

ABOVE

ARCTIC BOREAL VULNERABILITY EXPERIMENT

LOGISTICS OFFICE

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00:00:04,170 --> 00:00:23,460

[Music]

Welcome back to NASA's Earth Expeditions.

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A quick glance at the many Earth Science field projects NASA's conducting around the world

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this year.

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We've been scaling heights and diving deep for new important insights about our planet,

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from underground in Alaska to in the air about the Eastern United States, and we're even

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circling the remote parts of the global atmosphere.

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And these field campaigns are preparing tomorrow's Earth scientists today.

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These experiments give students and early career scientists the opportunity to engage

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with NASA Earth Science from building, testing, and flying instruments to collecting and analyzing

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00:00:53,140 --> 00:00:58,769

data, helping foster a new generation of Earth Systems scientists, who can turn NASA's global

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00:00:58,769 --> 00:01:01,780

view from space into new insights.

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00:01:01,780 --> 00:01:06,190
And the circle of Earth Science life continues.

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00:01:06,190 --> 00:01:09,210
Let's take a quick peek at NASA's ABOVE mission.

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00:01:09,210 --> 00:01:13,170
ABOVE is the Arctic Boreal Vulnerability Experiment, which is getting down and dirty into the study

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00:01:13,170 --> 00:01:17,890
of climate change in the arctic and boreal, or far northern, regions of our planet.

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NASA scientists are gaining a better understanding of the vulnerability and resilience of the

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00:01:21,311 --> 00:01:23,530
delicate and large ecosystems there.

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Well, we're trying to quantify how climate change is impacting fires.

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So, the idea is that as the planet gets warmer, we're seeing hotter and drier summers, and

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00:01:35,439 --> 00:01:38,270
that in turn is resulting in more severe fires.

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And what I mean by severe fires is a greater consumption of the soil.

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So, historically, or in the past, the soil would burn just a minimal amount, and now

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00:01:50,729 --> 00:01:53,679

maybe we're seeing a deeper burning.

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In these ecosystems, a lot of carbon is stored in that soil layer.

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00:01:58,460 --> 00:02:04,159

So, if we're burning really old carbon that had accumulated over numerous fire cycles,

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00:02:04,159 --> 00:02:09,700

so hundreds, maybe even thousands of years old, that's going to be released into the

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00:02:09,700 --> 00:02:12,810

atmosphere and then cycled back into more climate warming.

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00:02:12,810 --> 00:02:17,280

Well, the heat's been on here in the continental US this summer, and despite the hot days on

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00:02:17,280 --> 00:02:22,170

the tarmac, our team from the Langley Research Center has been all over the country investigating

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00:02:22,170 --> 00:02:25,260

atmospheric carbon in transportation with ACT-America.

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ACT-America is using two NASA aircraft to measure atmospheric carbon dioxide and methane

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over the Eastern half of the US during all

four seasons and under a whole range of weather

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00:02:34,400 --> 00:02:35,400

conditions.

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00:02:35,400 --> 00:02:39,709

The mission will advance our ability to predict and manage future climate change by helping

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00:02:39,709 --> 00:02:43,790

us better understand where carbon in the atmosphere comes from and where it goes.

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One of the things, I think, to understand is that atmospheric science can be really,

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00:02:47,299 --> 00:02:50,069

really tough to do because the atmosphere is always moving.

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00:02:50,069 --> 00:02:54,410

And take, like, a typical, like, cold front moving into a warm area here, right?

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00:02:54,410 --> 00:02:56,110

You've got clouds forming.

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00:02:56,110 --> 00:02:58,700

You've got air masses going up and down.

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00:02:58,700 --> 00:03:03,430

And we're trying to trace something like CO₂ or methane coming from a natural source or

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00:03:03,430 --> 00:03:05,270

coming from a well, and we want to know where it goes.

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00:03:05,270 --> 00:03:09,709

And so, you go and take your airplane and see what it's like to go through right through

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00:03:09,709 --> 00:03:14,069

the front, through a cloud, come over here to the warm sector, and things like that.

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00:03:14,069 --> 00:03:18,190

Yeah, and it's really interesting too because a lot of this carbon, it actually has moved

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00:03:18,190 --> 00:03:21,910

around a lot through our weather systems, through our storms and things like that.

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00:03:21,910 --> 00:03:26,140

So ACT-America is really cool because it's actually going to be flying through storms

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00:03:26,140 --> 00:03:30,659

during the summer months and the winter months, which is important because for satellites,

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00:03:30,659 --> 00:03:31,670

satellites are great, you know.

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00:03:31,670 --> 00:03:36,160

But, they can't quite see through clouds and they can't quite do through the storms, like

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00:03:36,160 --> 00:03:38,579

our field campaigns and our planes will be able to do.

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00:03:38,579 --> 00:03:41,790

Yeah, and it makes--you know, planes are so complementary to what they do--what we do

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00:03:41,790 --> 00:03:45,120

with satellites because they can go in and see really, really fine-scaled stuff.

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00:03:45,120 --> 00:03:47,890

But, we can build it all together into our models.

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00:03:47,890 --> 00:03:52,510

You know, take the satellite data, take process-level knowledge that we get here, and get a better

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00:03:52,510 --> 00:03:53,510

understanding of how the Earth works.

