in capturing the magnitudes and rates of past changes – a key benchmark for confidence in their future projections.

Ice core records evidence polar amplification, the fact that temperature variations are amplified in polar regions compared to the global mean – a feature that is also occurring in response to human influence on climate.

We have combined ice core information with other lines of evidence to provide more accurate estimates of climate sensitivity – a key metric which measures the amount of global surface temperature change resulting from changes in atmospheric greenhouse gas concentrations. And this has been combined with results from climate models to deliver more accurate future climate projections.

We have also used ice core information to better understand how past warm periods have affected the slow adjustments of the Greenland and Antarctic ice sheets and their contributions, over thousands of years, to past periods of high sea level.

Today, the melt and flow from the Greenland and Antarctic ice sheets is adding to the global retreat of glaciers and the expansion of our warming ocean, driving the acceleration of sea level rise, due to human-caused climate change.

Future sea level rise will depend on both future greenhouse gas emissions and peak warming, and uncertain ice sheet instabilities. We need to advance our understanding of the risks of such tipping points, which have major implications for coastlines worldwide and for the one billion people living in these regions.