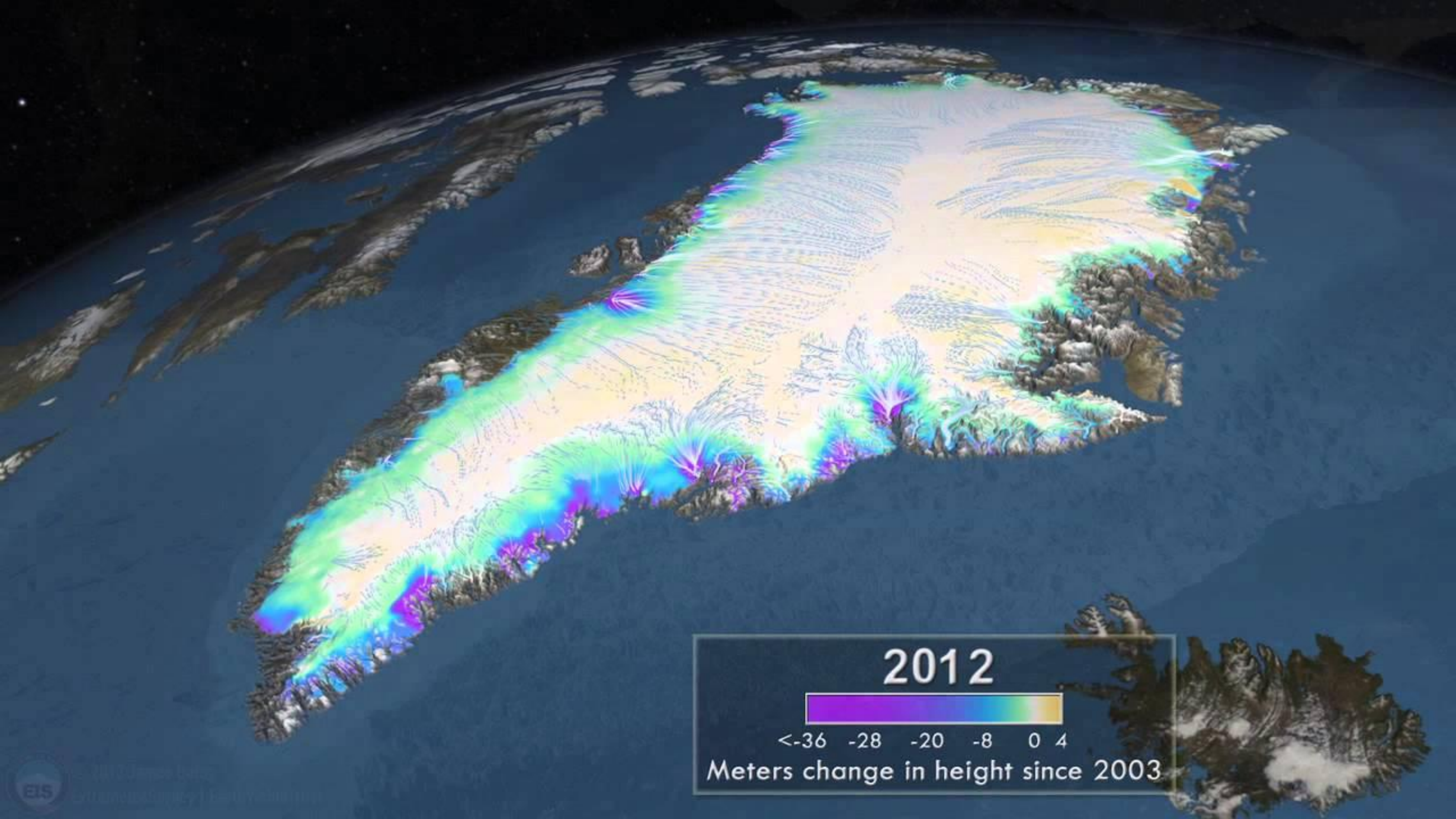
2012
<-36 -28 -20 -8 0 4
Meters change in height since 2003

1
00:00:00,020 --> 00:00:04,040
[music]

2
00:00:04,060 --> 00:00:08,210
Greenland,

3
00:00:08,230 --> 00:00:12,230
the world's largest island, extends over an area more than one quarter the size

4
00:00:12,250 --> 00:00:16,320
of the continental United States. Although sparsely populated,

5
00:00:16,340 --> 00:00:20,480
it holds the potential to impact populations around the world.

6
00:00:20,500 --> 00:00:24,540
The Greenland Ice Sheet, covering three quarters of the country

7
00:00:24,560 --> 00:00:28,620
in ice up to 3 kilometers thick, would increase global

8
00:00:28,640 --> 00:00:32,760
sea level by 7.2 meters if it were to melt completely.

9
00:00:32,780 --> 00:00:36,810
Since the late 1970's, NASA

10
00:00:36,830 --> 00:00:40,910
has been monitoring the changes in the Greenland Ice Sheet.

