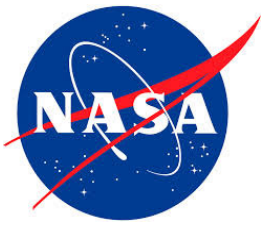
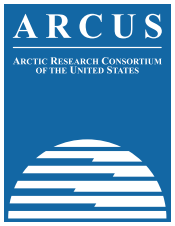
# PolarTREC Public Science Report
# Russell Hood
# Operation Ice Bridge
# Greenland 2014

PolarTREC Expedition Page
http://www.polartrec.com/expeditions/airborne-survey-of-polar-ice-2014



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**Why should a teacher go on a science expedition?**

I teach students science. I teach them how to be scientists. I teach them how to question, observe, record, analyze, and summarize. And just as learning to become a teacher is an entirely different experience from being a teacher, it similarly follows that teaching about science and being a scientist are vastly different experiences.

In school students learn about the world around them from inside a large building. The better teachers find creative ways to get their students out into the wider world from time to time and show them how that world relates to what they have been learning. For students, this type of personal experience solidifies their understanding by making it concrete and relevant. It's one thing to talk about doing something but it is an entirely different, and more profound undertaking, to actually do it.

*A view near the southern end of the island.*

Teachers are no different from their students in this regard. I can spend my entire career teaching students how to become scientists but until I see firsthand what scientists actually do I'll be teaching from a relative void. It needs to be relevant and concrete for me before I can do the teaching justice. Going on a PolarTREC expedition shows a teacher what knowledge and skills a scientist needs. We learn to do what they do and how they do it. We learn to become better communicators through our stories, journals, photos, and videos that paint a picture for the students and families back home. We learn valuable field skills that we can pass on to our students with creative lessons. In some cases we even learn survival skills that will grip the attention of any young child. We bring home knowledge of other cultures and how they can be affected by a changing world around them. We communicate this empathy and understanding to our students so they, too have an awareness of issues beyond what time the local mall closes. We bring home stories that dramatically illustrate how fun science can be and show photos of the exotic places science can takes us. We bring back a link to the scientific world that keeps growing stronger as teachers and researches continue their collaboration beyond the expedition. [In my own case this began during my training in Fairbanks: There I met a PolarTREC researcher who lives nearby and together we are working on deploying sea ice measuring devices around our area. We plan to schedule the first deployment this coming October.]

In short, teachers on a PolarTREC expedition are injected with a contagious enthusiasm for science that few experiences can render. And when that enthusiasm is carried back to the classroom everyone benefits in a multitude of ways. And the enthusiasm can be sustained in

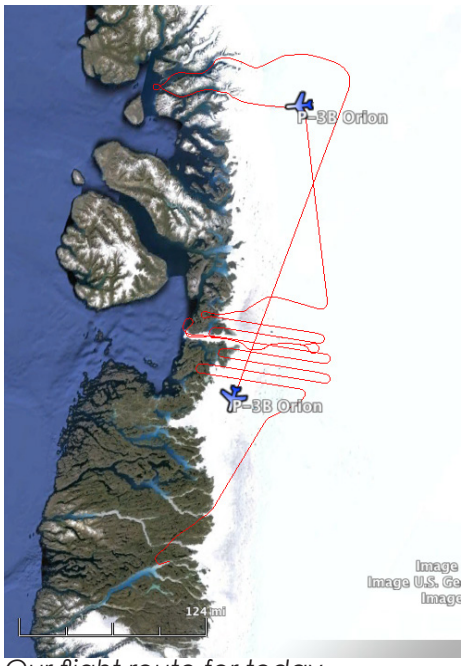
so many ways with additional outreach and communication/collaboration with researchers.

**How do I plan to link this experience back to my classroom?**

Well, I already have as my students followed my journals, sent me questions about the research, and participated in a PolarConnect event. But I think this question is really focused on how I plan to continue to link this experience back to the classroom.

I plan to incorporate this experience on multiple levels.

