



WHY OBSERVE?

TREE HEIGHT

1
00:00:00,000 --> 00:00:05,805

■■■Music■■■

2
00:00:05,805 --> 00:00:11,711

Nathan Kurtz: For me, I've only done airborne field work, which is very different than being on a ship.

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00:00:11,711 --> 00:00:19,986

And we're just very isolated, like the ship is really your whole world and all those people on the ship are your whole world.

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00:00:19,986 --> 00:00:27,894

And then just outside the ship is just a very hostile landscape. It's cold. There's polar bears.

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00:00:27,894 --> 00:00:30,530

There's water that can open up underneath your feet.

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00:00:30,530 --> 00:00:32,932

Ship horn

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00:00:32,932 --> 00:00:37,037

And so, it was a very interesting experience to

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00:00:37,037 --> 00:00:40,774

to be on the ship which was very safe and warm, and felt good.

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00:00:40,774 --> 00:00:44,611

But then we'd go out and do our fieldwork, and we'd set things up.

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00:00:44,611 --> 00:00:49,916

And we'd be out on the ice, we could feel like this is a very wild environment.

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00:00:50,216 --> 00:00:53,987

As we were transiting through the ice, we were searching for a suitable icefloe.

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00:00:53,987 --> 00:00:56,623

Something that would be thick enough that could support us

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00:00:56,623 --> 00:00:59,859
working on safely, and also survive through the year.

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00:01:00,693 --> 00:01:04,597
While searching for that floe, we had different satellite tools that we're using.

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00:01:04,597 --> 00:01:09,402
That would identify the shape of the floes. We could see how big the floes were.

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00:01:09,402 --> 00:01:11,371
But what we didn't know was how thick they were.

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00:01:11,371 --> 00:01:14,641
We went to some of these floes and we found, no. These were really thin.

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00:01:14,641 --> 00:01:16,509
We can't actually use this floe.

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00:01:17,477 --> 00:01:22,415
We looked at some ICESat-2 tracks in hopes that some of the floes that we had identified

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00:01:22,415 --> 00:01:25,185
we could see how thick they were.

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00:01:25,185 --> 00:01:29,556
It didn't work out this time, but for a future expedition

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00:01:29,556 --> 00:01:34,394
I think we've identified ways that we could utilize ICESat-2, or something like ICESat-2.

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00:01:34,394 --> 00:01:37,831
■ Upbeat Music ■

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00:01:37,831 --> 00:01:41,167
Text: GLOBE Observer Presents

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00:01:41,167 --> 00:01:43,136

■ Upbeat Music ■

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00:01:43,136 --> 00:01:48,808

Text: Why Observe?: Tree Height

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00:01:50,677 --> 00:02:00,153

Narrator: While there wasn't enough ICESat-2 data for MOSAiC, or the Multidisciplinary drifting Observatory for the Study of the Arctic Climate to use.

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00:02:00,153 --> 00:02:05,792

Dr. Nathan Kurtz and the team were able to locate an area with the right amount of sea ice thickness

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00:02:05,792 --> 00:02:07,827

by using different methods.

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00:02:08,628 --> 00:02:13,733

Likewise, scientists often use various methods to measure other aspects of our planet.

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00:02:13,733 --> 00:02:15,435

Like forests.

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00:02:15,435 --> 00:02:20,707

So, why take measurements of the same thing, using different methods?

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00:02:20,707 --> 00:02:24,878

And how does measuring sea ice thickness relate to tree height?

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00:02:24,878 --> 00:02:30,583

Let's take closer look at the Ice, Cloud, and land Elevation Satellite, or ICESat-2.

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00:02:30,583 --> 00:02:35,488

Its main purpose is to measure ice thickness using its sole instrument, ATLAS.

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00:02:35,488 --> 00:02:39,159

But, it also measures tree heights as it orbits Earth.

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00:02:39,159 --> 00:02:45,698

This is done with photon-counting lasers and algorithms developed to differentiate what environments they are measuring.

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00:02:45,698 --> 00:02:49,802

An algorithm is a step by step procedure for solving a problem

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00:02:49,802 --> 00:02:53,706

usually a mathematical one, in a limited number of steps.

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00:02:53,706 --> 00:02:58,378

Claudia Carabajal was the Deputy Lead for the Flight Science Receiver Algorithms.

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00:02:58,378 --> 00:03:01,681

One of the many subsystems of the ATLAS instrument.

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00:03:02,115 --> 00:03:06,986

Claudia Carabajal: The algorithms that process the data on the ground for ICESat-2 are tailored

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00:03:06,986 --> 00:03:11,758

directly to address that characteristics of the surface.

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00:03:11,758 --> 00:03:16,029

So they're tailored to sea ice and vegetation.

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00:03:16,629 --> 00:03:20,700

The coherence of those photons when reaching the surfaces changes.

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00:03:20,700 --> 00:03:24,904

So the algorithms need to be specifically tailored to the surface type.

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00:03:24,904 --> 00:03:28,408

Of course the comparisons against all the data sets help you.

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00:03:28,408 --> 00:03:33,880

And sometimes you need the help of an additional data set. As you're processing.

