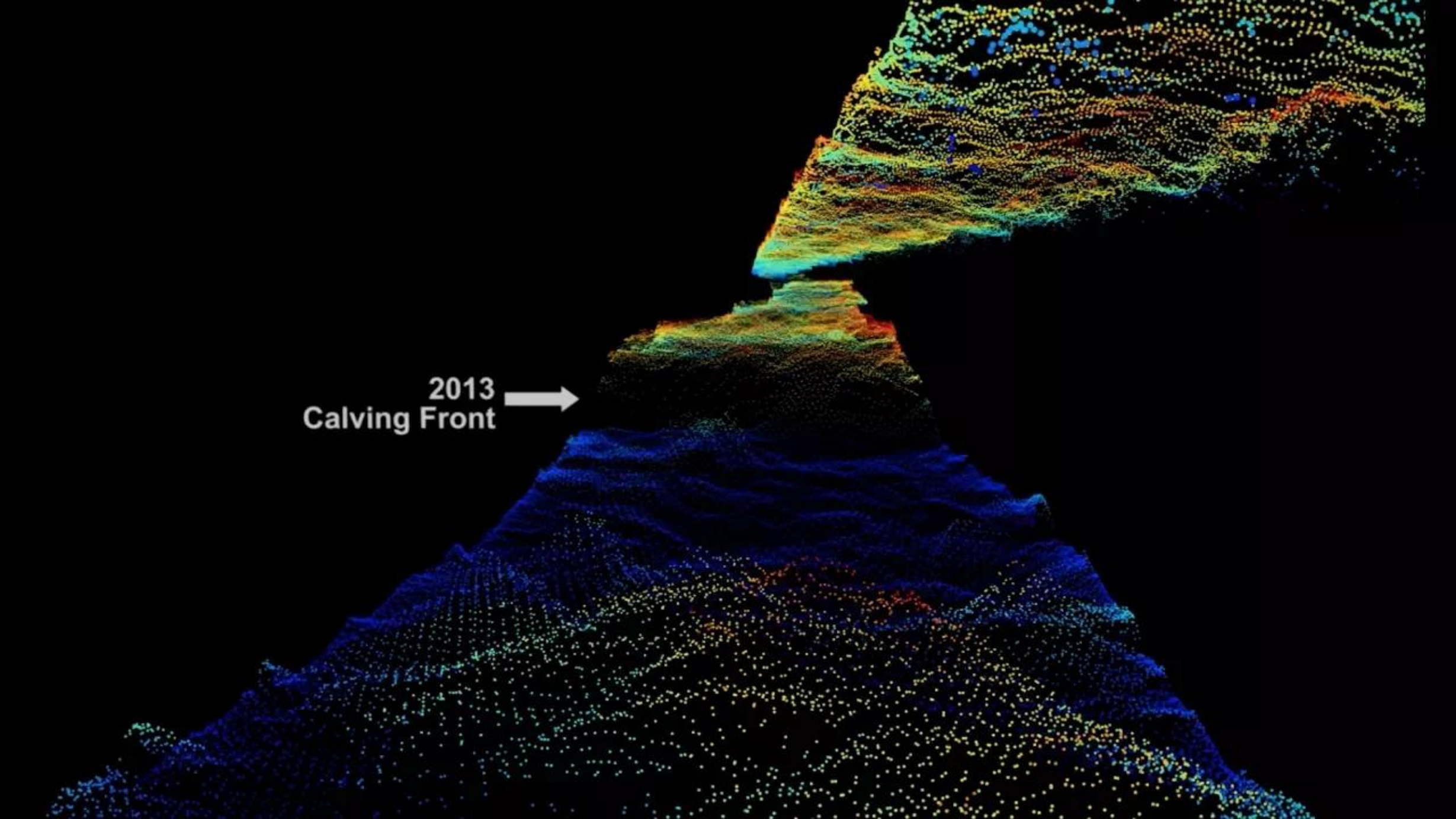
2013
Calving Front

1
00:00:00,060 --> 00:00:04,250
[music] Narrator: NASA’s airborne surveys are

2
00:00:04,270 --> 00:00:08,460
are giving scientists astonishingly accurate views of how

3
00:00:08,480 --> 00:00:12,650
Greenland’s glaciers are changing.

4
00:00:12,670 --> 00:00:16,740
Laser altimeters map the very details of glacier surfaces

5
00:00:16,760 --> 00:00:20,870
and flights spanning two decades reveal the dramatic changes

6
00:00:20,890 --> 00:00:25,070
that have taken place.

