Topic 1c - The challenges of monitoring an ice sheet

Logistics in the Arctic are really hard. It's hard to fly around everywhere, and to be able to sample all of the things that you would like to sample. So satellites give us a really good way of kinda getting a whole, landscape wide perspective where we can really just go in and sample a couple of individual lakes. This kind of gives us a sense of how our lakes, how our individual points fit into the broader picture.

While Greenland's actually an incredibly old island, some of the oldest rocks on the planet are in Greenland, just south from here, there's rocks that are about three billion years old. Kind of from the basement of time, and so Greenland's actually a very ancient island. When we think about Greenland as an icy island, it's only in it's very, very recent history that it's been an icy island. There used to be beavers on Ellesmere Island and up in the Arctic two million years ago. And then, as the climate started to cool, Greenland became a sort of refrigerator of the planet.

Here we are, the big mass of the ice sheet is up in this direction. And we're sloping very gently down to the west coast here and into this very well-known fjord called jakobshavn ice fjord or isbrae, which drains a huge portion of the Greenland Ice Sheet. So you can actually see, if you go over the lip here, you can see the edges of the mountain starting to emerge. And you can see the fjords further off in the distance.

There's an enormous mass of ice on Greenland, which basically pushes down the continental crust under Greenland. So there are actually mountains underneath the Greenland ice sheet. There's a range that kind of traverses the length of the Greenland ice sheet.

But all of the weight of the ice has been pushing that down. And so there's actually huge parts of the Greenland ice sheet that are under sea level. And as the ice retreats, that land starts to bounce up again. And actually, lots of scientists put out GPS stations to monitor the rebound of the ice sheet as the ice retreats.

What I have shown here on the map is actually the distribution of all the automatic weather stations. We installed from 1990 until about 2000. We have 18 stations monitoring the climate from the lower elevation, which we have along. In this profile, they call that JAR - Jakobshavn ablation region, one, two, three, Swiss camp all the way to the top of the ice sheet at 3,300 meters.

Why do we have so many stations? We actually tried to capture the climate of the ice sheet with these 18 stations. And over the last 25 years, we have proved that these stations give us all slightly different measurements responsible for our local climate.

And also interesting is, the station that we call Swiss Camp, what we have seen here, has to be at equilibrium line altitude, ELA. What we see here in 1990, well above the surface. In the early 90s, actually, we almost lost the station, because the climate was cooling due to the

Mount Pinatubo volcanic explosion that put a lot of aerosol at high elevation that reflected shortwave radiation.

And it cooled Greenland and the northern hemisphere within one year by 1.8 degrees centigrade. And all these small aerosols, they actually precipitated out of the atmosphere. And within a few years the warming goes back to the normal, what we actually know, and we can see 2007.

But when we look at that station at three time slots, this station has moved from 1990 to present already by 2 and 1/2 kilometers. The station moves about 30 centimeters per day towards the coast. When you multiply that by 25 years, you see it has moved more than two kilometers from that current location towards the coast. But it's still within the ELA altitude.