1
00:00:01,333 --> 00:00:04,837
[Snow machine engine]

2
00:00:04,870 --> 00:00:08,307
■

3
00:00:08,340 --> 00:00:17,083
[The Call of Science]

4
00:00:20,386 --> 00:00:31,297
[Operation IceBridge /
Greenland]

5
00:00:34,934 --> 00:00:37,670
[Joe MacGregor] I am looking out
over this beautiful landscape

6
00:00:37,703 --> 00:00:40,073
that is covered in snow.

7
00:00:40,106 --> 00:00:42,575
I realize that it won't
always be that way

8
00:00:42,608 --> 00:00:44,177
for the rest of my lifetime.

9
00:00:44,877 --> 00:00:47,680
And I felt sad because
this is a landscape

10
00:00:47,713 --> 00:00:50,216
that is an integral
part of the Earth.

11
00:00:54,019 --> 00:00:56,956
Life as an Earth scientist
means understanding

12
00:00:56,989 --> 00:00:59,158
the planet that we live on, and,

13
00:00:59,191 --> 00:01:01,194
especially in the context
of climate change,

14
00:01:01,227 --> 00:01:03,363
understanding where that
planet is headed.

15
00:01:03,896 --> 00:01:05,331
So, for a glaciologist
that means

16
00:01:05,364 --> 00:01:07,367
understanding where
ice is headed.

17
00:01:13,772 --> 00:01:17,043
I try to understand how
glaciers in Greenland

18
00:01:17,076 --> 00:01:20,313
and Antarctica flow, how they
have changed in the past,

19
00:01:20,346 --> 00:01:21,948
how they're changing presently

20
00:01:21,981 --> 00:01:23,583
and how they will
change in the future.

21
00:01:30,556 --> 00:01:35,061
That ice flow can vary over
time and can have significant

22
00:01:35,094 --> 00:01:38,998

consequences for the Earth
systems around it and hence

23
00:01:39,031 --> 00:01:42,869
also societies that are
dependent on either the water

24
00:01:42,902 --> 00:01:45,671
that those glaciers
release or the sea levels

25
00:01:45,704 --> 00:01:47,440
that those glaciers
can influence.

26
00:01:56,415 --> 00:01:59,051
When you are flying over
these polar regions,

27
00:01:59,084 --> 00:02:01,254
it's a alien world.

28
00:02:01,287 --> 00:02:04,624
And when you're standing on
the ice in these regions,

29
00:02:04,657 --> 00:02:07,393
it can also feel
incredibly desolate

30
00:02:07,426 --> 00:02:09,429
but also liberating
at the same time.

31
00:02:15,968 --> 00:02:17,870
The biggest
scientific question

32
00:02:17,903 --> 00:02:19,705
that I'm pursuing

right now is,

33
00:02:19,738 --> 00:02:22,608
"What is going
to happen to these

34
00:02:22,641 --> 00:02:26,546
two remaining large ice sheets
in Greenland and Antarctica,

35
00:02:26,579 --> 00:02:28,114
in the coming centuries?

36
00:02:28,147 --> 00:02:30,216
Are they going to
retreat dramatically?

37
00:02:30,249 --> 00:02:32,218
Are they going to collapse?

38
00:02:32,251 --> 00:02:35,821
Or are they going to be
relatively unaffected

39
00:02:35,854 --> 00:02:37,657
by a changing climate?"

40
00:02:39,491 --> 00:02:40,793
That's the question.

41
00:02:43,963 --> 00:02:47,333
On board IceBridge airplanes
we have a laser that can

42
00:02:47,366 --> 00:02:50,803
very precisely measure the
elevation of the surface.

43
00:02:51,203 --> 00:02:52,838

That allows us to
monitor the health

44
00:02:52,871 --> 00:02:54,707
of glaciers and ice sheets.

45
00:02:55,541 --> 00:02:57,577
We have ice-penetrating radars

46
00:02:57,610 --> 00:02:59,745
that send out radio
frequency pulses

47
00:02:59,778 --> 00:03:02,481
and reflect off of
layers within the ice.

