

APECS-ARICE Webinar

From icebreakers into classrooms

– opportunities for educators and scientists

Moderation: Josefine Lenz (AWI, APECS & ARICE)



Speakers:

Mauro Hermann (MOSAiC Ambassador, ETH Zurich)

Rainer Lehmann (Polar Educators Germany)

Friederike Krüger (Integr. Gesamtschule Bothfeld)

Falk Ebert (Herder Gymnasium)

Anne Gold (CIRES, CU Boulder)



Introduction to our speakers



Josefine Lenz
Moderator

APECS Project Officer in ARICE @ AWI
Coordinator of the MOSAiC School 2019



Mauro Hermann
MOSAiC Ambassador
PhD candidate
@ ETH Zurich
Participant of the
MOSAiC School 2019



Rainer Lehmann
***Teacher in Geography
& Biology***
Polar Educators
Germany



Falk Ebert
***Teacher in Maths &
Physics***
Herder Gymnasium
Berlin
Lecturer in the
MOSAiC School 2019



Friederike Krüger
***Teacher in Geography
& German***
Integr. Gesamtschule
Bothfeld
Lecturer in the
MOSAiC School 2019

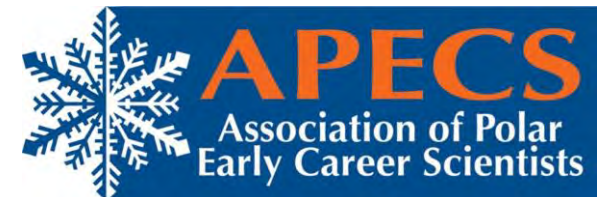


Anne Gold
Educator
Director Education &
Outreach @ CIRES,
CU Boulder
Lecturer in the
MOSAiC School 2019

MOSAiC Ambassador Projects



Mauro Hermann
(ETH Zurich)







Today, you will hear about...



...how 20 young scientists became MOSAiC Ambassadors

...some great examples of science outreach we created for kids and classrooms

	Anika Happe	(MSc@University of Oldenburg, marine environmental sciences)
	Francesca Doglioni	(PhD@Alfred Wegener Institute, physical oceanography)
	Carolynn Harris	(PhD@Montana State University, environmental science & ecology)
	Pierre Priou	(PhD@University in Newfoundland, fisheries and marine sciences)

...where to get materials, contact details, and further information



MOSAiC Embassy: purpose



MOSAiC embassy: getting ready in Tromsø



photos by Josefine Lenz



MOSAiC embassy: growing in the Arctic

assisting,
experiencing



© Sean Horvath

© Katie Gavenus



© Jari Haapala

learning, discussing



© Anika Happe

© Julika Zinke

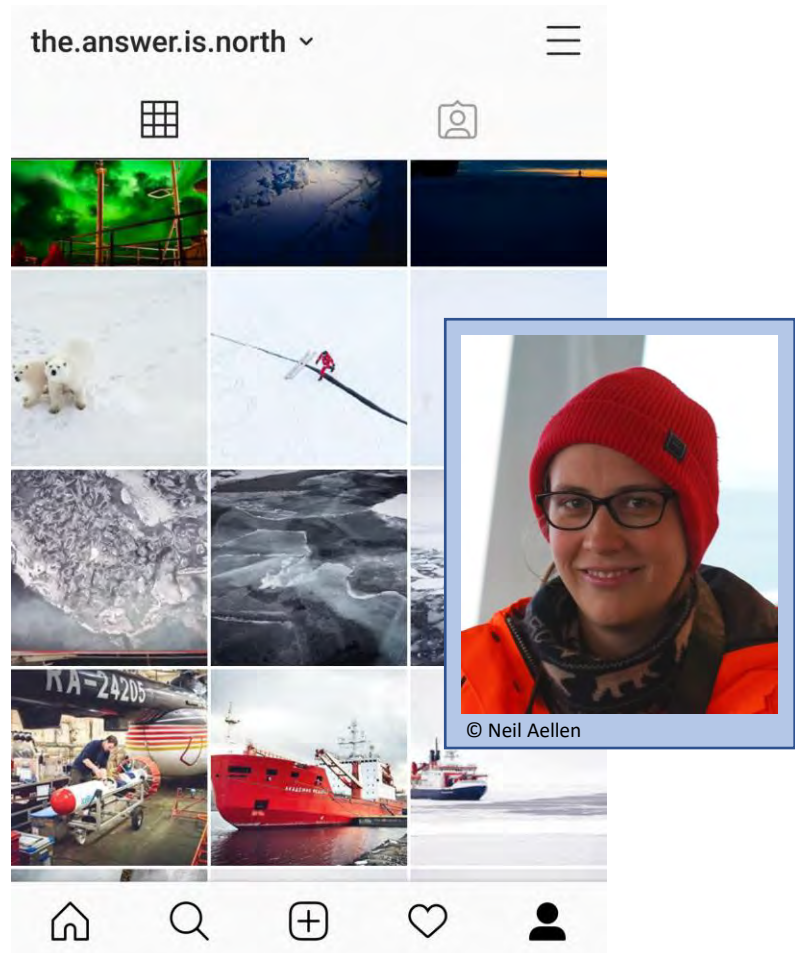


creating, collaborating

MOSAiC embassy: growing together

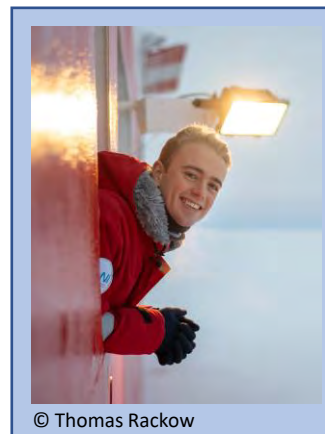


Some MOSAiC entertainment



[Thea: Check out on instagram](#)

[Rosalie: MOSAiC School in 52 seconds](#)



[Sam: Play on spotify](#)

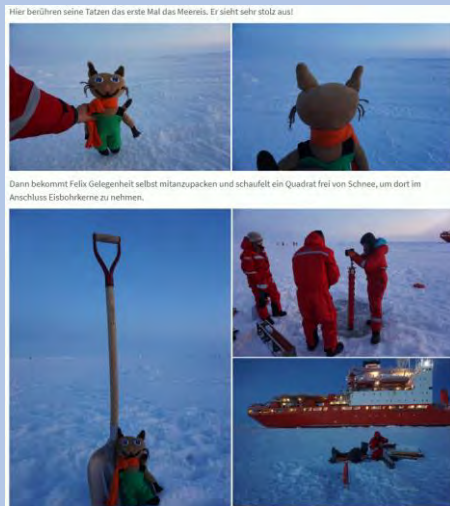


Anika & Felix - #felixerkundetdieWelt

Together with “ZukunftWald” foundation

Painting contest >> mascot Felix

Felix joined Anika to learn about the Arctic climate system, equipped with questions from students around **age 10-13**



- **39-day diary** of their journey to the Arctic (aboard Akadmeik Fedorov, MOSAiC leg 1a)
- **Advent calendar**, answering 24 questions about ice, snow, daylight, polar bears, ship life, and many more...

<https://www.zukunftwald.de/felixerkundetdieWelt/> (in German)



Francesca – classroom experiments



Francesca wants to equip the students with **tools to answer big questions** on climate change themselves, by organizing fun hands-on experiments

Directed towards students of **age 14-18**

Worksheets freely available in Italian, English, and German & experiments are easily replicable at home (some DIY for lockdown times)

- 1) prepare
- 2) observe
- 3) analyze
- 4) interpret



Contact
Francesca

Experiment: Oceans acidification

Experiment: Ices melting

Experiment: Thermal Expansion

Experiment: Thermohaline circulation

Experiment: Albedo feedback

Time (hh:mm:ss) | Temperature W (°C) | Temperature D (°C)

Time (hh:mm:ss)	Temperature W (°C)	Temperature D (°C)
START:		
+2min:		
+4min:		
+6min:		
+8min:		
+10min:		
+12min:		
+14min:		
+16min:		

3) Analysis: Draw in a graph the temperatures in the two glasses (y axis) versus time (x axis). In which glass the water warms up more quickly?

4) Interpretation: 1. What is represented in the glass covered by the cardboard and in the one uncovered? Which of the two systems warm up more quickly? 2. Interpret the results: What happens in the Arctic when sea ice melts, uncovering the dark ocean?



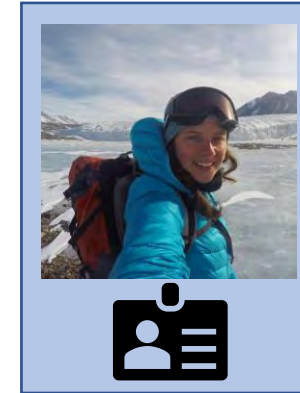
Carrie – science and outdoor skills



Science & adventure education for girls

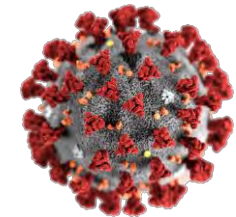
- age 11-16
- lab coat
- science
- adventure skills

Girls **aged 11-16** are reporting less confidence and interest in science. Teaching science and adventure skills in tandem will broaden their perspective on what a scientist looks like.

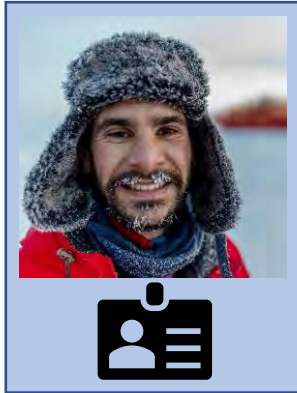


Collaborating with **Girl Scout** leaders in her home country (USA)

Currently halted but Carrie continues to **virtually speak** to school groups
https://www.youtube.com/watch?v=Kmduf3_BQck&t=70s



Pierre – “éTer(re)nelle”

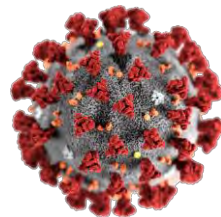


Pierre started discovering fascinating Arctic research together with a large group of students (**age 13-15**) already since 2018.

Drafting an **illustrated book** with educational purpose (in a humorous way)

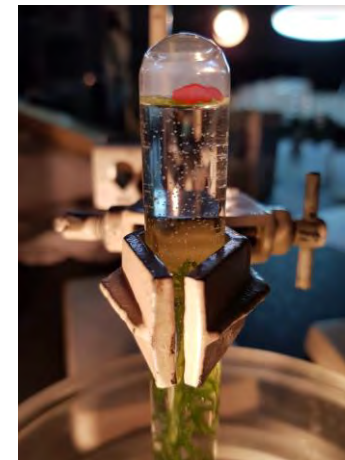
Story about Gump, who is discovering polar research & global warming from hands-on **experiments**,...

