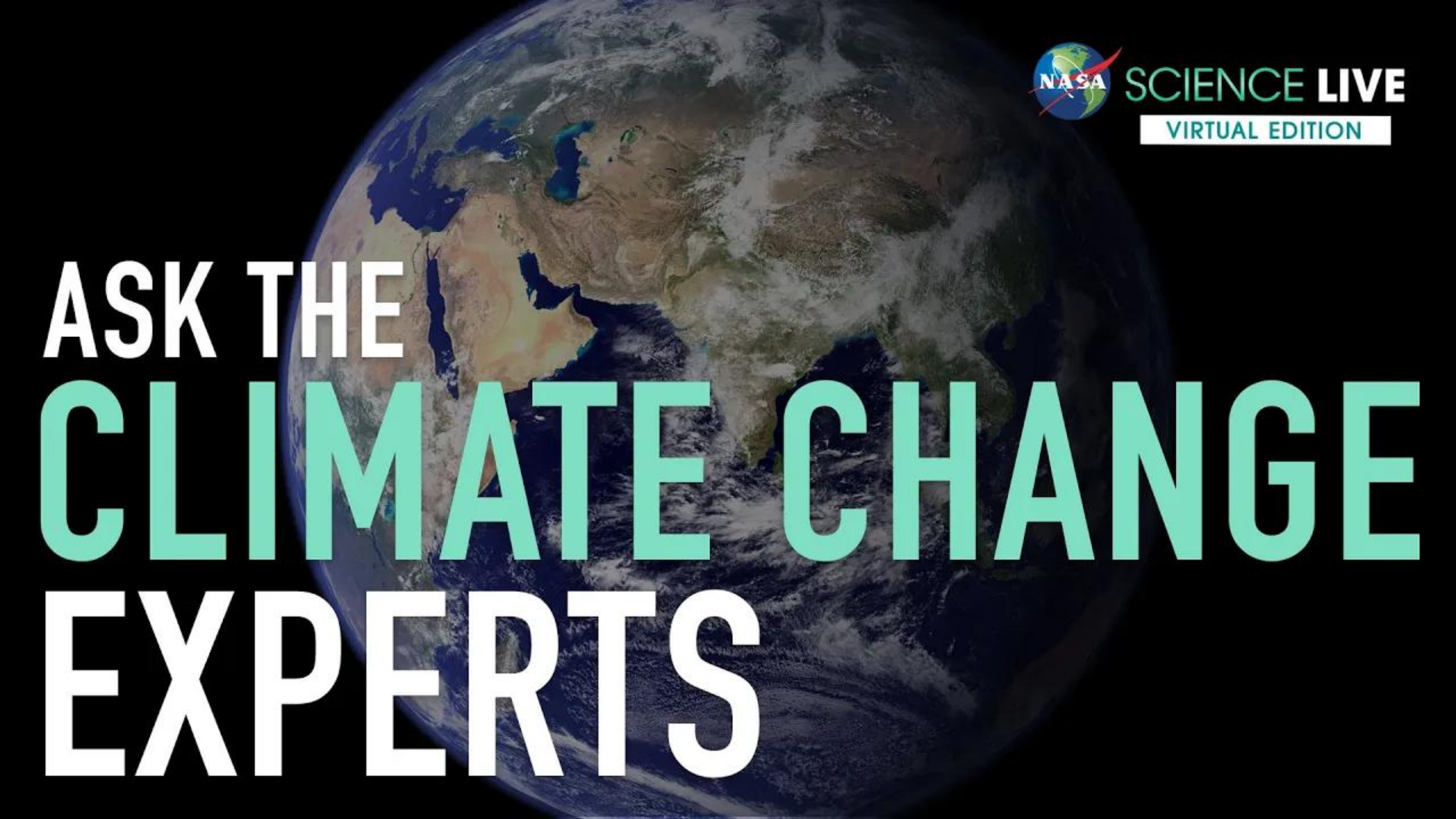
NASA
SCIENCE LIVE
VIRTUAL EDITION
ASK THE
CLIMATE CHANGE
EXPERTS

1
00:00:06,090 --> 00:00:11,910
[Music]

