

Clues to the Cryosphere: Lessons from the Ice

Follow-up sessions, NSTA Conference, Saturday March 12th

Marriott San Francisco Marquis Hotel
Room Pacific B

All sessions are free to NSTA Conference participants

8:00-9:00 Dr. Cristina Takas-Vesbach, Microbial Ecologist, University of New Mexico

The McMurdo Dry Valleys of Antarctica: harshest place on Earth or polar oasis?



The McMurdo Dry Valleys are a region of Antarctica that has been ice free for the past 4 million years. Low temperatures, high winds, and no vegetation earn this ecosystem the name the harshest place on Earth. However, temperatures do rise above freezing in the summer, which melt the glaciers to form ephemeral streams that feed lakes permanently covered by meters of ice. At first glance, one might think this system is devoid of life, but a rich microbial food web exists that make this ecosystem the perfect place to study ecosystem function in the absence of higher organisms. Because of the lack of vegetation and vertebrates, researchers have always referred to the McMurdo Dry Valleys as a relatively simple

ecosystem, but the more it is studied, the clearer it becomes that this was a simple misconception. At every turn, research in the dry valleys has surprised us and this presentation will detail a number of these unexpected findings.

9:30-10:30 Louise Huffman, ANDRILL Outreach Coordinator, University of Nebraska-Lincoln
Susan Kelly WISSARD Outreach Coordinator, Montana State University

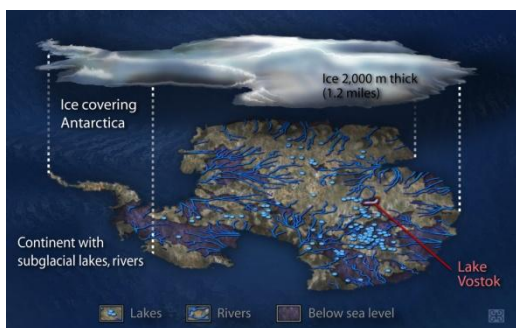
Science is Cool! Using polar science resources in your classroom



The Polar Regions contain some of the most extreme conditions on Earth. Science conducted at the Poles is helping us better understand the climate patterns and processes that are impacting the planet. Using hands on activities for the classroom, educators will learn about climate change and the importance of polar science research to us all. Experienced polar science educators will share classroom tested materials that will engage all learners in inquiry science. Join us and take home polar science resources and activities ready to use in your classroom tomorrow!

11:00-12:00 Dr. Slawek Tulaczyk, Glaciologist, University of California Santa Cruz

Under the Ice: Studying one of the last aquatic environments on Earth



Until recently, ice sheets and glaciers were thought of as vast reservoirs of frozen water devoid of life, shrinking slowly under warm climates and growing slowly in cold ones. Glacial changes are supposed to be gradual to the point of being almost imperceptible. New research in Antarctica challenges these ideas. Scientists are just learning how dynamic these giant slabs of ice really are, moving up to 30 feet (10 m) a day, powered by a series of flooding and draining of streams at their base. An extensive network of rivers and lakes lies beneath the immense West Antarctic Ice Sheet, where more than 300 lakes have been discovered. Using satellite imagery and an on-the-

ground technique, “active seismic imaging” scientists are discovering a vast unexplored interconnected hydrologic system.

12:30-1:30 Michael Gooseff, Hydrologist, Pennsylvania State University

How are Arctic landscapes responding to permafrost degradation under a warming climate?

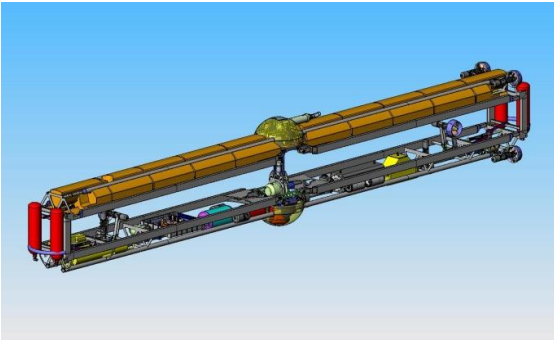


Air temperatures in the Arctic are warming and consequently the permafrost that underlies this polar landscape is susceptible to degradation, namely thaw. At the land surface, significant erosion is occurring, forming thermokarst. In arctic tundra settings, thermokarst features are stark discontinuities in the landscape where the thick organic mat is left unsupported by thawing of the underlying permafrost and the land subsides, exposing mineral soil. We have observed hundreds of such features in Arctic Alaska and we are currently studying the causes, development, and consequences of thermokarst formation in a fundamentally interdisciplinary manner. Our team is made up of

ecologists, geomorphologists, hydrologists, and modelers. Thermokarst occurrence is not new, it has been observed for several decades in Arctic settings. However, we propose that in response to climate warming, the occurrence of thermokarst will be more extensive.