1. I intend to keep in touch with the OIB folks and hope to be able to meet up with them again in the near future. We'll discuss the possibility of my flying down to CA to meet the crew as they outfit a DC-8 with instruments in preparation for a winter campaign down in Antarctica. Continuing communication with the researchers (and not necessarily just OIB researchers, but any others I've met by way of this PolarTREC experience) allows for my students to follow the missions over a longer term and get a better sense of the larger pictures. For instance, having been there I have a reasonable picture of the Greenland Ice Sheet dynamics, but what's going on down in Antarctica and why might that be an area of concern? Following the OIB team this winter can help us answer these questions.



*Our flight route for today.*

2. Using information and data from OIB for classroom lessons. This is one of the holy grails for us teachers, and often one of the most difficult (and hence, one of the most rewarding as well). The OIB team produces countless Terabytes of data every year that is eventually made available to the public. A well-designed lesson will show students how to access, utilize, and interpret this data in a meaningful way. I've been ruminating for some time about some concrete ideas on this and once school begins this fall I hope to put some of the ideas into action.

3. Students directly contact and interact with the researchers. One of the neatest aspects of an OIB flight is that, while flying, they allow people to interact with the crew via a text-only interface (the bandwidth isn't there for video/audio). Students can directly question the researchers in real time while they are working. How incredible is that! This kind of connection particularly resonates with students as they interact with a professional and put their learning to use. Besides, hearing from someone other than their day-to-day teacher is always a highlight.

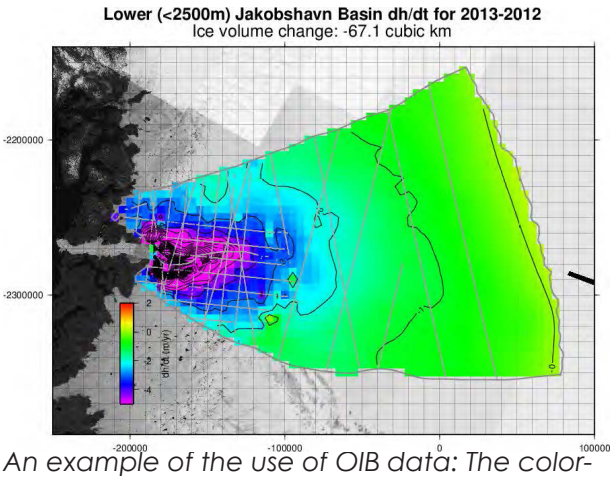
4. Can my students take something from this experience and become teachers themselves? I am an advisor for our school's Science Club -a group of students that are involved with science outreach in the local primary schools. We run several stations each time the club visits a school. How can polar research be implemented in our program? How can we interest elementary school kids in Polar Science? These are questions I'll put to my students

to challenge them to develop a polar science station for our Science Day outings.

**List 3-5 things you expected to learn during my experience. Did I learn them, why or why not?**

Going into the OIB expedition I was curious about the academic backgrounds of the people working on the plane. My expectation was that each one was a PhD student or post-doctoral. This did not prove to be the case. In fact the backgrounds for all of scientists ranged from an undergraduate BS all the way up to the post- doctoral. I noticed that even those with only the undergraduate degrees contributed extensively and worked just as hard as everyone else. And I was very impressed with the knowledge and skill set everybody had, regardless of background.

I look forward to telling my students that this kind of exciting scientific career can be within their reach after fours years of college (though additional education certainly does not hurt!). It is not what I would have guessed from the beginning.



*An example of the use of OIB data: The color-coded map shows the rate of change in the thickness of the Jakobshavn Glacier in meters per year. The more active zone (the pinks) are the heavily crevassed regions closest to the ocean.*