Project currently put on ice



Pierre summarizing the story written
by the students of éTer(re)nelle

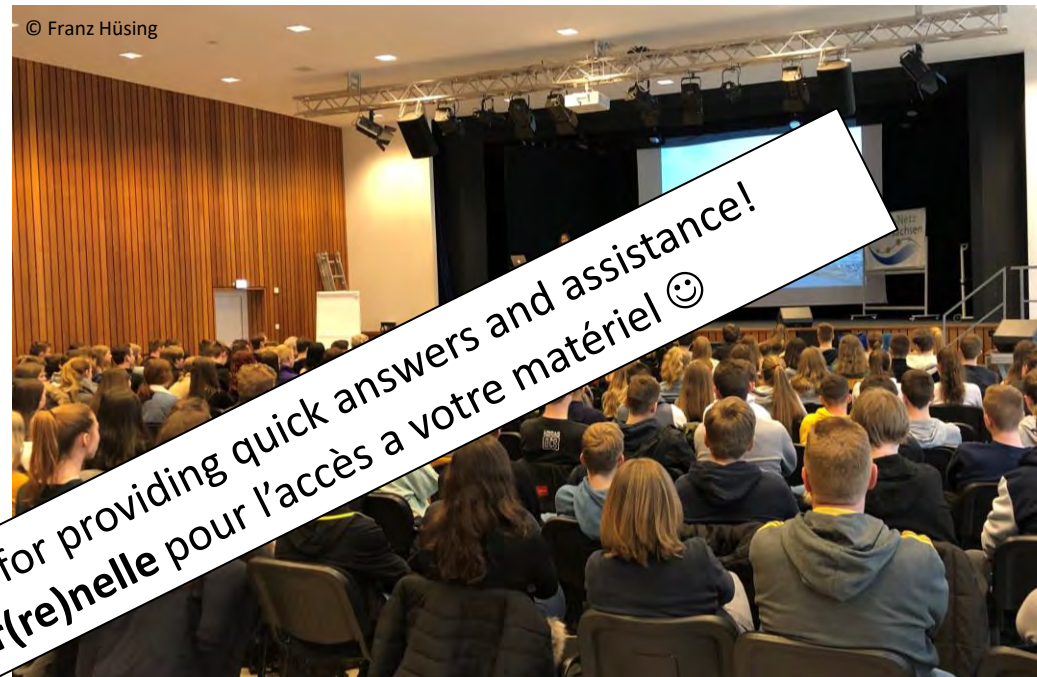
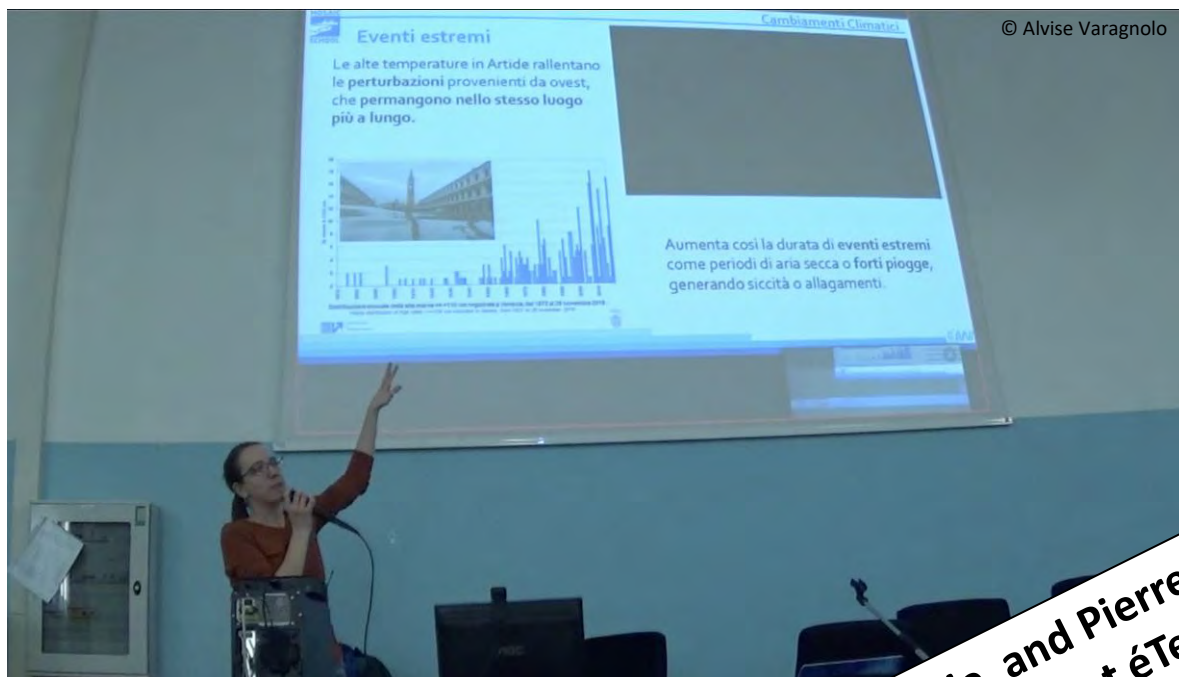
“It is about a rich person, called Gump, who wants to buy Greenland because there is oil. Because of a volcano eruption in Iceland, planes are grounded, and he then jumps on his yacht and sets sail to Greenland. Suddenly, he hits an iceberg and his yacht sinks. He starts drifting in the Arctic and gets rescued by scientists. These researchers are part of a drifting expedition in the Arctic Ocean, MOSAiC. Once aboard he starts to learn about how climate science is done, the effects of climate change in the Arctic and globally, and **starts changing his mind...**”



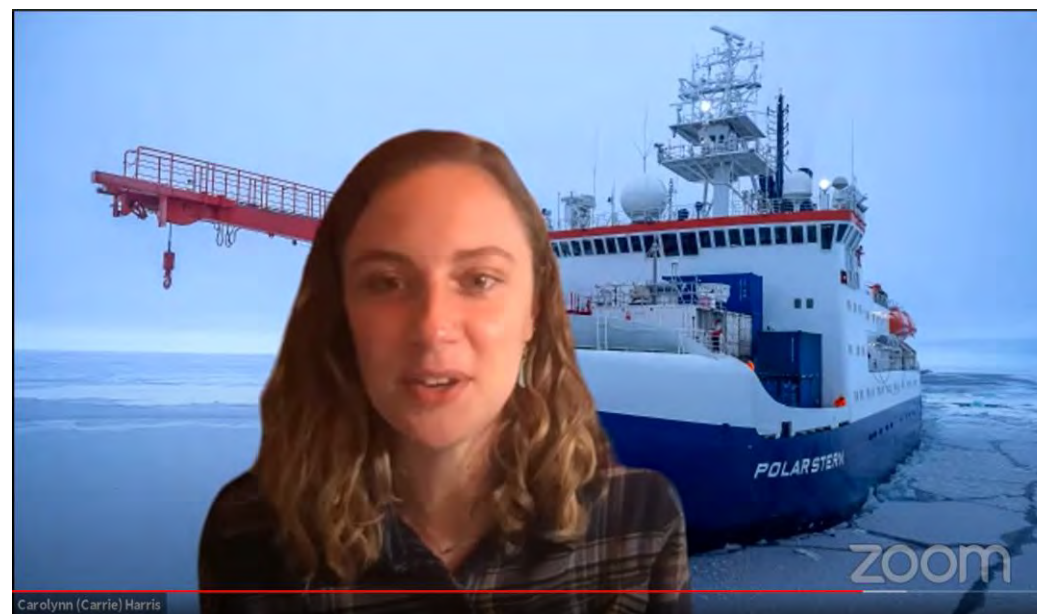
Chapitre 1+

	Situation/divers	A l'image	Dit par les personnages
scène 1	bureau de gump 	Il joue avec la terre (en ballon) (chaplin) 	





Thanks to Anika, Francesca, Carrie, and Pierre for providing quick answers and assistance!
Un grand merci aux élèves du projet éTer(re)nelle pour l'accès à votre matériel 😊



APECS – MOSAiC Ambassadors' projects



ASSOCIATION OF POLAR EARLY CAREER SCIENTISTS

[v](#) [in](#) [@](#) [t](#) [f](#)


APECS Home WHO WE ARE GET INVOLVED NEWS EVENTS CAREER RESOURCES MENTORS RESEARCH **OUTREACH**

Home / OUTREACH / MOSAiC School Outreach / MOSAiC Ambassadors' Projects

MOSAiC Ambassadors' Projects

Twenty highly enthusiastic, and through the MOSAiC School 2019 well trained early career polar researchers will engage with public outreach and science communication during the full year of the MOSAiC project. Please see their projects here!

You can follow their activities along on a special MOSAiC Ambassadors' Journal twitter channel moderated by MOSAiC School 2019 participant Marylou Athanase.




MOSAiC School 2019 (Photo credits to Dave Costa, CIRES)

Neil Aellen

Lectures with experiments in a museum and media interviews


Neil is giving regular public lectures at the Museum focusTerra of the Dpt. of Earth Sciences including physical



Marylou Athanase

MOSAiC Ambassadors Journal on Twitter & school workshops

The MOSAiC Ambassadors Journal twitter channel (@MOSAiC_embassy) aims to share regular updates on all MOSAiC-related outreach



OUTREACH

- Outreach Events
 - International Polar Week
 - Antarctica Day
 - International Mountain Day
- MOSAiC School Outreach
 - FrostBytes
 - Blogs
 - Polar Outreach Resources

<https://www.apecs.is/outreach/mosaic-school-outreach/mosaic-ambassadors-projects.html>



MOSAiC Ambassador activities

Ambassador projects



- Outreach from us
- Description of realized and planned outreach activity

MOSAiC school 2019



- School programme
- Personal background of all ambassadors
- Educators and lecturers

MOSAiC Embassy



- @MOSAiC_embassy
- Recent outreach activity related to MOSAiC
- Link to ambassadors

Facebook



- News from during MOSAiC School
- Link to ambassadors

Ctrl+click on the icons

- MOSAiC [homepage](#)
- Social media MOSAiC ([Twitter](#), [Instagram](#))
- Social media APECS ([Twitter](#), [Facebook](#), [Instagram](#))
- Social media ARICE ([Twitter](#), [Facebook](#))



**MOSAiC
Ambassadors' Journal**

Concepts for Polar Teaching in Germany



Rainer Lehmann
(Polar Educators Germany)



Polar Educators Germany

German Society for Polar Research



Concepts for polar teaching in Germany

Rainer Lehmann

ak-polarlehrer@polarforschung.de

<https://www.polarforschung.de/arbeitskreise/ak-polarlehrer/>

<https://www.polarforschung.de/>

Networking

Scientists

- all specialisations



Bundesanstalt für
Geowissenschaften
und Rohstoffe



Universität
Rostock



Traditio et Innovatio



Polar Educators Germany

- all school types
- all school subjects

Educator participation



Expeditions



Involving the students



Educator participation



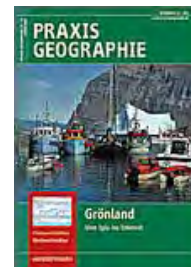
Workshops
Advanced training



Conferences
Presentations



Publications
Newsletter



Educator participation activities



Example **ANDRILL**

From science in Antarctica
to the classrooms

Rainer Lehmann

2007



Drill site



Core tour



Thin sections



Curators



XRF-Scanning



Outreach

→ active participation in
different working groups



Educator participation results

Example **ANDRILL**

From science in Antarctica to the classrooms

LEHMANN, R. & MAY, I. 2013:
Polargebiete.- In der Reihe: Themenhefte
Erdkunde – Landschaftszonen der Erde
entdecken. Verlag an der Ruhr, 48 Seiten.



Cooler Steine
Naturräumliche G

Gesteine können
Gesteine an der Erd-
kanten von Wetter
sie sich verändern.
witterung. Besond-
zu und führt zur Ze-
kleineren Gesteins-
Gebirge bis ins Meer
als Steine, Sand od-
abgelagert.