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00:03:36,549 --> 00:03:41,287

Nathan Kurtz: When I was on MOSAiC, we took specific measurements that are useful, and will be used.

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00:03:41,287 --> 00:03:45,158

By combining multiple measurements together, we're able to

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00:03:45,158 --> 00:03:51,097

quantify and see whether ICESat-2 is making its measurements accurately and how it's needed to be done.

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00:03:53,166 --> 00:03:57,604

Claudia Carabajal: One of the ways that you can actually figure out if ICESat-2 is actually measuring

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00:03:57,604 --> 00:04:02,508

the right thing is to compare it with observations that are being collected by other means.

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00:04:02,508 --> 00:04:06,613

For example, airborne campaigns, other satellite data,

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00:04:06,613 --> 00:04:09,482

and see what the surface looks like.

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00:04:09,482 --> 00:04:12,752

You can look at how things are changing in different seasons.

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00:04:14,187 --> 00:04:19,726

Narrator: Whether it's sea ice thickness or tree height, comparing data collected by different missions

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00:04:19,726 --> 00:04:24,030

and field campaigns allows scientists to better understand how the instrument works.

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00:04:24,631 --> 00:04:29,369

Dr. Laura Duncanson uses LIDAR data to create 3D maps of forests.

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00:04:29,369 --> 00:04:34,374

And Dr. Nancy Glenn is currently looking at various ways in which tree height data collected

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00:04:34,374 --> 00:04:37,510
by ICESat-2 and GLOBE Observers can be utilized.

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00:04:37,510 --> 00:04:42,415
For both, tree height data adds to our understanding of Earth's systems.

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00:04:43,149 --> 00:04:46,486
Laura Duncanson: Of course we can't go out into the woods all over the planet

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00:04:46,486 --> 00:04:48,254
and measure every dingle tree on the ground.

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00:04:48,254 --> 00:04:51,257
So, for ICESat-2 these estimates of tree height,

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00:04:51,257 --> 00:04:57,130
we don't know exactly how precise they are, or how good they are in all of the different forests around the globe.

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00:04:57,130 --> 00:04:59,399
There's a lot of variability in forests.

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00:04:59,666 --> 00:05:03,836
Narrator: Just like how taking field observations and airborne data collected of sea ice thickness

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00:05:03,836 --> 00:05:06,639
can act as supplementary data to ICESat-2.

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00:05:06,639 --> 00:05:10,176
Tree height measurements collected in the field can also be used to do the same.

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00:05:10,643 --> 00:05:15,848
This supplementary data can help scientists account for variability between different

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00:05:15,848 --> 00:05:18,685
environments when looking at measurements collected by satellites.

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00:05:18,685 --> 00:05:23,022

As mentioned, tree height measurements can be taken in different ways.

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00:05:23,022 --> 00:05:27,794

One method is to use trigonometry to estimate the height of a tree.

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00:05:27,794 --> 00:05:31,097

This is the method that students and citizen scientists use.

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00:05:31,664 --> 00:05:34,500

By measuring the distance to the tree

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00:05:34,500 --> 00:05:39,639

along with angles a and b , using a handheld clinometer. Or the one built into a smartphone.

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00:05:39,639 --> 00:05:42,308

Observers can calculate the height.

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00:05:42,842 --> 00:05:46,479

Laura Duncanson: Having people go into the woods and actually measure tree height

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00:05:46,479 --> 00:05:52,051

to compare to the satellite estimates of tree height, gives us a sense of how reliable those tree height estimates are

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00:05:52,051 --> 00:05:58,558

and maybe some ecosystems that they're particularly good at doing tree height, or particularly challenged doing tree height.

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00:05:59,225 --> 00:06:04,464

Narrator: Now we know that by taking measurements of the same thing using different methods can help scientists.

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00:06:04,464 --> 00:06:11,637

Taking tree height measurements adds a whole new data set for satellites and instruments such as ICESat-2 and GEDI to compare with.

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00:06:11,637 --> 00:06:16,776

These measurements also provide content that only an observer on the ground can provide.

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00:06:16,776 --> 00:06:22,048

Like recent changes including drought, fire, invasive species and more.

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00:06:22,849 --> 00:06:25,051

Now that leaves the question.

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00:06:25,051 --> 00:06:27,453

Why do scientists study trees?

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00:06:29,222 --> 00:06:35,161

Laura Duncanson: So, for decades now we've had really good maps of where there are forests and where there aren't forests.

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00:06:35,161 --> 00:06:39,098

But we've never before known how tall those trees in those forests are.

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00:06:39,098 --> 00:06:45,405

And this is a really critical piece of information because it tells us not only of course how tall the forests are

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00:06:45,405 --> 00:06:48,541

but how much above ground woody carbon they store.

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00:06:49,375 --> 00:06:54,080

Forests represent one of the biggest carbon stocks on the Earth's surface.

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00:06:54,080 --> 00:07:00,253

And if we cut down and burn forests, we essentially are pushing more carbon into the atmosphere.