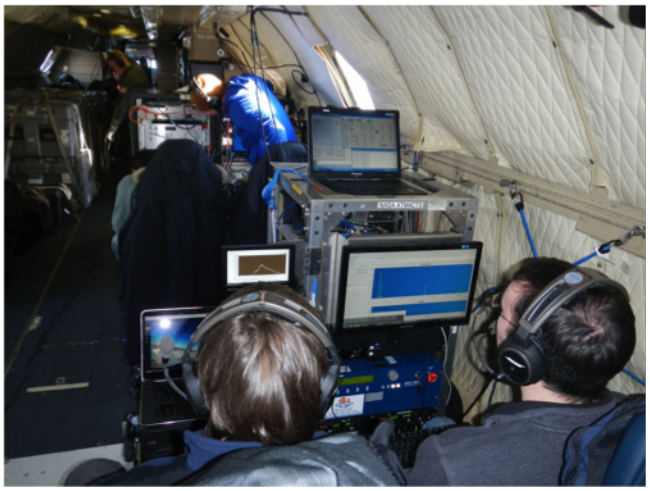
Another question I had - rather obviously - was simply what is happening with Greenland's ice balance these days? What is the OIB data telling us? Overall, Greenland is losing ice, but not uniformly. The fastest moving glaciers are calving enormous volumes of ice (measured in the tens of cubic km per year) into the ocean. In addition the melting of the ice sheet results in a similar volume loss annually. The highest elevations of the ice cap are increasing in thickness, slightly, by a few cm/year. The "continental divide" that runs down the ice cap is shifting due to the higher snowfall rates seen in the SE portion of the island. In recent years there has been a notable acceleration in the loss of ice from both melting and calving sources.

If the entire Greenlandic Ice Sheet (GIS) disappeared the world's oceans would rise by about 7m. But even during past warm periods much of the ice sheet remained intact leaving scientists scratching their heads about how continued warming temperatures will actually affect the GIS.

How is the Greenlandic culture affected by climate change? This question was a difficult one to answer seeing as communication with most of the locals was impossible due to the language barrier. But I found my answer, over time, by talking to some of the long-term OIB researches, reading magazines found in the KISS building, and my own independent research.

The native people of Greenland are closely tied to their environment and its animals. The country has the largest population of arctic Eskimos who still lead a largely subsistence way of life. As the animals of the arctic go so will go the native Greenlandic culture.

Muskox and Caribou are important game animals for many locals. While these populations are currently more or less stable (as they are managed with some oversight) they are also vulnerable to winter icing events which can kill 40% of the animals in a herd. These events, occurring more frequently as the winters become more mild, begin when an early or mid winter thaw melts the snow covering the browse. When the "normal" sub-freezing temperatures return the melt water turns to ice encasing the browse in a bulletproof armor of ice that neither animal can easily penetrate. And they starve to death. Warmer winters increase the likelihood of these thaw-freeze events and can quickly decimate a local population. This in turn can dramatically effect the availability of such meat for the native people.



Polar bears and Greenlanders alike depend on seals and walrus for feeding their families (and in the latter case, their sled dogs). And both hunters are having trouble with the sea ice that is decreasing in extent as well as thickness throughout the country. In Greenland it is illegal to hunt seals by snowmachine. As such, every hunter uses a dog team, which also needs to be fed. (Gasoline and snowmachines are also very expensive in Greenland, whereas a couple of well-fed dogs can produce a litter of sled dogs every year.) Seals and walrus use sea ice to haul out upon and rest, give birth, and nurse their young. As sea ice thins it becomes more dangerous to travel upon. In addition, the decreasing extent of sea ice limits where hunters can go with their dog teams. For thousands of years this has been a constant in the Greenlandic culture - dog teams taking hunters out to get meat for the family. But this tie between dog and human will be tested as the conditions for sledding deteriorate. Meanwhile, seals and walrus will also have to adapt or their numbers will be imperiled too.

The only learning I didn't get to during Operation Ice Bridge were the questions I failed to ask. To be sure there are many unknowns still out there - like how the shape of the bedrock beneath the tidewater glaciers affect their melting and calving rates. But questions like these will be answered as data, computing power, and research equipment improve with time.

Still another question I had had to do with how teaching physics in the US compared with teaching physics in Greenland and Denmark. When Jakob and Peter joined the OIB team for a week I had a wonderful opportunity to learn from my international counterparts.

I was amazed and could not have predicted how similar our experiences in the classroom were. Sure, we had slightly different approaches and students, but the material we taught, the misconceptions held by students, the fun lab experiments - so many of those were dead-on identical between all of us it was incredible. Physics, and probably any other science for that matter, simply transcends culture. We do, after all, abide by the same laws of physics regardless of where we live.