7
00:00:25,090 --> 00:00:29,250
[atmospheric music]

8
00:00:29,270 --> 00:00:33,440
On Greenland’s rugged eastern coast, spilling into

9
00:00:33,460 --> 00:00:37,630
a mountainous fjord, lies the four-mile-wide

10
00:00:37,650 --> 00:00:41,840
Helheim Glacier, named for the Viking world of the dead.

11
00:00:41,860 --> 00:00:46,070
It’s had a wild ride over the last 20 years,

12
00:00:46,090 --> 00:00:50,260
first rapidly retreating and thinning, then partially recovering

13
00:00:50,280 --> 00:00:54,510

its former extent. NASA science

14
00:00:54,530 --> 00:00:58,690
missions have flown the glacier’s center line year after year,

15
00:00:58,710 --> 00:01:02,780
collecting a wealth of valuable data.

16
00:01:02,800 --> 00:01:06,820
It all begins

17
00:01:06,840 --> 00:01:10,870
with a single beam of light.

18
00:01:10,890 --> 00:01:15,050
Firing several thousand pulses per second, laser instruments on board

19
00:01:15,070 --> 00:01:19,100
research aircraft measure the height of the surface below.

20
00:01:23,260 --> 00:01:27,460
The lasers spin in a

21
00:01:27,480 --> 00:01:31,540
250 meter circle, providing a swath of data that can be

22
00:01:31,560 --> 00:01:35,660
turned into a topographic map of the ice.

23
00:01:39,880 --> 00:01:44,050
Here we’ve shown higher elevations

24
00:01:44,070 --> 00:01:48,210
in red and orange, and lower elevations in green and blue,

25
00:01:48,230 --> 00:01:52,270
all the way down to the glacier’s calving front –

26
00:01:52,290 --> 00:01:56,450
where Helheim’s mighty icebergs break off into the sea.

27
00:01:56,470 --> 00:02:00,520
But one snapshot

28
00:02:00,540 --> 00:02:04,600
only tells part of the story. Here’s a 1998

29
00:02:04,620 --> 00:02:08,770
swath compared with 2013.

30
00:02:08,790 --> 00:02:12,960
We’ve changed the color scale to highlight the local

31
00:02:12,980 --> 00:02:17,060
differences in elevation.

32
00:02:17,080 --> 00:02:21,270
We’re now moving below the surface of the ice as it was in 1998,

33
00:02:21,290 --> 00:02:25,450
and over the mélange of icebergs and ocean that were present in the same spot

34
00:02:25,470 --> 00:02:29,480
in 2013. The calving front of the glacier

35
00:02:29,500 --> 00:02:33,660
has retreated significantly, by two and half miles.

36
00:02:33,680 --> 00:02:37,880
The glacier has thinned as well. We couldn't have flown at this elevation

37
00:02:37,900 --> 00:02:42,050
15 years ago. This all would have been ice.

38
00:02:42,070 --> 00:02:46,230

NASA’s Operation IceBridge, which has been measuring Greenland

39
00:02:46,250 --> 00:02:50,420
since 2009, has added to the laser data from previous missions

40
00:02:50,440 --> 00:02:54,680
with new instruments like ice penetrating radar,

41
00:02:54,700 --> 00:02:58,740
a magnetometer, and a gravimeter. It’s also used a

42
00:02:58,760 --> 00:03:02,860
high-resolution camera system, taking overlapping images of the ice

43
00:03:02,880 --> 00:03:06,920
throughout its eight-hour flights.

44
00:03:06,940 --> 00:03:11,100
These images can be pieced together

45
00:03:11,120 --> 00:03:15,260
into a mosaic, and since they overlap, provide us with a

46
00:03:15,280 --> 00:03:19,420
stereoscopic view of the ice, and an elevation model of their own.

47
00:03:19,440 --> 00:03:23,510
Here is that model overlaid onto the laser data,

48
00:03:23,530 --> 00:03:27,640
as we approach Helheim’s 70 meter high calving front.

49
00:03:27,660 --> 00:03:31,750
As we get

50
00:03:31,770 --> 00:03:35,940
close to the glacier’s terminus, large cracks in the ice, called crevasses

51
00:03:35,960 --> 00:03:40,130
get longer and deeper, a sign new icebergs

52
00:03:40,150 --> 00:03:44,280
will soon join their comrades on their way out to sea.

53
00:03:44,300 --> 00:03:48,460
Until the launch of a

54
00:03:48,480 --> 00:03:52,680
new NASA satellite, ICESat-2, Operation IceBridge

55
00:03:52,700 --> 00:03:56,710
will return to Greenland every spring to continue measurements

56
00:03:56,730 --> 00:04:00,860
of this large and ever-changing glacier.