Erzählungen

Wenn nun, oftmals
Gesteinsmaterial
das wie ein Buch, i-
genheit gelangt. D-
der die Information
So weiß er z.B., un-
Gesteinsgrößen ab-
mig, stammen die
in dem das Eis die
Das Klima war zur
dige Ablagerungen
da sie durch Flüsse
witterten Steine in
gelagert, war das K-
Bohrer der Wissensc-
einen Bohrkern (G-
Altersbestimmung
weltbedingungen in
zurückverfolgen un-
ablesen.

Cooler St
Naturräumlich

- Aufgaben**
1. Erkläre dein „Steine kön-“
 2. Formuliere e-
Worten Zusä-
rungen als B-
bezeichnet
 3. Stelle dir vo-
im antarktischen
und sollst n-
- a) Die Tabel-
des Bohr-
leer. Bere-
Angaben
und zur D-
- b) Fertige n-
Im Origin-
Zeichnung
abbilden
des Kerns
Realität &
Zeichne d-
Schichten
der Tabel-

Tiefe der Schicht [m]
695,2–695,9
695,9–696,3
696,3–696,8
696,8–703,1
703,1–703,9
703,9–704,2
704,2–709,9
709,9–711,3
711,3–714,4
714,4–715,2

Legende für dein
[]

Lösungen

Cooler Steine → S.

Aufgabe 3a-d:

Tiefe [m]	Dicke [m]
695,2–695,9	0,7
695,9–696,3	0,4
696,3–696,8	0,5
696,8–703,1	6,3
703,1–703,9	0,8
703,9–704,2	0,3
704,2–709,9	5,7
709,9–711,3	1,4
711,3–714,4	3,1
714,4–715,2	0,8

3a: Gletscherablagerungen b-
ablagerungen kaltes und Meer
Das Klima wechselte im gesamt
immer wieder. Die Zeiträume
mit sehr kaltem Klima, sind a-
Jahre ein, die Phasen mit kal-
28500 Jahre und diejenigen (a-
rungen) 31000 Jahre. Das Kl-
benen Zeitraum vorwiegend s-
wärmere Phasen. Weitere Er-
benötigen für die gleiche Dicke
Ablagerungszeitraum als Glet-

Cooler Skelette → S

Aufgabe 3:
Art A → Schichten mit Glets-
Art B → Schichten mit Fluss-
Art C → Schichten mit Meer-
Als Begründung ist die Verkn-

Polarforscher erkun-

Aufgabe 1:
An den Rändern steht ausschließ-

Aufgabe 3:
Ausschließlich Norden. Steht man direkt auf dem Südpol, gibt
es kein Osten oder Westen, denn wenn ich geradeaus, nach rechts
oder links schaue und auch wenn ich mich umdrehe, blicke ich
immer nach Norden. Und ein „weiter-Südlich“ gibt es gar nicht.



DIE BOHRKERNE
aus der Antarktis verstehen

ANDRILL ist ein internationales geologisches
Bohrprogramm, dessen Ziel es ist, tief in die
Sedimentablagerungen rund um die Antarktis
vorzudringen, um die dynamische Vergangenheit
und die Zukunft des globalen Klimas besser zu
verstehen. Die Eigenschaften der Sedimente und
die darin erhaltenen Fossilien geben Hinweise auf
frühere Umweltveränderungen in der Antarktis.



APECS cooperation



Example Buoy Project:
From Polarstern into the
classrooms

Stefanie Arndt, AWI
2017-19

<https://www.meereisportal.de/archiv/2020-kurzmeldungen-gesamttexte/das-bojenpatenschafts-projekt-geht-nach-ueber-zweieinhalb-jahren-zu-ende/>



Bojen-Paten-Urkunde

Herzlichen Glückwunsch, Karla,
dein Bild ist nun auf der Reise
mit den Pinguinen!

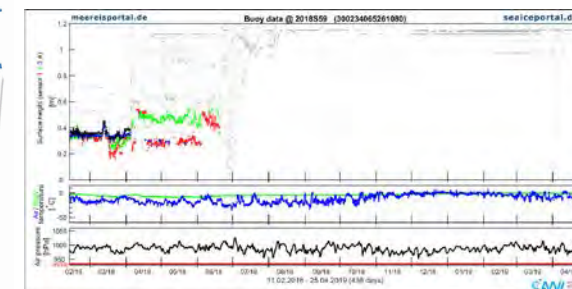
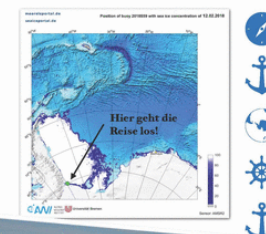
Mit was für einer Boje?
Schneeboje

Seit wann?
11.02.2018, 12:45 Uhr (UTC)

Wo ging die Reise los?
74°59.226'S / 59°37.103'W

Wie dick ist das Eis?
1.80 m

Und der Schnee?
33 cm



meereisportal.de
seaceportal.de
Position of buoy 2018M11 with sea ice concentration of 27.11.2019

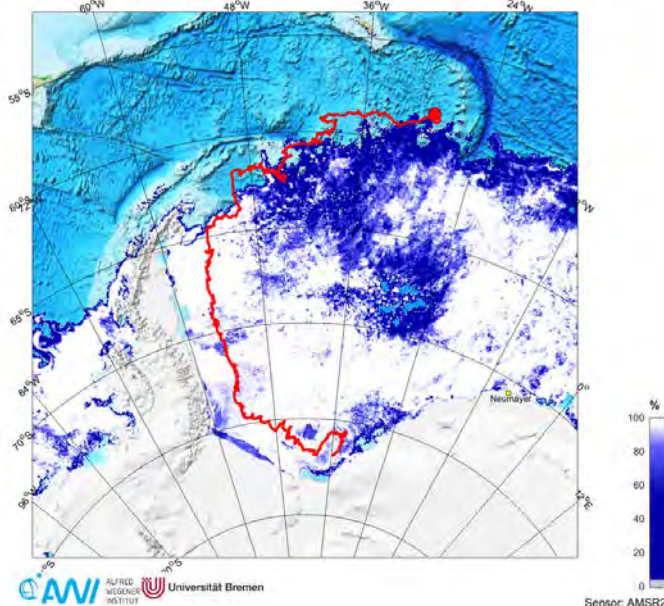


Foto: M. Nicolaus

<https://www.meereisportal.de/archiv/2017-kurzmeldungen-gesamttexte/openship/>



Polar Educators Germany

German Society for Polar Research



Concepts for polar teaching in Germany

One current project is MOSAiC
Thank you for your attention

Rainer Lehmann

ak-polarlehrer@polarforschung.de

<https://www.polarforschung.de/arbeitskreise/ak-polarlehrer/>

<https://www.polarforschung.de/>

MOSAiC Teaching Materials



Friederike Krüger
(IGS Bothfeld)





@Mario Hoppman

MOSAiC-Expedition Educational work

Friederike Krüger
teacher at IGS Bothfeld (Germany)
contact: friederike.krueger@igs-bothfeld.org
instagram: fkruegr



Source & Copyright:
CAFF - Conservation of Arctic Flora and Fauna



ALFRED-WEGENER-INSTITUT
HELMHOLTZ-ZENTRUM FÜR POLAR-
UND MEERESFORSCHUNG

Niedersächsisches
Kultusministerium



Questions of students and public interest, that are discussed in the school material during MOSAiC

- How does climate change effect the Arctic?
- What is MOSAiC about?
- Who owns the Arctic?
- What are the scientists doing in the Arctic?
- What is life like on board?
- How do they measure ice thickness?
- How do they read coordinates?



www.mosaic-expedition.org/education



Deutsche Gesellschaft für
Polarforschung e.V.

<https://polarforschung.de/arbeitskreise/ak-polarlehrer/>

Example of material: What are the scientists doing in the Arctic?

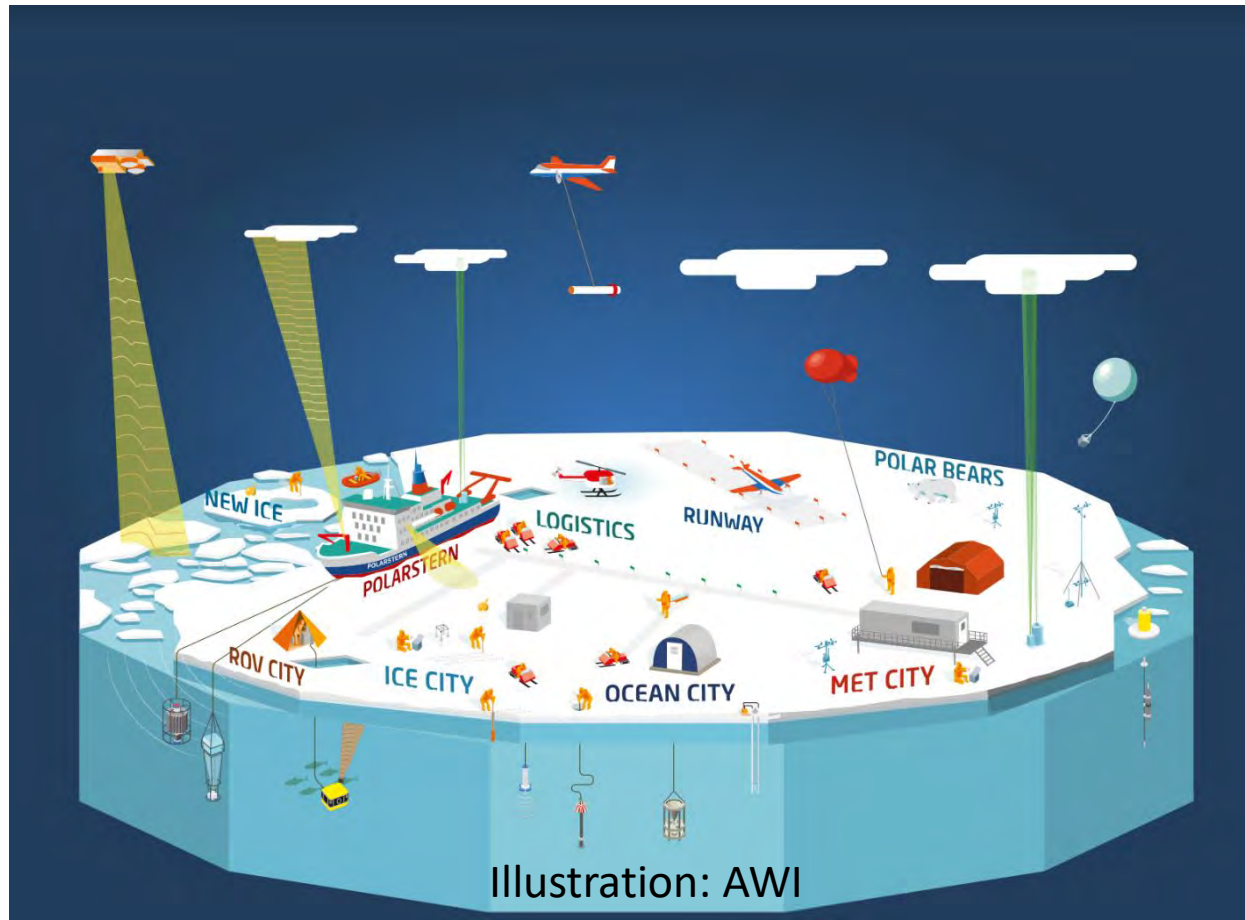


Illustration: AWI



Autonomous Ocean Flux Buoy (mit Pycnocline Spar)



Aufbauzeit:
8-10 Stunden auf dem Eis

Weight:
260 Kilogramm

Stellfläche:
1 Meter

Entfernung zu anderen Instrumenten:
30 Meter

Kosten:
EUR € 80,000

Herausforderungen:
Diese Instrumente sind handgefertigt, komplex und schwer zu handhaben, sie überstehen jedoch sehr gut die eisigen Bedingungen.