2
00:00:11,920 --> 00:00:14,910
earth

3
00:00:19,109 --> 00:00:17,910
home of all the planets nasa has

4
00:00:21,990 --> 00:00:19,119
explored

5
00:00:25,750 --> 00:00:22,000
none have matched the dynamic complexity

6
00:00:28,470 --> 00:00:26,790
deserts

7
00:00:31,910 --> 00:00:28,480
tropical forests

8
00:00:33,270 --> 00:00:31,920
icy poles massive storms rage over land

9
00:00:35,190 --> 00:00:33,280
and oceans

10
00:00:36,790 --> 00:00:35,200
a unique atmosphere protects and

11
00:00:39,830 --> 00:00:36,800
insulates us

12
00:00:42,229 --> 00:00:39,840
liquid water spans its vast surface

13
00:00:46,150 --> 00:00:42,239

and a delicate balance of systems gives

14
00:00:51,430 --> 00:00:49,350
earth is a very special place

15
00:00:53,670 --> 00:00:51,440
from the vantage point of space

16
00:00:55,910 --> 00:00:53,680
the perspective of sky and sea

17
00:00:58,310 --> 00:00:55,920
and all across the land we study our

18
00:01:00,930 --> 00:00:58,320
planet not only to learn about it but

19
00:01:06,390 --> 00:01:00,940
also to protect it

20
00:01:12,469 --> 00:01:09,030
hello everyone and welcome to another

21
00:01:15,429 --> 00:01:12,479
episode of nasa science live i'm your

22
00:01:18,149 --> 00:01:15,439
host dr kimberly miner and i'm so glad

23
00:01:20,469 --> 00:01:18,159
you could join us today for earth day

24
00:01:23,670 --> 00:01:20,479
i'm a nasa climate scientist and this

25
00:01:25,749 --> 00:01:23,680
year at nasa earth day is all about

26
00:01:28,390 --> 00:01:25,759
connections

27
00:01:30,149 --> 00:01:28,400
our planet is home to over 7 billion

28
00:01:31,590 --> 00:01:30,159
people of diverse backgrounds and

29
00:01:34,950 --> 00:01:31,600
experiences

30
00:01:37,190 --> 00:01:34,960
and we are all connected by earth

31
00:01:40,230 --> 00:01:37,200
nasa earth science shows us the ways

32
00:01:44,069 --> 00:01:40,240
that the natural systems like land water

33
00:01:46,389 --> 00:01:44,079
air and ice connect to and affect each

34
00:01:48,469 --> 00:01:46,399
other and our climate

35
00:01:51,190 --> 00:01:48,479
earth's climate is changing and since

36
00:01:53,830 --> 00:01:51,200
the mid 20th century we know that human

37
00:01:55,990 --> 00:01:53,840
activity has been driving this change

38
00:01:57,749 --> 00:01:56,000

today we're going to explore how nasa

39
00:01:59,429 --> 00:01:57,759
studies climate change and how that

40
00:02:01,350 --> 00:01:59,439
information is used

41
00:02:03,350 --> 00:02:01,360
worldwide

42
00:02:06,069 --> 00:02:03,360
but first let's start with the basics

43
00:02:08,389 --> 00:02:06,079
what is climate change

44
00:02:10,710 --> 00:02:08,399
i'm here today with dr leslie ott a

45
00:02:13,670 --> 00:02:10,720
climate scientist at nasa goddard and

46
00:02:16,390 --> 00:02:13,680
aquisha glenn research assistant and phd

47
00:02:17,990 --> 00:02:16,400
candidate at nasa guests to break all of

48
00:02:19,910 --> 00:02:18,000
this down for us

49
00:02:21,510 --> 00:02:19,920
leslie aquisha thank you so much for

50
00:02:22,710 --> 00:02:21,520
joining us today

51
00:02:24,470 --> 00:02:22,720
thanks for having me thank you for

52
00:02:27,190 --> 00:02:24,480
having me

53
00:02:30,390 --> 00:02:27,200
so leslie will start with you

54
00:02:32,309 --> 00:02:30,400
tell us what is climate

55
00:02:33,750 --> 00:02:32,319
so a lot of people get confused about

56
00:02:35,670 --> 00:02:33,760