2:00-3:00 Dr. Ross Powell, Geologist, Northern Illinois University

Ice Sheet Warming Oceans, rising sea levels and the West Antarctic Ice Sheet



Some of the biggest unknowns in trying to estimate the height and rate of future global sea-level rise come from a poor understanding of ice sheet dynamics and vulnerability of the ice sheet to warming of oceans and atmosphere. Complete disappearance of the West Antarctic Ice Sheet alone would contribute 3-5m to global sea-level rise, making it a focus of scientific concern due to its possible susceptibility to internal or ocean-driven instability. Data from the new RAGES (Robotic Access to Grounding-zones for Exploration and Science) is an exciting new Antarctic science initiative that is part of the WISSARD (Whillans Ice Stream Subglacial Research Drilling)

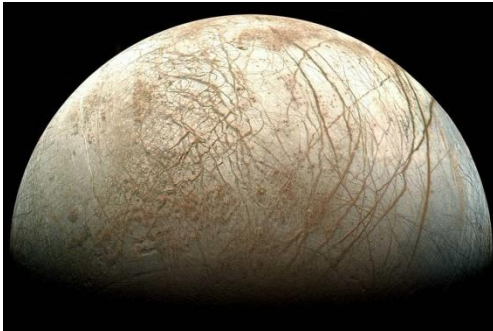
project will contribute to an effort by the scientific community to develop more realistic ice-sheet models that can lessen our uncertainties about future ice sheet changes and sea-level rise.

This research concentrates on the stability of the fast flowing Whillans Ice Stream grounding zone of the West Antarctic Ice Sheet. A grounding zone is an area where the ice goes afloat in the ocean, and the ice, ocean waters and sea floor interact. It's in this area that the ice is being melted by or is freezing seawater, and where till below the ice, debris within the ice, and sediment carried by streams flowing under the ice are all released and discharged to the sea. Grounding zones are seen as high priority targets to investigate scientifically due to ice sheet models showing that they strongly influence how stable the ice sheet will be during future climate change.

3:30-4:30 Dr. Jill Mikucki, Microbial Ecologist, Dartmouth

Icy life on Earth and beyond?

“Chance only favors the prepared mind” Louis Pasteur.



The possibility that life may exist beyond planet Earth has captured the imagination for decades. But how do we search for life beyond Earth? What type of life will we encounter and will we know it when we see it? Missions to outer space are costly and any samples returned to Earth will likely be small. We must carefully consider how to sample and what we want to sample if we are to unambiguously detect extraterrestrial life or its signature. The extreme environments on Earth offer a ‘training ground’ for sampling strategies and may enhance science questions we ask on future space exploration missions.

Our universe is a cold place and our search for extraterrestrial life will likely lead us to icy habitats. Thus to better understand what to look for and how to look for it we must study icy systems here on Earth. We now know that microbial life exists in a diversity of frozen niches such as lake and glacier ice, permafrost, ground ice and subglacial lakes. In this seminar we will explore several examples of exobiological targets and their Earthly analogs. For example, the McMurdo Dry Valleys (MCM) is the coldest, driest desert on our planet and thus offers a suitable earthly analog to our nearest exobiological candidate, Mars. Lake Vostok, the largest subglacial lake, exists below hundreds of meters of ice; sampling this and other subglacial lakes will help scientists prepare for someday sampling the ice-covered ocean of Europa.

5:00-6:00 Christine Foreman, Microbial Ecologist, Montana State University

The Western Antarctic Ice Sheet Divide-A U.S. deep ice coring project



Polar ice cores are powerful tools for reconstructing the timing and extent of past changes in Earth’s climate, and for documenting changes in atmospheric levels of greenhouse gases. Ice cores also have provided insight into other climate forcing mechanisms, such as atmospheric sea salt and dust loading, volcanic eruptions, and biomass burning. Ice core records provide a basis for assessing the range of natural variability of climate, and for testing regional and global climate models under a wide range of conditions.

The West Antarctic Ice Sheet (WAIS) Divide is a U.S. deep ice coring project. The goal of WAIS Divide is to collect a deep ice core from the flow divide in central West Antarctica in order to develop a unique series of interrelated climate, ice dynamics, and biologic records focused on understanding interactions among global Earth systems. The WAIS Divide ice core will provide Antarctic records of environmental change with the highest possible time resolution for the last ~100,000 years and will be the first Antarctic climate record with an absolute, annual-layer-counted chronology for the most recent ~40,000 years, providing a basis from which to understand relative timing of climate change in the northern and southern hemisphere.