Wie werden AOFBs installiert?
Zuerst wird ein 0,5 m breites Loch in das Eis gebohrt. Dann wird ein Stativ mit einer Handkurbelwinde aufgestellt. Dies hält das Gewicht des Instruments. Nun wird ein Kabel am Instrument befestigt und an diesem etliche Sensoren. Das Kabel verbindet die Sensoren mit der Schwimmboje, die auf dem Meereis liegt. Langsam wird das Kabel ins Wasser hinabgelassen. Schließlich wird die Boje über dem Loch in Position gebracht. Kleine Solarmodule und eine Windturbine liefern zusätzliche elektrische Energie für das Instrument.

Welche Parameter werden aufgezeichnet?
Das AOFB misst Wassertemperatur, Salzgehalt und Strömungen, um zu bestimmen, wie sich Wärme und Salz in den 3 Metern unter dem Eis innerhalb der Wassersäule vermischen. Es misst auch Chlorophyll-A (ein Indikator für die Photosynthese) und Trübung (Finsterkeit im Wasser). Ein Höhenmesser prallt vom Boden des Meereises ab, um die Eisschmelze zu messen. Die Ströme werden mit einem ADCP Profiler bis zu einer Tiefe von etwa 80 Metern

Fotos: Katie Gavenus

Welche Parameter werden aufgezeichnet?

Das AOFB misst Wassertemperatur, Salzgehalt und Strömungen, um zu bestimmen, wie sich Wärme und Salz in den 3 Metern unter dem Eis innerhalb der Wassersäule vermischen. Es misst auch Chlorophyll-A (ein Indikator für die Photosynthese) und Trübung (Finsterkeit im Wasser). Ein Höhenmesser prallt vom Boden des Meereises ab, um die Eisschmelze zu messen. Die Ströme werden mit einem ADCP Profiler bis zu einer Tiefe von etwa 80 Metern

Further outreach products and educational work

- about 20 Lectures in schools for single classes and up to 500 students
- about 15 Lectures in museums, zoos, public institutions, clubs, publisher's etc.

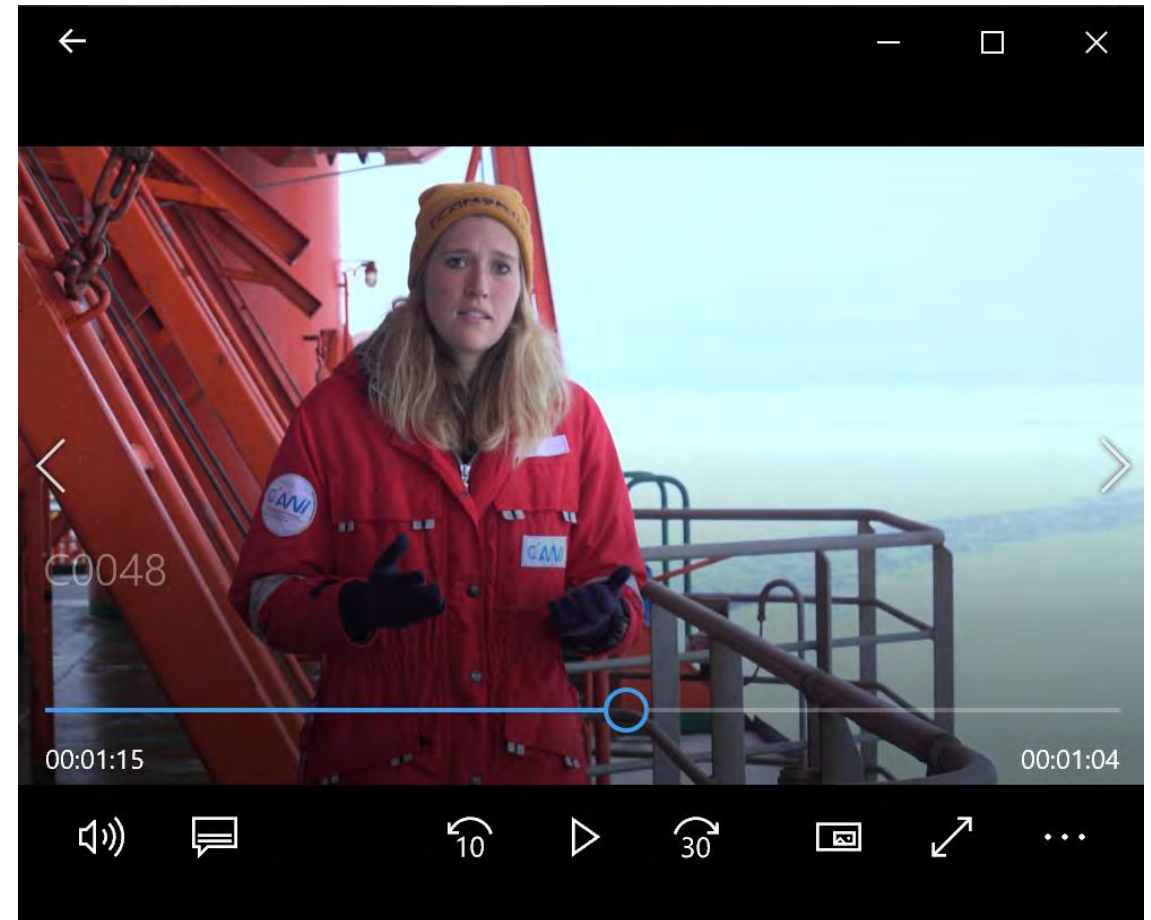


@Friederike Krüger



therefore AWI
provides me with
different original
objects

- 10-minutes-documentation about MOSAiC for schools
 - soon at mosaic-expedition.org
- Different publications
- Media work (radio, newspaper, social media)



working together with Landesmuseum Hannover and Leibniz University Hannover

- educating children and adults in the Landesmuseum Hannover about Climate Change and MOSAiC
- educating future teachers at the university about MOSAiC-related topics in lectures and seminars



Climate Physics in Experiments



Falk Ebert
(Herder Highschool)



Falk Ebert
Herder High School
Berlin Germany

HERDER

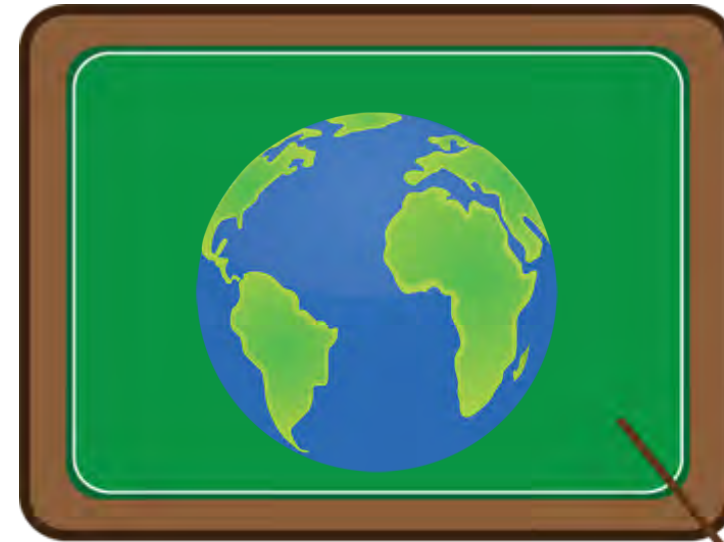
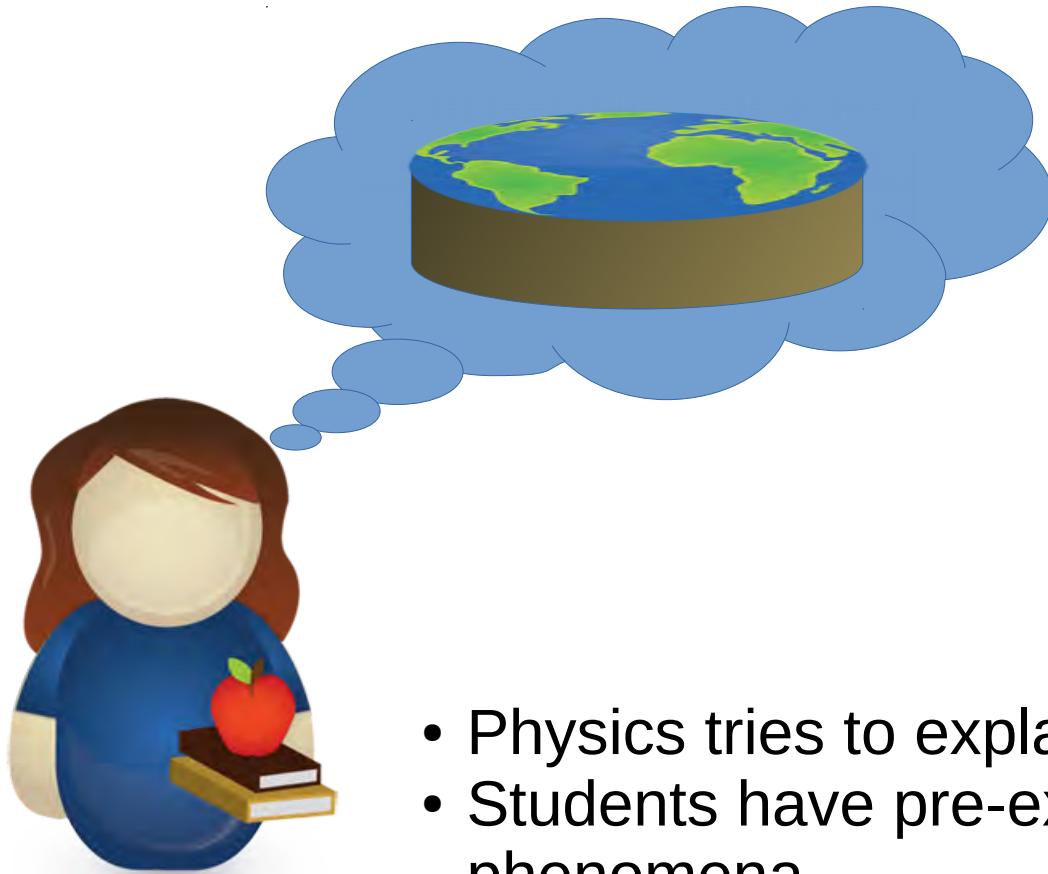


Falk Ebert



Jan Rohde

Understanding (climate) physics



- Physics tries to explain the physical world.
- Students have pre-existing notions of many phenomena.
- Educators need to „bend“ these notions.

Understanding (climate) physics

climate hysteria

fake data

CO₂ is a
natural gas

media hype

Greta marketing

green propaganda



Adobe stock

- Everybody has pre-existing notions about climate effects
- often wrong
- often counterintuitive

There is so little CO₂ in the atmosphere?
How can it have an effect?