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00:03:53,510 --> 00:03:54,510

Yeah, yeah.

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00:03:54,510 --> 00:03:57,489

This will be helping us a lot in learning where the sources and the syncs are for our

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00:03:57,489 --> 00:03:59,129

carbon cycle.

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We're learning a lot from this airborne mission.

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00:04:02,379 --> 00:04:06,459

And it's great to see all the different applications and missions that NASA's C-130 aircraft is

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00:04:06,459 --> 00:04:07,459

involved in.

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00:04:07,459 --> 00:04:16,030

Well, the DC-8 has also been getting a lot of air time, this time on NASA's ATom mission.

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00:04:16,030 --> 00:04:24,220

The ATom mission is the atmospheric tomography experiment or mission, and this is a mission

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00:04:24,220 --> 00:04:30,470

to go out and look at gasses all over the planet, down the Pacific and then back up

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00:04:30,470 --> 00:04:37,100

the Atlantic, a suite of more than 200 trace gasses in our atmosphere.

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00:04:37,100 --> 00:04:43,260

We are measuring over 200 gasses, and these include the primary greenhouse gasses, like

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00:04:43,260 --> 00:04:49,690

carbon dioxide, methane, nitrous oxide, all of the famous ozone-depleting substances like

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00:04:49,690 --> 00:04:55,790

chlorofluorocarbons, and then other more exotic species, volatile organics.

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00:04:55,790 --> 00:04:57,310

And we're measuring aerosols.

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00:04:57,310 --> 00:05:01,690

So, it's just a huge suite of gasses that we're measuring.

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So, what are--?

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00:05:03,480 --> 00:05:07,160

--Methane and CO₂ and nitrous oxide, these are greenhouse gasses.

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00:05:07,160 --> 00:05:13,710

So, the more you add into the atmosphere, the warmer the surface is going to become

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00:05:13,710 --> 00:05:14,950
with time.

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00:05:14,950 --> 00:05:20,230
And so, you want to understand how these gasses
are controlled in our atmosphere.

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00:05:20,230 --> 00:05:22,130
We know we're releasing them.

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00:05:22,130 --> 00:05:25,060
The question is how are they removed?

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00:05:25,060 --> 00:05:31,480
And it's really important to understand the
minor gasses that remove in particular methane

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00:05:31,480 --> 00:05:32,480
in our atmosphere.

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00:05:32,480 --> 00:05:36,060
So, the ATom mission has a number of places
it's going to.

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00:05:36,060 --> 00:05:39,800
The first thing it's going to do is it's going
to leave California, fly up towards the North

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00:05:39,800 --> 00:05:41,430
Pole, and then land down in Alaska.

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00:05:41,430 --> 00:05:47,970
Then we're going to go from Alaska to Hawaii,
Hawaii to American Samoa in the Southern Hemisphere,

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00:05:47,970 --> 00:05:52,890
then American Samoa down to New Zealand, then
New Zealand over the southern tip of South

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00:05:52,890 --> 00:05:57,700
American and Chili, then up the Atlantic to
Ascension Island, then from Ascension Island

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00:05:57,700 --> 00:06:03,520
to the Azores, the Azores all the way up to
Greenland, and then down across the Canadian

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00:06:03,520 --> 00:06:07,280
Arctic and Canada, across the US back to California.

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00:06:07,280 --> 00:06:13,010
The whole ATom trip, knock on wood, will take
about 26 days to execute.

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00:06:13,010 --> 00:06:18,710
You know, the way the Earth works is a fascinating
puzzle.

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00:06:18,710 --> 00:06:21,510
There are a huge number of gasses out there
in our atmosphere.

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00:06:21,510 --> 00:06:23,430
We normally think of nitrogen and oxygen.

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00:06:23,430 --> 00:06:27,140
Those are the two primary gasses, N₂ and O₂.

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00:06:27,140 --> 00:06:32,820
But, there are hundreds and hundreds of other
minor species, and those minor species are

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00:06:32,820 --> 00:06:36,860
actually really important to understand how
the Earth works.

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00:06:36,860 --> 00:06:43,910

And so, I'm really interested in atmospheric science, understand how air moves, how this

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00:06:43,910 --> 00:06:49,190
air with these different gasses moving around, how it affects our planet.

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00:06:49,190 --> 00:06:55,630
So, that's it, another amazing A-plus analysis of NASA Airborne Science.

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00:06:55,630 --> 00:07:00,280
And the ATom mission just wrapped up their 26-day mission around the world.

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00:07:00,280 --> 00:07:07,390
From Alaska to Hawaii to New Zealand, around South America and all the way back up to Greenland,

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00:07:07,390 --> 00:07:11,510
and finally, back to Armstrong Flight Research Center, the hard way.

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00:07:11,510 --> 00:07:13,040
That really is a global view.

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00:07:13,040 --> 00:07:16,640
Well, that is the best way to get a global picture of how air pollution and greenhouse

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00:07:16,640 --> 00:07:19,080
gasses cycle around the Earth.

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00:07:19,080 --> 00:07:23,920
ATom, ACT-America, and ABOVE, you can learn more about all of these by checking out NASA.gov

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00:07:23,920 --> 00:07:26,880
for all the latest Earth Expeditions information.