48
00:03:02,514 --> 00:03:04,083
From that, we can learn
about the structure

49
00:03:04,116 --> 00:03:06,018
of the ice below us,

50
00:03:06,051 --> 00:03:07,453
how thick the ice is,

51
00:03:07,486 --> 00:03:10,523
and about the properties
of the rock below.

52
00:03:12,124 --> 00:03:16,095
It takes a large, concerted
effort like Operation IceBridge

53
00:03:16,128 --> 00:03:19,966
to go out there and,
not only make the repeat

54

00:03:19,999 --> 00:03:23,035
measurements that we need to
understand changing ice,

55
00:03:23,068 --> 00:03:26,272
but to go out and learn
new things requires

56
00:03:26,305 --> 00:03:30,210
a steady focus on the
act of exploration.

57
00:03:40,252 --> 00:03:44,890
NASA, in my view, seeks to do
things both technologically

58
00:03:44,923 --> 00:03:48,161
and scientifically that have
never been done before.

59
00:03:48,861 --> 00:03:52,598
We're learning something about
the ice and the rock and the

60
00:03:52,631 --> 00:03:56,436
Earth system in these places
that no one ever knew before

61
00:03:56,735 --> 00:03:59,639
and so you really feel like
not only do you have the

62
00:03:59,672 --> 00:04:02,475
potential to leave your
mark as a scientist

63
00:04:03,375 --> 00:04:05,712
but you're contributing
to the greater good.

64

00:04:08,347 --> 00:04:12,318
We don't know if we can stop
the changes that we've seen,

65
00:04:12,584 --> 00:04:15,988
but what I do know is that if
we can, it will require us to

66
00:04:16,021 --> 00:04:19,725
learn a lot more about what is
going on in the polar regions,

67
00:04:19,758 --> 00:04:22,428
and to go out there,
"boots on the ground,"

68
00:04:22,461 --> 00:04:25,164
explore what's going
on as scientists.

69
00:04:35,074 --> 00:04:37,310
[CORAL Mission / Oahu, Hawaii]

70
00:04:37,343 --> 00:04:39,211
[Michelle Gierach] Coral
reefs, they're sometimes dubbed

71
00:04:39,244 --> 00:04:40,680
"the rainforests of the sea"

72
00:04:40,713 --> 00:04:42,248
and I think that's true.

73
00:04:42,281 --> 00:04:46,219
They actually house a quarter
of all the oceanic fish species.

74
00:04:49,188 --> 00:04:50,823
The COral Reef
Airborne Laboratory,

75
00:04:50,856 --> 00:04:53,292
otherwise called
the CORAL mission,

76
00:04:53,325 --> 00:04:55,661
is a three-year
investigation to use

77
00:04:55,694 --> 00:04:58,531
state-of-the-art airborne as
well as in-water measurements.

78
00:04:58,564 --> 00:05:01,767
We're looking at a portion of
the world's reef system to

79
00:05:01,800 --> 00:05:04,804
assess the condition of these
threatened ecosystems and

80
00:05:04,837 --> 00:05:07,273
relate how they're changing
to their environment.

81
00:05:09,007 --> 00:05:11,077
The instrument that flies
aboard the aircraft is

82
00:05:11,110 --> 00:05:14,347
observing light that's reflected
from the ocean surface.

83
00:05:14,380 --> 00:05:16,782
What the instrument is
actually able to do

84
00:05:16,815 --> 00:05:20,853
is break down that
light into profiles.

85
00:05:20,886 --> 00:05:23,122
So, just like you or I have
unique fingerprints

86
00:05:23,155 --> 00:05:26,492
the instrument's actually able
to discriminate the different

87
00:05:26,525 --> 00:05:29,329
sort of unique fingerprints of
coral, algae, and sand.

88
00:05:40,172 --> 00:05:43,576
We have an in-water team to
validate what we're seeing

89
00:05:43,609 --> 00:05:45,211
from the instrument itself.