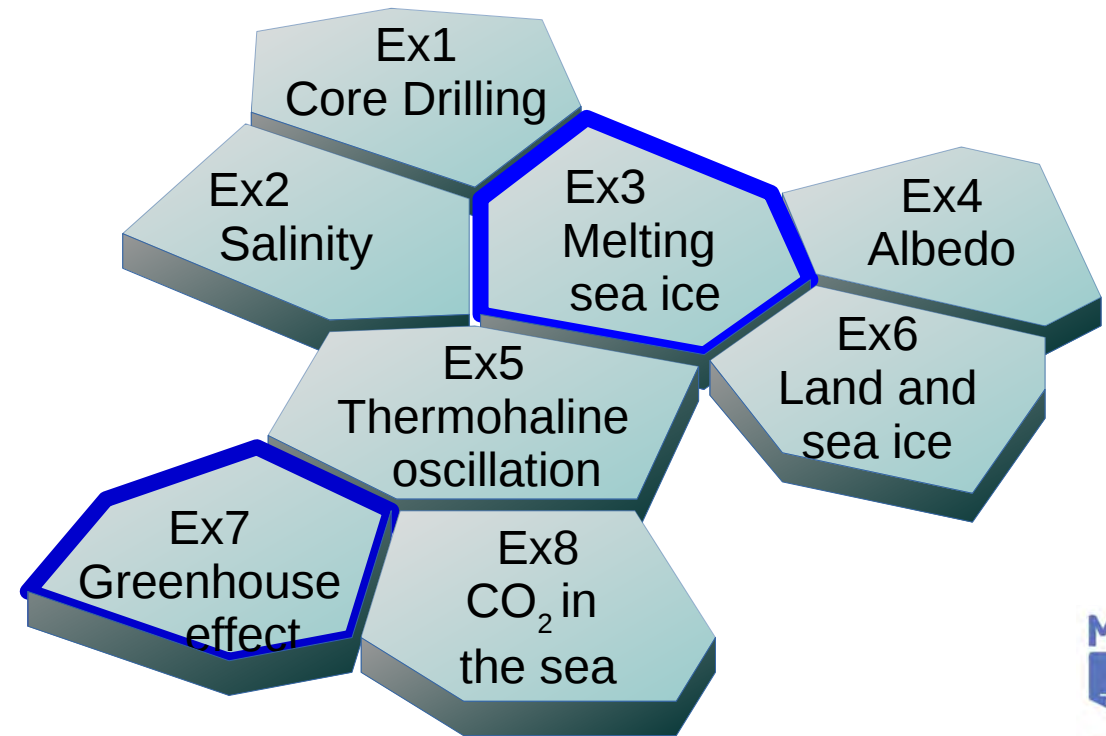
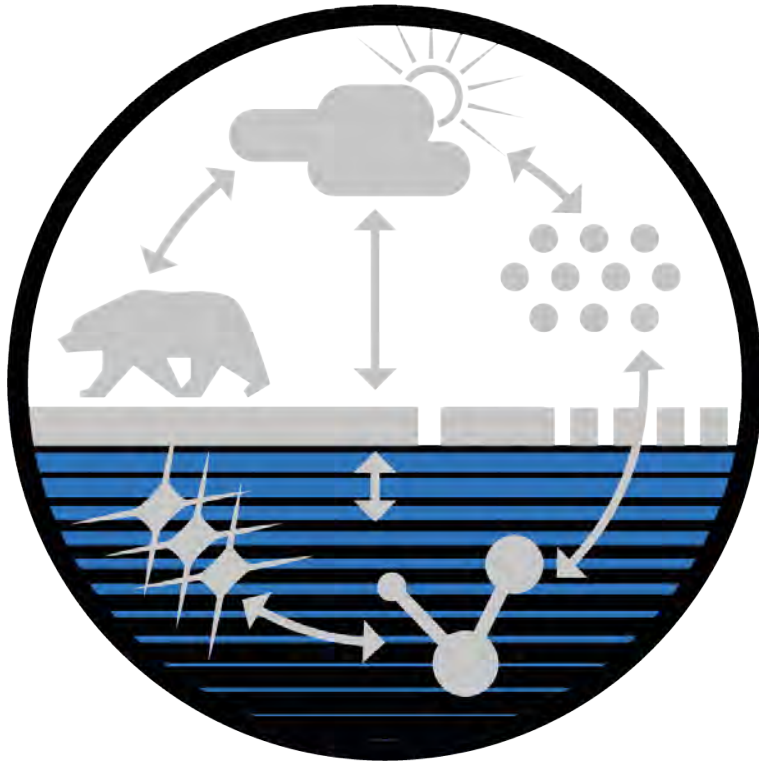
CO₂ is transparent. Why does it absorb
infrared light?

It is easier to dissolve salt in warm water. Thus,
CO₂ should dissolve better in warm water too.



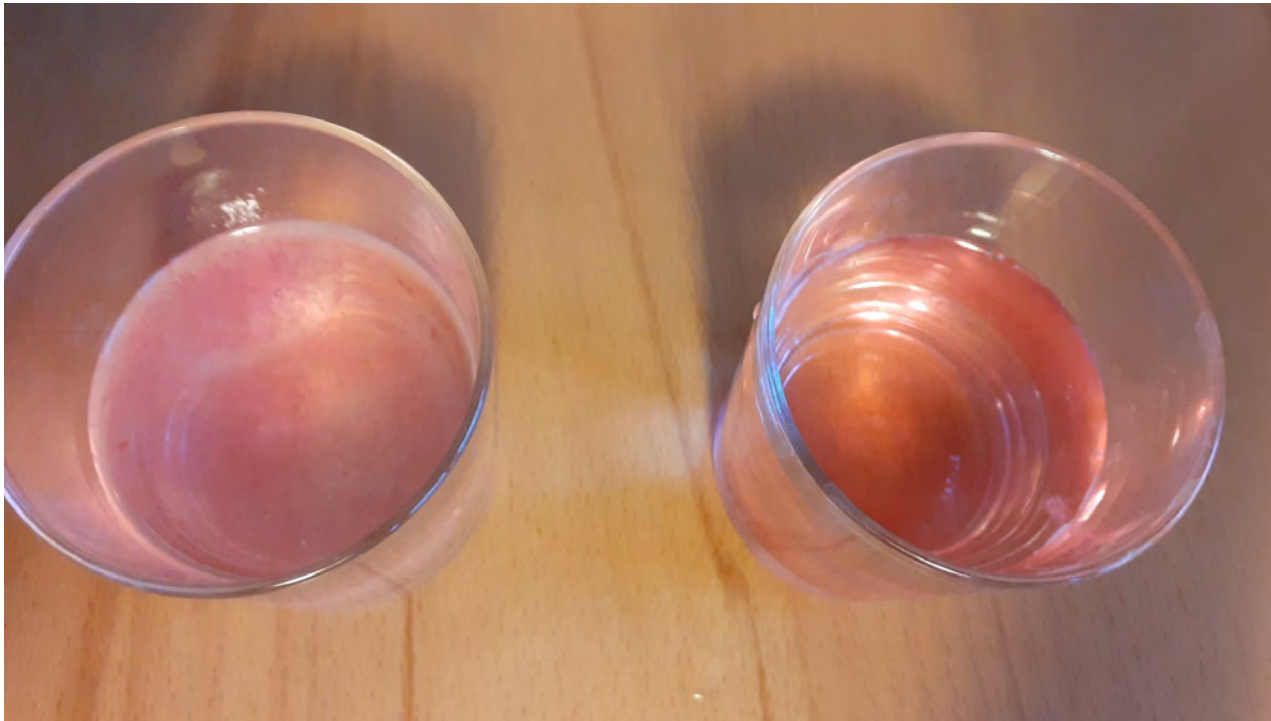
Interconnected effects

- Experiments provide cognitive conflict
- Possibility to adapt previous misconceptions



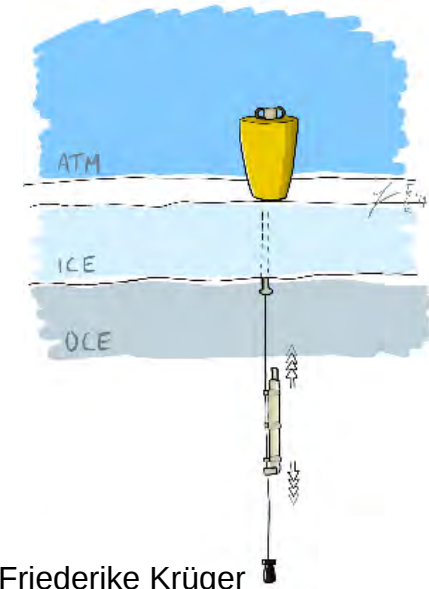
Melting sea ice

- Put two ice cubes into fresh and salt water.
- Which will melt first?
- Use coloring for more effect.



But doesn't salt
make ice melt faster?

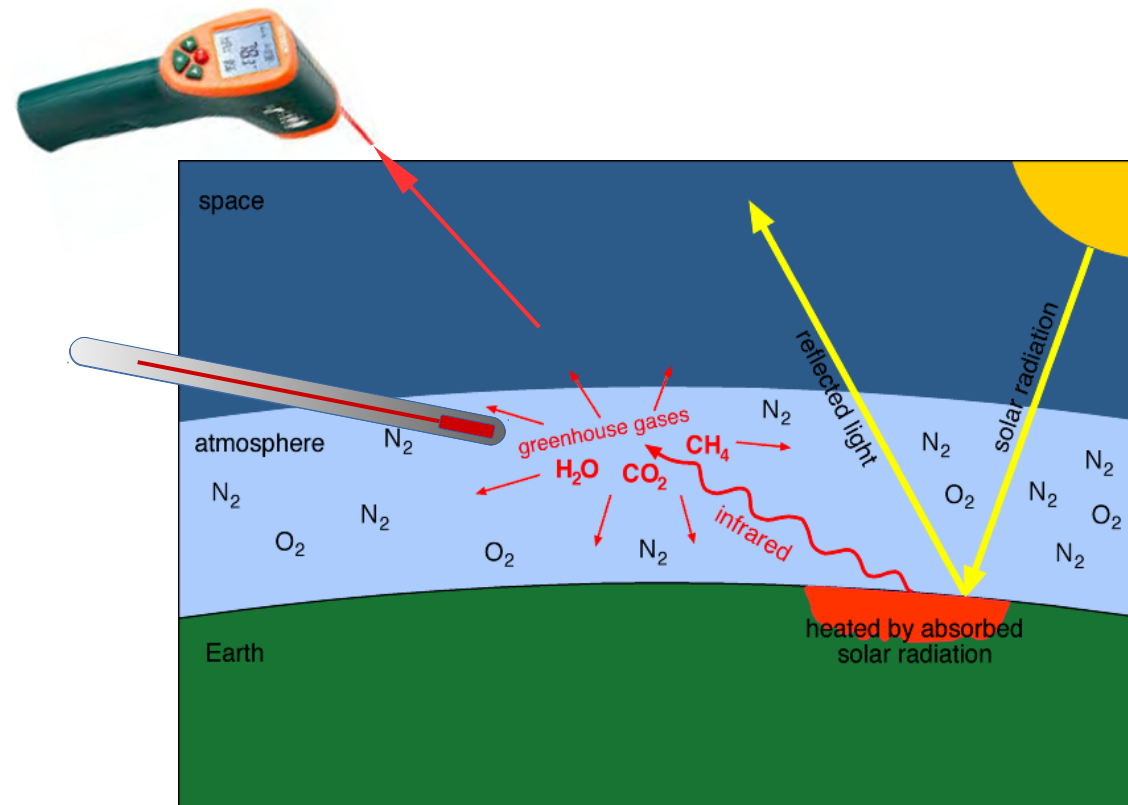
- formation of layers
- exchange of heat
- buoyancy