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00:07:00,253 --> 00:07:04,524

And if we allow those forests to regrow, we are sucking that carbon out of the atmosphere.

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00:07:04,524 --> 00:07:08,194

But we don't know right now how much carbon is where in Earth's forests

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00:07:08,194 --> 00:07:11,964

because we've never had that third dimensional measurement of Earth's forests

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00:07:11,964 --> 00:07:14,600

which is so tightly linked to its carbon content.

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00:07:14,600 --> 00:07:20,206

Narrator: Using tree height not only helps scientists track how much carbon is getting released into the air

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00:07:20,206 --> 00:07:22,074

but can also be used in other ways.

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00:07:22,074 --> 00:07:27,613

Nancy Glenn: Tree height is really important for us. As it is we're interested in knowing how tree height is affected

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00:07:27,613 --> 00:07:32,952

by increased CO2 or increased temperatures, or decreased temperatures.

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00:07:32,952 --> 00:07:37,857

And that gives us an indicator for making future predictions about trees in the future.

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00:07:38,157 --> 00:07:42,595

We're interested in is that trees and the differences in tree heights

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00:07:42,595 --> 00:07:45,231

provides some level of what we call structural diversity.

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00:07:45,231 --> 00:07:50,136

And structural diversity can be really really important for the health of an ecosystem.

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00:07:50,136 --> 00:07:54,540

As well as provide habitat for a variety of different types of animals.

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00:07:54,540 --> 00:08:01,814

So we're using NASA resources, NASA airborne data as well as satellite-based data like ICESat.

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00:08:02,548 --> 00:08:07,720

Narrator: Many Earth observing satellites such as Landsat can only see a top down view of Earth.

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00:08:07,720 --> 00:08:09,922

*camera shutter**camera shutter**camera shutter*

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00:08:09,922 --> 00:08:13,292

Narrator: This information comes in the form of two-dimensional images

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00:08:13,292 --> 00:08:18,397

made up of pixels between the size of 30 meters squared to 500 meters squared.

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00:08:18,998 --> 00:08:25,371

But now with GEDI on board the International Space Station and the launch of the ICESat-2 satellite in 2018,

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00:08:25,371 --> 00:08:29,509

scientists are able to see height added to this top down view of Earth.

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00:08:30,309 --> 00:08:35,448

By taking and submitting tree height observations, citizen scientists and students can help

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00:08:35,448 --> 00:08:37,350

scientists and researchers.

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00:08:37,350 --> 00:08:43,623

Not just by providing measurements from different ecosystems, but by providing a different type of data.

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00:08:43,623 --> 00:08:48,895

What seems like such a small piece to contribute, can help scientists across the world.

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00:08:49,695 --> 00:08:55,535

Laura Duncanson: The GLOBE Observer tree observation essentially let people all over the world

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00:08:55,535 --> 00:09:03,142

measure tree heights and give us that information where we can't go into every single forest ourselves as a small group of scientists.

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00:09:03,676 --> 00:09:08,180

Nancy Glenn: From a scientist's perspective, but also as somebody who participates in citizen science.

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00:09:08,180 --> 00:09:09,415

It's a great intersection.

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00:09:09,415 --> 00:09:11,217

The more data the better.

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00:09:11,217 --> 00:09:16,622

But also, the connection, right? Is this connection between scientists and the community. And

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00:09:16,622 --> 00:09:20,059

scientists understanding what's important to our communities.

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00:09:20,059 --> 00:09:23,296

And being able to engage and learn from one another.

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00:09:23,863 --> 00:09:26,699

Claudia Carabajal: There is a large part of collaboration

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00:09:26,699 --> 00:09:33,072

between the instrument scientists and everybody working on every aspect of the ATLAS instrument.

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00:09:33,072 --> 00:09:38,844

And the mission scientist and his deputy and everyone else, and all the universities.

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00:09:39,512 --> 00:09:42,949

Citizen science is really important to get the community involved.

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00:09:42,949 --> 00:09:48,154

It motivates everybody to be more informed about the science.

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00:09:48,154 --> 00:09:52,224

And also perhaps motivate a crowd new scientists.

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00:09:52,224 --> 00:09:55,828

Nancy Glenn: All of this is important because one, it's the pursuit of

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00:09:55,828 --> 00:09:58,698

answering questions about our natural environment.

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00:09:59,198 --> 00:10:02,101

Our natural environment is changing very rapidly.

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00:10:02,435 --> 00:10:07,006

Nathan Kurtz: A tree height measurement that's taken by citizen scientists could be useful for us.

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00:10:08,040 --> 00:10:11,978

Nancy Glenn: It's really important for us to monitor what is here now.

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00:10:12,478 --> 00:10:18,784

So we can document that, but also use that in models to predict what might be here in the future.

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00:10:19,518 --> 00:10:21,554

Narrator: To learn more about GLOBE Observer

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00:10:21,554 --> 00:10:22,755

check out the website at

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00:10:22,755 --> 00:10:25,224

observer dot globe dot gov

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00:10:25,224 --> 00:10:28,361

And download the app to start taking your own observations today.

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00:10:28,361 --> 00:10:29,328

Explore Earth