90
00:05:47,679 --> 00:05:48,781
[Splash]

91
00:05:55,487 --> 00:05:57,156
Our current understanding
of coral reefs

92
00:05:57,189 --> 00:06:01,494
is really only about .01 to 1%
of reefs worldwide.

93
00:06:01,627 --> 00:06:03,529
That's extremely small.

94
00:06:10,436 --> 00:06:13,172
We know they're threatened,
but do we really understand

95
00:06:13,205 --> 00:06:14,740

how that all works together,

96
00:06:14,773 --> 00:06:16,942
how their condition
changes with respect to their

97
00:06:16,975 --> 00:06:19,112
environment of global
climate change?

98
00:06:33,592 --> 00:06:35,261
That's really what we're
trying to do for coral;

99
00:06:35,294 --> 00:06:38,330
providing this unique data set
and then looking at those

100
00:06:38,363 --> 00:06:41,066
different conditions--how is
it changing with respect to

101
00:06:41,099 --> 00:06:43,068
increasing ocean acidification,

102
00:06:43,101 --> 00:06:45,104
increasing ocean temperatures.

103
00:06:50,042 --> 00:06:52,077
I am a soon-to-be-parent.

104
00:06:52,110 --> 00:06:56,182
I want to provide my child
with an Earth system

105
00:06:56,215 --> 00:06:58,951
that I grew up with, that I
know, that I love,

106

00:06:58,984 --> 00:07:00,953
that isn't so
dramatically different

107
00:07:00,986 --> 00:07:03,956
that certain species and
certain ecosystems

108
00:07:03,989 --> 00:07:07,593
are no longer there
and that it's viable for life.

109
00:07:12,231 --> 00:07:14,366
It's great when you find
what you expected,

110
00:07:14,399 --> 00:07:18,471
but I love when what I
assumed is not what I find.

111
00:07:19,037 --> 00:07:20,840
That's what drove me
to science--

112
00:07:20,873 --> 00:07:22,809
just the intrigue
of it, the mystery.

113
00:07:23,976 --> 00:07:25,511
It's what keeps me going.

114
00:07:29,047 --> 00:07:30,883
[MacGregor] There are
thousands of scientists

115
00:07:30,916 --> 00:07:34,353
at NASA, at JPL and other
institutions around the globe

116
00:07:34,386 --> 00:07:37,690

who have dedicated their
careers to better understanding

117
00:07:37,723 --> 00:07:39,325
the Earth as it is,

118
00:07:39,358 --> 00:07:42,595
and developing models that
can help us project

119
00:07:42,628 --> 00:07:44,230
what the future of
the Earth is.

120
00:07:45,130 --> 00:07:48,334
That is a personal commitment
from each of those scientists

121
00:07:48,367 --> 00:07:50,570
that you can't easily
walk away from.

122
00:07:51,770 --> 00:07:53,772
When you are a
scientist you want to

123
00:07:53,805 --> 00:07:56,442
understand the world as it is,

124
00:07:56,475 --> 00:07:58,845
not the world as you
wish it were.

125
00:08:00,712 --> 00:08:02,681
[Gierach] Though I'm
an oceanographer,

126
00:08:02,714 --> 00:08:05,651
clearly the ocean,
the atmosphere, the land,

127
00:08:05,684 --> 00:08:08,020
the cryosphere--we're all
connected as the Earth system.

128
00:08:08,053 --> 00:08:09,522
We're all impacting
one another.

129
00:08:09,555 --> 00:08:10,556
We really need to have

130
00:08:10,589 --> 00:08:13,025
a better understanding
of that interworking.

131
00:08:16,562 --> 00:08:19,398
[MacGregor] NASA continually
wants to move forward,

132
00:08:19,431 --> 00:08:22,401
not only our understanding of
Earth but, of course,

133
00:08:22,434 --> 00:08:25,838
the moon, the solar system,
worlds beyond that.

134
00:08:26,305 --> 00:08:28,274
We want to learn
the new things

135
00:08:28,807 --> 00:08:30,510
and I'm very glad to
be a part of that.

136
00:08:34,146 --> 00:08:36,015
[NASA/ Jet Propulsion Laboratory