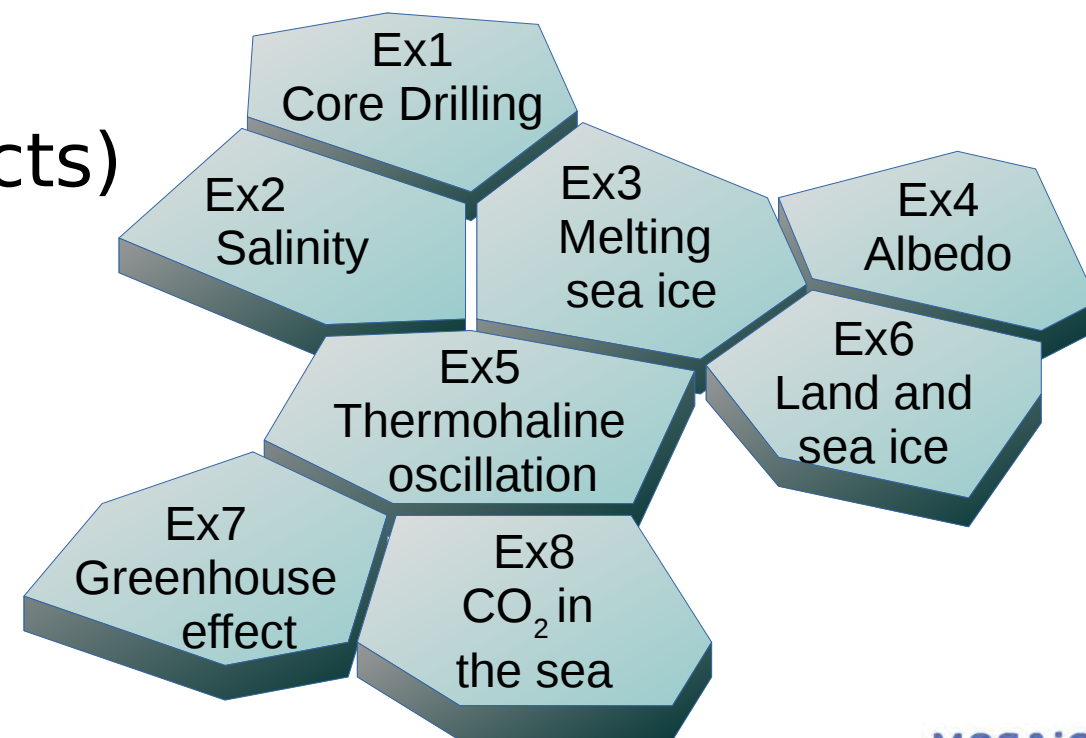
Greenhouse effect

- two bottles (1/3 full) with plain/sparkling water
- heating lamp for 10min
- compare temperature inside

Hotter or colder?

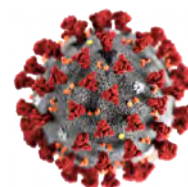


- Basic effects with simple materials
- Results need to be discussed
- Often exaggeration necessary
(otherwise too long or too small effects)
- Interdependence of phenomena
+ scientific areas



So far:

- set of 8 experiments (introductory text, complete setup, questions, cross-references)
- tested with students aged 10-16
- integrated into curriculum
- ~~presentation in school network~~
- ~~presentation in DPG~~
- possible publication



HERDER



BERLINER
NETZWERK

mathematisch-
naturwissenschaftlich
profilierter Schulen

Φ DPG

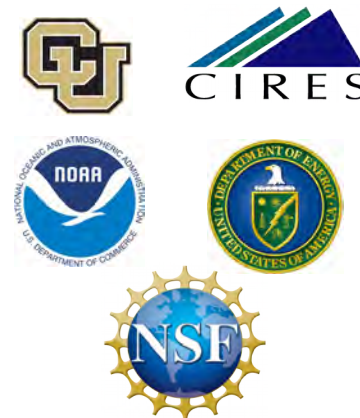


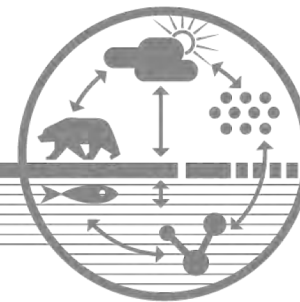
MOSAiC US

Education & Outreach

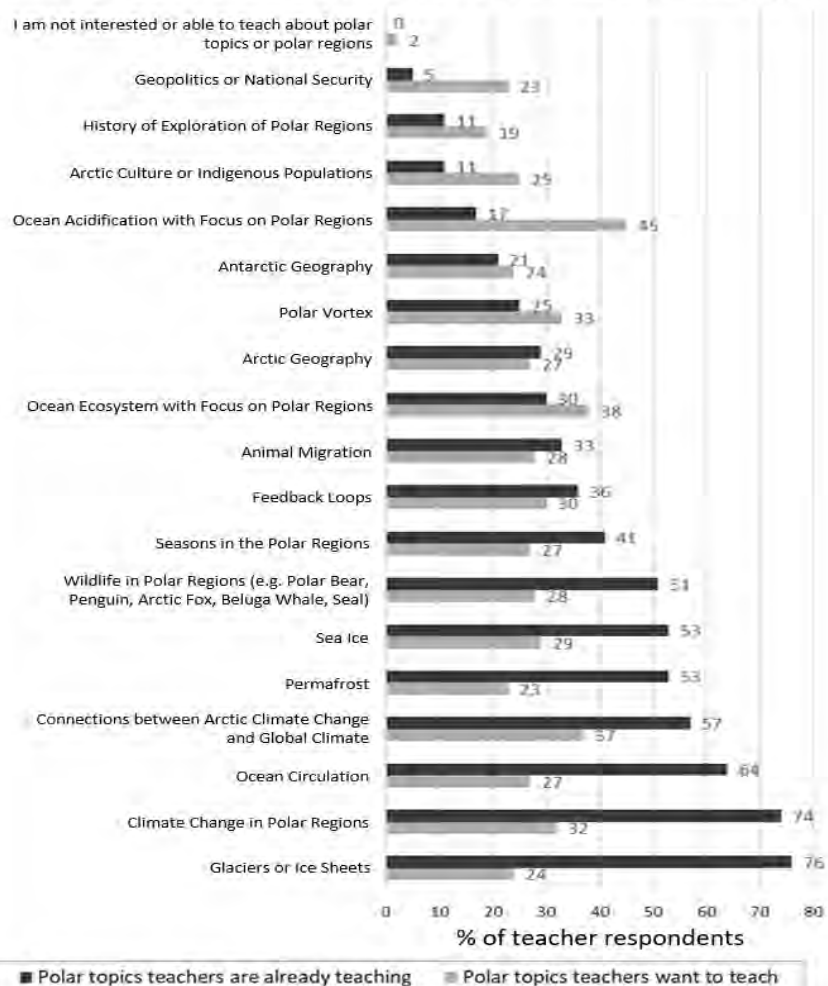


Anne Gold
Lynne Harden, Jonathan Griffith,
Katja Schloesser



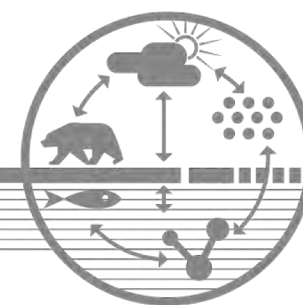


Polar topics in the classroom (% of teacher respondents)



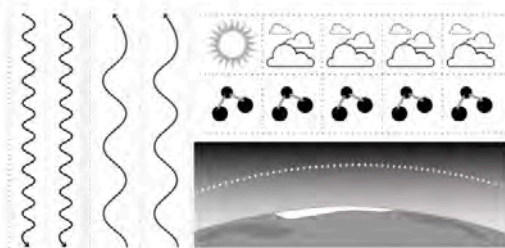
What do educators need?

- Classroom activities/lesson plans -- 84%
- Data on polar regions for students -- 80%
- Video or multimedia resources (67%)
- Professional development training (56%)

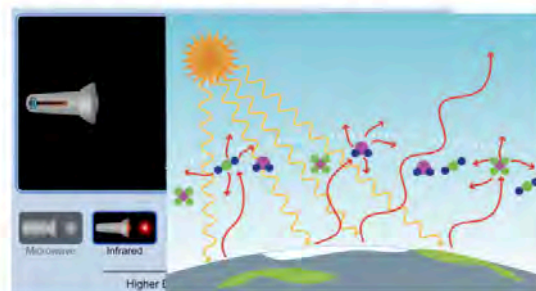


Anchoring Phenomenon: Why might the Arctic be warming twice as fast as the rest of the world?

