



EPISODE SIX:  
**HIGH MOUNTAIN  
GLACIERS**

1  
00:00:00,120 --> 00:00:04,180  
[Aircraft noise, music]

2  
00:00:04,180 --> 00:00:08,330  
Alex Gardner: My interest in glaciers

3  
00:00:08,330 --> 00:00:12,500  
comes from the sheer size of these things and

4  
00:00:12,500 --> 00:00:16,590  
how much they're able to change on human timescales.

5  
00:00:16,590 --> 00:00:20,710  
[waterfall noise] And so the amount of mass and energy being transferred

6  
00:00:20,710 --> 00:00:24,840  
by glaciers around the globe is tremendous,

7  
00:00:24,840 --> 00:00:29,060  
and it's an absolutely fascinating thing to study from space.

8  
00:00:29,060 --> 00:00:33,110  
[waterfall noise builds, intro music kicks in]

9  
00:00:53,760 --> 00:00:57,950  
Narrator: Mountain glaciers are some of the most charismatic parts

10  
00:00:57,950 --> 00:01:02,120  
cryosphere. Some might cling to the edges of cliffs

11  
00:01:02,120 --> 00:01:06,240  
[music rises] at higher elevations, then lay bare and flat in a broad plain,

12  
00:01:06,240 --> 00:01:10,450  
looking cracked and weathered like elephant skin, before tumbling

13  
00:01:10,450 --> 00:01:14,650

thousands of feet toward the sea, and terminating in a dramatic

14

00:01:14,650 --> 00:01:18,780

calving front. They're like motion frozen in time - [iceberg calves]

15

00:01:18,780 --> 00:01:22,970

until they aren't. They tell a story about

16

00:01:22,970 --> 00:01:27,050

the distant past, and yet are incredibly responsive to the present.

17

00:01:27,050 --> 00:01:31,130

You can understand why they'd be captivating to all of us,

18

00:01:31,130 --> 00:01:35,230

and especially cryospheric scientists.

19

00:01:35,230 --> 00:01:39,370

Meet Alex Gardner, a cryospheric scientist at NASA's

20

00:01:39,370 --> 00:01:43,470

Jet Propulsion Laboratory, who is going to help break down what a classic

21

00:01:43,470 --> 00:01:47,550

west coast North American glacier might look like, where high amounts of snow

22

00:01:47,550 --> 00:01:51,670

dump on to the mountains. Gardner: And at higher elevations,

23

00:01:51,670 --> 00:01:55,800

there's melt in summer, but not enough melt to get rid of all that snow. So that snow

24

00:01:55,800 --> 00:01:59,940

it compacts, it turns into ice, and it starts to flow under its own weight.

25

00:01:59,940 --> 00:02:04,030

And it flows down the valleys. As it flows down the valleys, it actually

26

00:02:04,030 --> 00:02:08,150

it actually carves those valleys out and it makes them deeper. And so it creates these beautiful fjords

27

00:02:08,150 --> 00:02:12,320

where the ice flows down, it snakes out to the ocean

28

00:02:12,320 --> 00:02:16,510

or to the lakes or further inland. And so that ice is flowing. It's moving.

29

00:02:16,510 --> 00:02:20,630

[music builds] Narrator: Alex uses satellite data to study large-scale changes

30

00:02:20,630 --> 00:02:24,660

. But two thousand miles to the north, Chris Larsen

31

00:02:24,660 --> 00:02:28,730

from the University of Alaska Fairbanks spends a lot of time studying

32

00:02:28,730 --> 00:02:32,860

glaciers from the air. He's been flying over Alaskan

33

00:02:32,860 --> 00:02:36,950

mountain glaciers for many years, most recently on a NASA-funded mission

34

00:02:36,950 --> 00:02:41,090

[water fall noise] called Operation IceBridge Alaska. He's absolutely

35

00:02:41,090 --> 00:02:45,280

enamored with his local rivers of ice.

36

00:02:45,280 --> 00:02:49,430

Interviewer: And what do you love about mountain glaciers? Chris Larsen: Well, they're in mountains

37

00:02:49,430 --> 00:02:53,490

so they're really pretty! You couldn't ask for a better way to experience

38

00:02:53,490 --> 00:02:57,580

Alaska on a large scale than to go flying around for campaign after campaign

39

00:02:57,580 --> 00:03:01,800

and to look at all the mountains in Alaska -- truly infinite.