Peter, the Greenlandic teacher, had an additional parallel with me that was most insightful. The animosity between native Greenlanders and the local ethnic Danes casts a constant shadow over the school environment in Greenland. Some teachers are blatantly racist against the native while many natives are the same in reverse. This often creates tension that is very counterproductive to learning. These problems are also rife within the Alaskan bush communities and, to a lesser extent, even here in urban Alaska where I teach. Nonetheless, I could empathize with Peter as to his plight in the classroom. That tension is one reason while he seemed certain that he would not be staying in Nuuq very long before returning to work in Denmark. (And rural AK has a near 50% turnover rate amongst their teachers for similar reasons...)

**List 3-5 concepts I'd like to teach better or differently. How does this impact your students?**

Here are three concepts that resonated with me as I have had time to reflect upon my experience in Greenland.

Concept 1: What is a scientist? What do they do and why do they do it?

I've always dabbled with this as a teacher but now I plan to immerse my students in it. Every step of the way I will remind them that what there are doing is science and why we are doing it. Scientists often have some of the most fascinating and important jobs on earth. Without knowledge we are nothing. Without the ability to communicate our knowledge we (scientists) are useless. And without the ability to use that knowledge to wisely we (the general population) are negligent. I want each and every student of mine understand these statements by the end of the school year. (And with luck they will adopt them as well.)

Concept 2: Why does climate change matter to us?

Ah, the elephant in the room. Is there a single sentence that can adequately answer this for us? Our planet's climate is changing. Check -it always has. Our planet's climate is changing faster than it usually has. Okay. We, humans, are helping to change our planet's climate faster than it usually has. Okay - so what? We, humans, are helping to change our planet's climate faster than it usually has and this will have profound consequences to our species even in the immediate short term. Oh really? Yes! Let the enumeration begin... I don't want to come across as some climate change-obsessed alarmist of a teacher. That's not my goal and that is not what I want to convey. But I also feel (passionately) that I'd be negligent if I didn't teach my students something about this phenomenon. It is, arguably, one of the most important scientific understandings that they will need to have as they navigate the rest of their lives - no matter what they do with their careers. Every student of mine will have countless opportunities to vote on

and participate in events - related to the consequences of climate change - that will have significant impacts on the quality of their future lives. That is why I want them to learn something about it.

Concept 3: Why should you (students) become a scientist?

Because science is fun and interesting. Because science can take you places you never thought you would ever go, physically and intellectually, at the same time! I want my students to see this passion within me and feel this passion themselves by the end of the school year. If they never learn a lick of physics but came away with this same passion about science that I have - and frankly, I have no idea how that could actually happen - I'd still consider the year a success.

The OIB folks really enjoyed what they were doing. To a person they were very good at what they did and they enjoyed the heck out of it. Sure, there were times of tedium and grunt work (and teachers have to grade papers...) but those are found in every job. And yes, the food in Greenland was not the best. But we were in Greenland for goodness sake! I was working with a crew that in 6 months time was going to prepare a new plane to head down to Antarctica. Based out of Punta Arenas, Chile. Doing science. Awesome! Incredible! (And the food is really good there.)

Why *shouldn't* you become a scientist?

That is probably the harder question to answer.

**Activities that you will pursue that the public should know about?**
**Other ideas on how I'll share this experience with the public and my peers.**

I have already presented a few slideshows/talks since being home from Greenland. Since my return home nearly coincided with the end of the school year my opportunities were limited but should be opening up again as school is set to begin in just about three weeks.

Our school is going to add a new feature to our schedule that will allow me a great chance to share my experience with my colleagues. For the first time ever we will have, built in to every Monday's schedule, a block of time for collaboration. One of the first chances I get I plan to share my PolarTREC experience with my fellow science teachers at school.

Finally, I often give classes to local chapter of OLE -a lifetime learning "school" for retirees. To date my classes have been focused around topics in physics (sound, electricity, magnetism) but I plan to use this outlet to give a presentation about my time in Greenland to show what I experienced, what I learned, and what we can take away from it (especially me!).

I am desperately looking forward to the beginning of the school year so I can resume sharing my PolarTREC experience with my students and begin incorporating it into my teaching. Soon my students will be rolling their eyes every time I say, "When I was in Greenland..."