1. Earth's energy budget



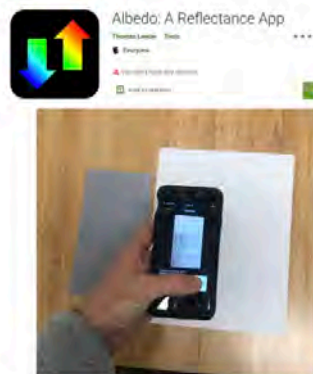
2. Greenhouse Effect



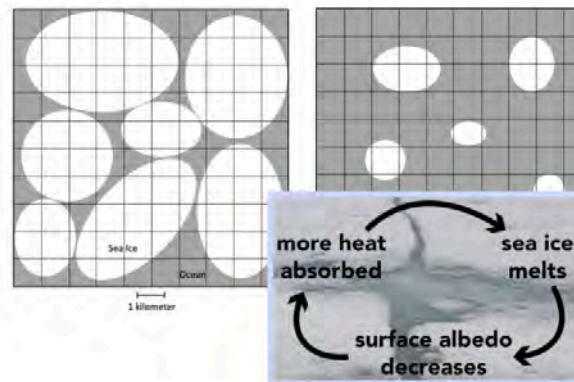
3. MOSAiC Distributed Network in VR



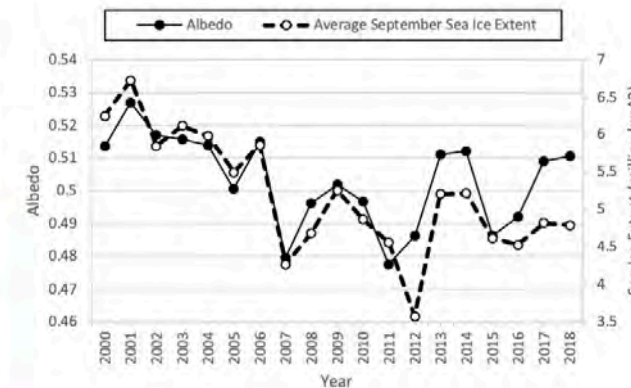
4. Albedo Reflectance App

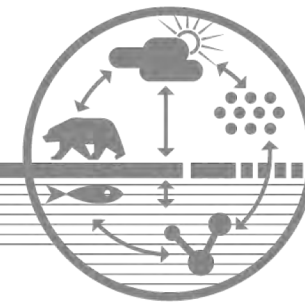


5. Ice-Albedo Feedback



6. Real-Time Arctic Data





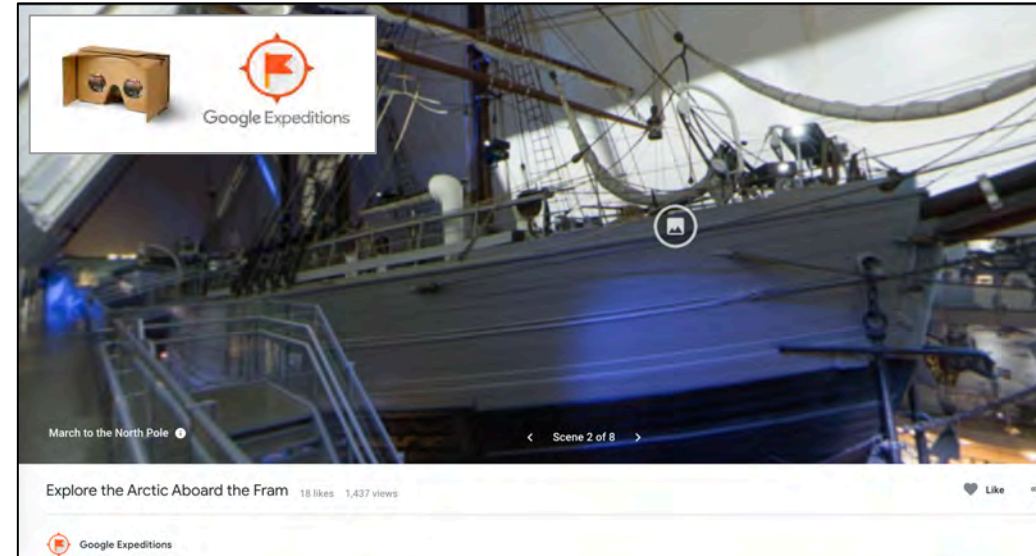
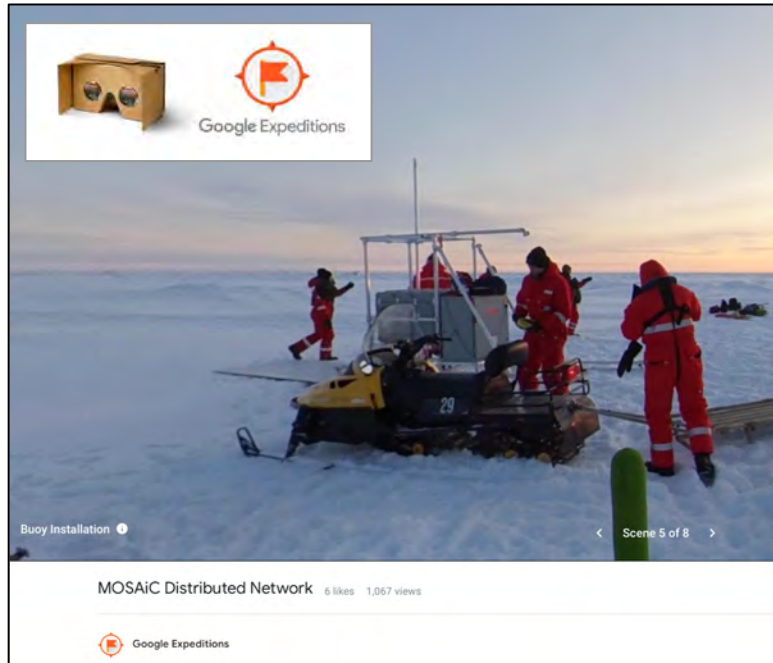
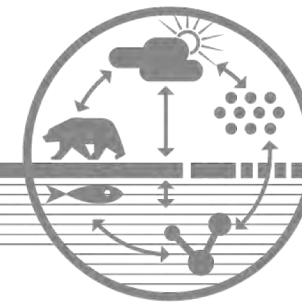
Anchoring Phenomenon: How have motivations, methods, technologies, and our knowledge of the Arctic changed over the past 125 years?



Photo: National Library of Norway



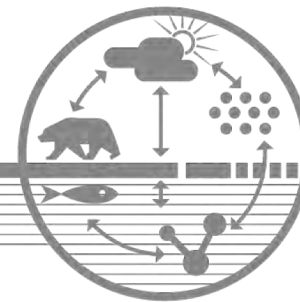
Photo: Stefan Hendricks



Explore the Arctic Aboard the Fram:
<https://poly.google.com/view/6UdZ-VJScpL>

MOSAiC Distributed Network:
<https://poly.google.com/view/belkmpdxevd>





MOSAiC Monday

Weekly updates from the Arctic



Mar 9, 2020 This week: The atmosphere, part 3; Photo credit: AWI

The Atmosphere, Part 3

Cloudy with a Chance of Science



The MOSAIC Atmosphere Team is particularly interested in studying clouds in the Arctic. Why is this? Clouds play an important role in weather and climate, and the focus of MOSAIC is all about studying the Arctic climate system. Scientists also don't fully understand what Arctic clouds are made up of since getting into the field to study them directly is so difficult. Also, climate models have trouble accurately representing clouds since the droplets and crystals that make up clouds are so tiny and the geographic areas and processes that climate models represent are so large. Imagine trying to accurately draw a picture of a tree and all of the cells that make it up, both to scale! This week, we're looking to the sky to learn more about clouds and what kind of role they might play in the Arctic climate system.

Learn more about MOSAIC atmospheric research and meet members of Team Atmosphere

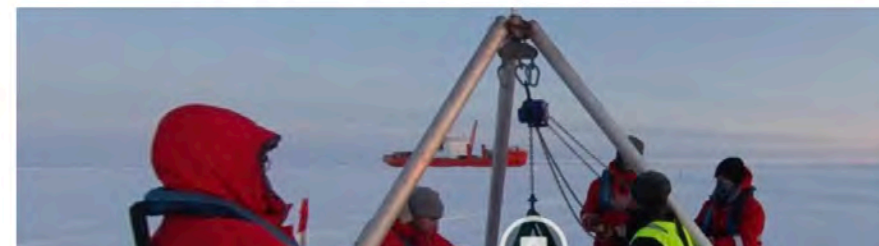
Why do climate models have trouble with clouds, and is there a solution?

Postcards from the Arctic Ice

Education & Outreach News from the **MOSAiC** Expedition

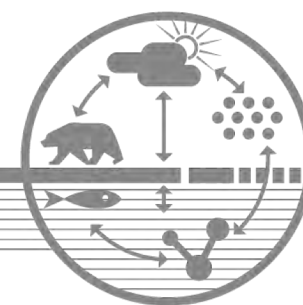


The Latest With MOSAiC!



Sign up for MM newsletter:
<http://bit.ly/MOSAiCMonday>

MM Homepage:
<https://mosaic.colorado.edu/education/mosaic-mondays>



University of Colorado Boulder

A Year in the Ice


MOSAIC: Multidisciplinary Drifting Observatory for the Study of Arctic Climate

Home About News People Education Blogs Partners MOSAIC Monday

Remote, online, and at-home polar learning resources

Remote, online, and at-home polar learning resources

Do you have resources you'd like us to add to the list below, or is there something in particular you are looking for?
Email us at mosaic@colorado.edu!



1. Videos and other multimedia

Frozen in the Ice: Exploring the Arctic MOSAIC MOOC now on Coursera!

Created by the University of Colorado Boulder in partnership with the Alfred Wegener Institute and with funding from the National Science Foundation, *Frozen in the Ice: Exploring the Arctic* is a new massive open online course (MOOC) about the MOSAIC expedition. The course features 50 videos from MOSAIC scientists and Arctic experts on topics ranging from the behavior of sea ice, to Arctic clouds, to how climate change is impacting Arctic indigenous peoples. All videos are available for **free** to everyone, and certificates of completion or graduate credits (coming soon) can be obtained for a small fee.

[Go to the course on Coursera](#)

[Watch all of the course videos on YouTube](#)

MOSAIC and Arctic video collection from CU Boulder

What is it like to be a baker on the *Polarstern*? What changes have we been observing in the Arctic climate system? How do you deploy a buoy in Arctic sea ice? Explore our carefully curated collection of MOSAIC and Arctic-related short videos to learn the answers to these questions and more!

[Go to the CU Boulder MOSAIC and Arctic video collection](#)

MOSAIC Media Center

Browse this continuously-updated and extensive collection of photos from the MOSAIC expedition, courtesy of the Alfred Wegener Institute,

University of Colorado Boulder

A Year in the Ice


MOSAIC: Multidisciplinary Drifting Observatory for the Study of Arctic Climate

Home About News People Education Blogs Partners MOSAIC Monday

Educational Resources

Subject Grade Level Resource Type Search

[Apply](#)



Albedo: measuring the reflective properties of different surfaces

Students measure the albedo and surface temperature of various ice surfaces and changing processes as the ice melts over time. Students apply what they've learned in the experiment to the understanding of albedo, and the role albedo plays in the Earth's energy budget.

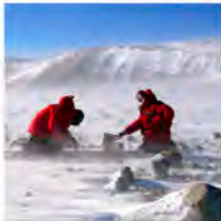
[NGSS Aligned](#) [Lesson plan](#)

Subject: Analyzing and interpreting data, Asking questions, Developing and using models, Earth science, Obtaining and evaluating information, Physical science, Planning investigations, Sea ice

Grade Level: Middle School, High School, University/college

Developer: U.S. Ice Drilling Program

[View Resource](#)



Arctic Climate Curriculum: Do you really want to visit the Arctic?

This jigsaw activity is designed for students to become familiar with several datasets of Arctic weather data, collected in Eureka on Ellesmere Island. Students join a role-playing activity to read and interpret graphs while considering the optimal time to plan a research mission to the Arctic.


[NGSS Aligned](#) [Lesson plan](#)

Subject: Analyzing and interpreting data, Arguing from evidence, Asking questions, Climate, Computational thinking, Constructing explanations, Earth science, Obtaining and evaluating information, Physical science

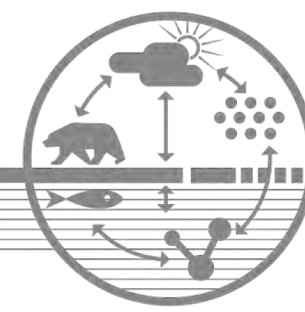
Grade Level: Middle School, High School, University/college

Developer: CIRES

[View Resource](#)



Arctic Climate Curriculum: Exploring Arctic Climate Data



REACH THE WORLD

Journey Home
Logbooks
Field Notes
Journals
Albums

MOSAiC Expedition to the Arctic Ocean

Travelers' Bios

Play GeoGames!

MOSAiC Expedition to the Arctic Ocean

Current Location

University of Colorado, Boulder, Colorado
Join the most extensive Central Arctic research expedition in history! Connect with MOSAIC's international team of researchers, as they return from the top of the globe and share their experiences.

Logbooks

A Typical Week Aboard Polarstern
Engineer Dave Costa spent almost four months aboard Polarstern during Leg I of the MOSAIC Expedition. Find out how a typical week aboard Polarstern differs from a typical week in most other places!