11
00:00:40,930 --> 00:00:44,950
Recent analysis of seven years of surface elevation readings from NASA's ICESat satellite

12
00:00:44,970 --> 00:00:49,020
and four years of laser and ice-penetrating

13
00:00:49,040 --> 00:00:53,190

radar data from NASA's airborne mission called Operation IceBridge

14
00:00:53,210 --> 00:00:57,210
show us how the surface elevation of the ice sheet has changed.

15
00:00:57,230 --> 00:01:01,310
The colors shown here represent the accumulated

16
00:01:01,330 --> 00:01:05,440
change in elevation since 2003.

17
00:01:05,460 --> 00:01:09,470
The light yellow over the central region of the ice sheet indicates a slight thickening

18
00:01:09,490 --> 00:01:13,560
due to snow.This accumulation, along

19
00:01:13,580 --> 00:01:17,730
with the weight of the ice sheet, pushes ice toward the coast.

20
00:01:17,750 --> 00:01:21,780
Thinning near coastal regions, shown in green, blue and purple,

21
00:01:21,800 --> 00:01:25,820
has increased over time and now extends into the interior of the ice sheet

22
00:01:25,840 --> 00:01:30,000
where the bedrock topography permits.

23
00:01:30,020 --> 00:01:34,100
As a result, there has been an average loss of 300 cubic kilometers of ice

24
00:01:34,120 --> 00:01:38,280
per year between 2003 and 2012.

25
00:01:38,300 --> 00:01:42,310
The bedrock formations under the ice sheet

26
00:01:42,330 --> 00:01:46,370
affect the size of the basins being drained by outlet glaciers.

27
00:01:46,390 --> 00:01:50,550
The weight of the massive ice sheet has depressed the interior bedrock topography,

28
00:01:50,570 --> 00:01:54,600
shown here in shades of brown, but mountains along the coast,

29
00:01:54,620 --> 00:01:58,780
shown in green, confine the ice sheet along the margins.

30
00:01:58,800 --> 00:02:02,950
In southeast Greenland, the ice sheet experienced fast thinning

31
00:02:02,970 --> 00:02:07,020
2004 to 2006, followed by brief periods of slower

32
00:02:07,040 --> 00:02:11,140
loss or even slight gain.

33
00:02:11,160 --> 00:02:15,180
Although significant loss has occurred, the glaciers that drain this region of

34
00:02:15,200 --> 00:02:19,260
Greenland’s ice sheet are short troughs hemmed in by coastal mountains.

35
00:02:19,280 --> 00:02:23,440
[music]

36
00:02:23,460 --> 00:02:27,500
The topography of the north is quite different, where the Northeast Greenland

37
00:02:27,520 --> 00:02:31,580
Greenland Ice Stream has unfettered access to the large interior basin.

38
00:02:31,600 --> 00:02:35,760

After a long period of stability,

39
00:02:35,780 --> 00:02:39,800
several large glaciers draining the region began thinning in 2000

40
00:02:39,820 --> 00:02:43,820
with increasing rates ever since.

41
00:02:43,840 --> 00:02:47,990
[music]

42
00:02:48,010 --> 00:02:52,080
This thinning could result in increasing mass loss from the deep central portion

43
00:02:52,100 --> 00:02:56,260
of the Greenland Ice Sheet, which would affect sea level

44
00:02:56,280 --> 00:03:00,300
and coastlines worldwide.

45
00:03:00,320 --> 00:03:04,410
The most dramatic mass loss has been observed since the

46
00:03:04,430 --> 00:03:08,590
late 1990s in the region feeding the Jakobshavn glacier on the central west coast.

47
00:03:08,610 --> 00:03:12,650
[music]

48
00:03:12,670 --> 00:03:16,820
Increased glacier calving has continued

49
00:03:16,840 --> 00:03:21,010
augmented by both an increase in surface melt, as well as

50
00:03:21,030 --> 00:03:25,100
melt caused by warming ocean temperatures.

51
00:03:25,120 --> 00:03:29,260
The ice sheets’ response to climate change has been both more rapid and

52
00:03:29,280 --> 00:03:33,280
much more complex than we would have thought a few decades ago.

53
00:03:33,300 --> 00:03:37,440
Over the last ten years, starting with the first ICESat satellite and

54
00:03:37,460 --> 00:03:41,630
continuing with Operation IceBridge, NASA missions have increased our understanding

55
00:03:41,650 --> 00:03:45,660
of the ice sheets' response to environmental changes.

56
00:03:45,680 --> 00:03:49,770
Future IceBridge flights and the launch of ICESat-2 will continue to help us better understand

57
00:03:49,790 --> 00:03:53,920
how the ice sheets respond to a changing climate

58
00:03:53,940 --> 00:03:57,960
and ultimately, help us more accurately project how much they might contribute