40

00:03:01,800 --> 00:03:05,970

You just feel like you'll never see the end of them, and you don't want to.

41

00:03:05,970 --> 00:03:10,070

Narrator: But Chris doesn't spend weeks away from home

42

00:03:10,070 --> 00:03:14,180

and family for the views. Chris and his colleagues at NASA want to answer

43

00:03:14,180 --> 00:03:18,330

some pretty big questions by learning more about Alaskan glaciers

44

00:03:18,330 --> 00:03:22,470

and how they tick. Larsen: You know, why does NASA care about these?

45

00:03:22,470 --> 00:03:26,530

Well, they actually disproportionately contribute a large amount to sea level rise.

46

00:03:26,530 --> 00:03:30,600

Narrator: In the long run as the Earth warms due to climate change,

47

00:03:30,600 --> 00:03:34,720

the big ice sheets and mighty outlet glaciers of Greenland and Antarctica

48

00:03:34,720 --> 00:03:38,850

stand to contribute the most to sea level rise, simply because

49

00:03:38,850 --> 00:03:43,040

the vast majority of the planet's ice is stored there. But currently,

50

00:03:43,040 --> 00:03:47,180

it's the world's smaller mountain glaciers in comparatively warmer places,

51

00:03:47,180 --> 00:03:51,270

places like Alaska and Patagonia that are contributing about a third of all

52

00:03:51,270 --> 00:03:55,370

inputs to sea level rise, even though they account for only

53

00:03:55,370 --> 00:03:59,470

1% of the world's ice. Larsen: It's mostly due to them

54

00:03:59,470 --> 00:04:03,540

them being dynamic. They have water at the bed, which allows them to slide

55

00:04:03,540 --> 00:04:07,730

fast, and they react quickly to climate change

56

00:04:07,730 --> 00:04:11,850

and have higher velocities than their polar counterparts.

57

00:04:11,850 --> 00:04:15,990

Narrator: Back at JPL, Alex uses satellite measurements

58

00:04:15,990 --> 00:04:20,130

of global ice and computer models to predict ultimately,

59

00:04:20,130 --> 00:04:24,340

how much sea level rise we might see due to climate change.

60

00:04:24,340 --> 00:04:28,450

But in the case of mountain glaciers, we also care about the local impacts

61

00:04:28,450 --> 00:04:32,500

of disappearing ice. Alex: When we think of changes in ice sheets,

62

00:04:32,500 --> 00:04:36,580

we typically think of just what is the consequence for sea level rise

63

00:04:36,580 --> 00:04:40,680

and the future evolution of the ice sheets. But glaciers in other regions, like high mountain Asia,

64

00:04:40,680 --> 00:04:44,870

Alaska, the European Alps, these are places where

65

00:04:44,870 --> 00:04:49,060

these are places where changes in runoff matters to stream flows.

66

00:04:49,060 --> 00:04:53,140

In places like high mountain Asia, you have a lot of glaciers that feed the streams

67

00:04:53,140 --> 00:04:57,230

that flow down to populated regions. And that runoff

68

00:04:57,230 --> 00:05:01,340

becomes significant for water resources, irrigation, and agriculture.

69

00:05:01,340 --> 00:05:05,410

Narrator: Both Alex and Chris are passionate about

70

00:05:05,410 --> 00:05:09,570

understanding how glaciers are changing and what it means for our planet's future.

71

00:05:09,570 --> 00:05:13,750

They'll continue to use tools like elevation maps from the

72

00:05:13,750 --> 00:05:18,020

ICESat-2 satellite and detailed airborne measurements to monitor changing ice.

73

00:05:18,020 --> 00:05:22,090

[music fades, teaser music builds]

74

00:05:22,090 --> 00:05:26,180

Peter Griffith: by the end of the tunnel you're about 100 feet under ground, and you're surrounded by

75

00:05:26,180 --> 00:05:30,370

bones sticking out of the wall from the steppe bison and the

76  
00:05:30,370 --> 00:05:34,480  
mastodons, there's sticks that are 40,000 years old