Journals

Drones Above the Ice
I'm Dr. Radiance Calmer, and I am part of a team that conducts atmospheric science using unmanned aerial systems (UAS)—otherwise known as drones. Let's see what these drones can do!

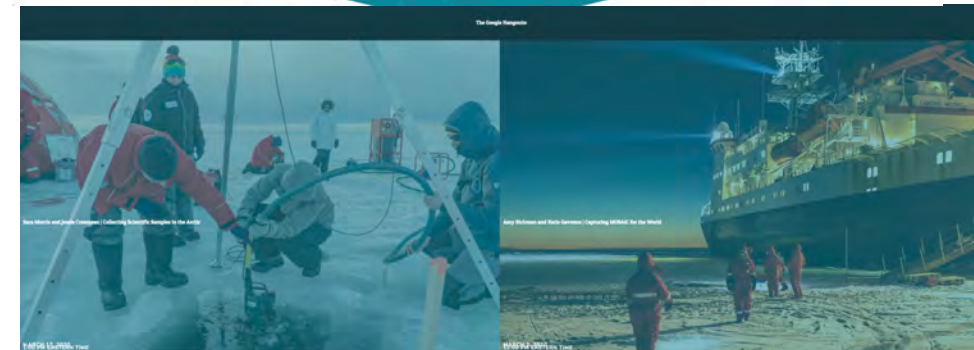
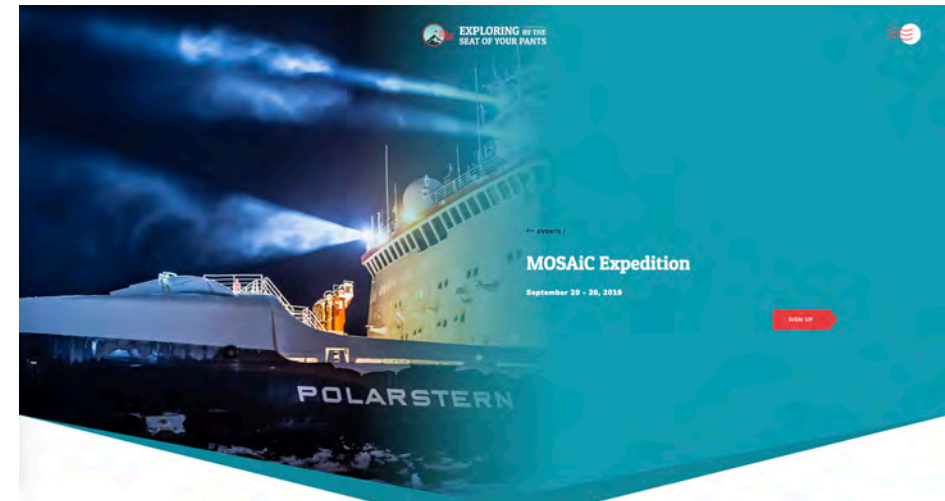
Field Notes

The Harsh Habitat of the Central Arctic
The Central Arctic is cold, icy, isolated and not a place where humans typically live. How can researchers aboard the Polarstern survive in these harsh environmental conditions? Let's find out!

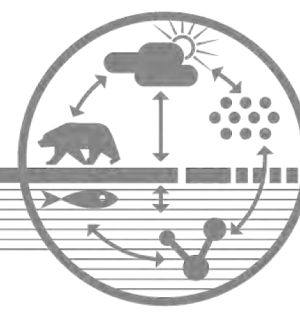
Albums

Live Video Call with Dr. Radiance Calmer (Recorded)
Join Dr. Radiance Calmer as she talk about the important role that unmanned aerial systems (UAS) play in research. You won't believe what these drones can do in the hands of an amazing scientist!

RTW MOSAIC Expedition Page:
<https://www.reachtheworld.org/mosaic-expedition-arctic-ocean>



Exploring by the Seat of Your Pants:
<http://www.exploringbytheseat.com/event/mosaic-expedition/>



Browse > Physical Science and Engineering > Research Methods

Offered By

Frozen in the Ice: Exploring the Arctic

University of Colorado

Anne U. Gold [+1 more instructor](#)

Go To Course

Already enrolled
Financial aid available

coursera

1,543 already enrolled

[About](#) [Instructors](#) [Syllabus](#) [Enrollment Options](#) [FAQ](#)

About this Course

43,094 recent views

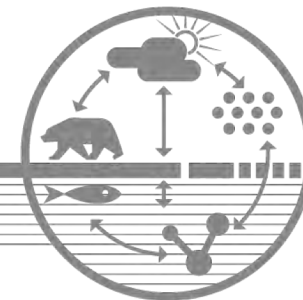
Why would hundreds of scientists from around the world intentionally freeze a ship in Arctic sea ice for an entire year, braving subzero temperatures and months of polar darkness? This may sound like a fictional adventure movie plot, but from September 2019 through October 2020, the MOSAIC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) Arctic research expedition did just this.



<https://www.coursera.org/learn/frozen-in-the-ice>



50 Lectures from 37 different presenters covering the breadth of MOSAIC science and Arctic change
Assessments use MOSAIC data



A Year in the Ice

MOSAIC: Multidisciplinary Drifting Observatory for the Study of Arctic Climate

Home About News People Education Blogs Partners MOSAIC Monday

Museum of MOSAIC Art (MoMoA)



Welcome to the Museum of MOSAIC Art!

Take a virtual stroll through the galleries to enjoy the artistic creations of MOSAIC fans around the world. Interested in seeing your MOSAIC-related artwork in the museum?

[Submit your masterpieces here!](#)

Galleries



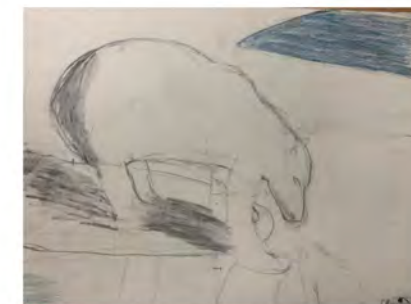
Gallery: MOSAIC Science



Artist: Dylan, age 10, from Turu
Title: Scientist at Work

I drew this piece of art because we did a project called Walk in Someone's Snow Boots. It's a project where you go on the slideshow on MOSAIC Monday for January 20. The slideshow was full with photographs of people, the conditions they work in, and other kinds of photos like that. Also, captions gave information about the photo and it was taken. You pick a photo with a person in it, and then you write an imaginary letter to your family pretending you're the person writing. I drew a picture of one of the scientists to go along with my letter.

Gallery: Arctic Flora and Fauna



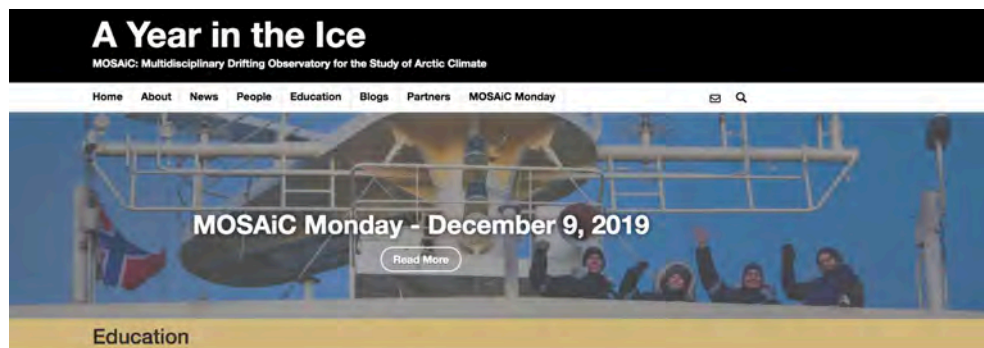
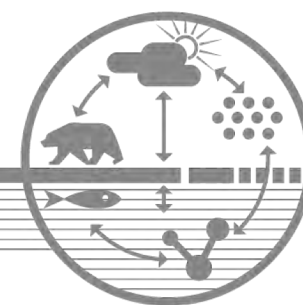
Artist: Claire, age 11, from Boulder, CO
Title: N/A

Gallery: Arctic Land and Seascapes



Title: MOSAIC Mug (MOMu)
Artist: Katy

I've been obsessed with the MOSAIC mission for more than a year now. It's part of my work as a communicator. This fall and winter, especially, I've spent months thinking about my colleagues up there on the ice. In the dark, I make pottery as a hobby, and I wanted to make a set of mugs that somehow represented MOSAIC. This is one. The sea ice below is white and atmospheric black, and the glass rim is a way that (to me) reflects the interconnections of the ocean-ice-atmosphere system. Can you see the sun? It's normally not visible from Polarstern (the ship is too far north) but I wanted to put something in that dark sky...



A Year in the Ice

MOSAIC: Multidisciplinary Drifting Observatory for the Study of Arctic Climate

Home About News People Education Blogs Partners MOSAIC Monday

MOSAIC Expedition Virtual Teacher Workshops

MOSAIC Expedition Virtual Teacher Workshops

Connect your classroom to MOSAIC, one of the largest Arctic climate research expeditions ever with new curricula developed by the University of Colorado Boulder!

In September 2019, the German icebreaker *RV Polarstern* was frozen in sea ice in the Central Arctic to give scientists an unprecedented opportunity to study the Arctic climate system at ground zero for an entire year. The MOSAIC (Multidisciplinary drifting Observatory for the Study of Arctic Climate) expedition will improve our understanding of why the Arctic is warming twice as fast as the rest of the globe, and how the Arctic climate system influences our global climate.

Participants can earn graduate credit and bring the unprecedented science and adventure of the 2019-2020 MOSAIC expedition into their classrooms with new middle and high school curricula developed by the education and outreach team at the University of Colorado Boulder. Teacher workshops will be facilitated virtually by MOSAIC scientists and the curriculum developers. Participants will engage with immersive 360° virtual expeditions, authentic real-time Arctic datasets, and App-based labs in these two-day online teacher workshops.

Learn more about earning graduate credit from CU Boulder for participating in these workshops (coming soon)!

Workshop 1: Arctic Feedbacks: Not All Warming is Equal

When: Tuesday, June 2 and Wednesday, June 3 from 10 am - 2 pm MT

Registration: Free

Continuing Education hours: 10

Description: In this workshop, you'll hear from MOSAIC scientists and the curriculum developers as they lead you through "Arctic Feedbacks: Not all warming is equal", a curriculum tied to NGSS Earth's Systems standards in which students explore parts of the Arctic climate system to determine why the Arctic might be warming twice as fast as the rest of the world. Engage with 360 virtual expeditions, authentic real-time Arctic datasets, and App-based labs in this 2-day online teacher workshop.

Grade level: Middle and High School

Additional course information:

- Flyer
- Syllabus

[Register for the workshop here](#)

Workshop 2: Exploring the New and Old Arctic

When: Tuesday June 9 and Wednesday June 10 from 10 am - 2 pm MT

Registration: Free

Continuing Education hours: 10

ARICE Webinar

From icebreakers into classrooms

Questions!?



An international collaboration strategy for meeting the needs of marine based research in the Arctic



ARICE Webinar

From icebreakers into classrooms

Thank you very much!



An international collaboration strategy for meeting the needs of marine based research in the Arctic



Webinar recording will be available on arice.eu and on the APECS website

[Home](#) [About](#) [News](#) [Outreach](#) [Training](#) [Apply for Ship Time](#) [Call Results](#) [Intranet](#)