the difference between weather and

57
00:02:38,630 --> 00:02:35,680
climate you can kind of think of climate

58
00:02:40,470 --> 00:02:38,640
as the long-term average of weather

59
00:02:42,470 --> 00:02:40,480
so say you have a friend who's thinking

60
00:02:43,910 --> 00:02:42,480
of moving to your city from out of state

61
00:02:45,270 --> 00:02:43,920
they might ask you what's the weather

62
00:02:47,030 --> 00:02:45,280
like but what they really mean is what

63
00:02:49,430 --> 00:02:47,040

is the climate like what's the typical

64
00:02:51,110 --> 00:02:49,440
weather like things like how many days

65
00:02:53,509 --> 00:02:51,120
in a month does it rain when does the

66
00:02:55,670 --> 00:02:53,519
snow end in the winter how hot are your

67
00:02:58,710 --> 00:02:55,680
summers in july and august those are the

68
00:02:59,830 --> 00:02:58,720
kind of basic pieces of information that

69
00:03:02,149 --> 00:02:59,840
uh

70
00:03:03,670 --> 00:03:02,159
affect our lives every day and those are

71
00:03:05,910 --> 00:03:03,680
the re some of the reasons that

72
00:03:10,550 --> 00:03:05,920
scientists like us get so concerned when

73
00:03:15,750 --> 00:03:12,949
right and now the reason why climate

74
00:03:19,589 --> 00:03:15,760
change is a cause for concern is because

75
00:03:21,030 --> 00:03:19,599
of the rate of change in these baseline

76
00:03:22,869 --> 00:03:21,040
average weather conditions that are

77
00:03:24,949 --> 00:03:22,879
being reported by cities all over the

78
00:03:27,670 --> 00:03:24,959
world

79
00:03:31,430 --> 00:03:27,680
okay interesting so equitia why is this

80
00:03:35,589 --> 00:03:33,190
human activity

81
00:03:38,509 --> 00:03:35,599
um co2 emissions from human related

82
00:03:40,390 --> 00:03:38,519
activities are being released at an

83
00:03:43,789 --> 00:03:40,400
unprecedented rate

84
00:03:46,789 --> 00:03:43,799
and this is considering a time span over

85
00:03:48,949 --> 00:03:46,799
66 million years

86
00:03:51,830 --> 00:03:48,959
so we have this large influx of carbon

87
00:03:53,830 --> 00:03:51,840
dioxide which is a greenhouse gas and

88
00:03:56,550 --> 00:03:53,840

this is accumulating in the atmosphere

89
00:03:58,550 --> 00:03:56,560
is trapping and absorbing radiation and

90
00:04:00,550 --> 00:03:58,560
this is driving temperature change at a

91
00:04:02,070 --> 00:04:00,560
rapid rate

92
00:04:04,550 --> 00:04:02,080
okay thank you for the great

93
00:04:06,869 --> 00:04:04,560
explanations you guys i know i have more

94
00:04:07,990 --> 00:04:06,879
questions and so do the people watching

95
00:04:09,990 --> 00:04:08,000
from home

96
00:04:12,229 --> 00:04:10,000
so remember you can join the

97
00:04:13,750 --> 00:04:12,239
conversation and ask your questions by

98
00:04:15,990 --> 00:04:13,760
writing in the comment box wherever

99
00:04:19,590 --> 00:04:16,000
you're watching this or by using the

100
00:04:20,949 --> 00:04:19,600
hashtag asknasa on social media we're

101
00:04:22,629 --> 00:04:20,959
going to be answering all of your

102
00:04:24,629 --> 00:04:22,639
questions near the end of the show so

103
00:04:26,790 --> 00:04:24,639
please do stay tuned

104
00:04:28,550 --> 00:04:26,800
first let's take a look at how nasa is

105
00:04:30,550 --> 00:04:28,560
studying carbon dioxide

106
00:04:33,909 --> 00:04:30,560
and its effect on our weather and

107
00:04:35,830 --> 00:04:33,919
climate here on earth

108
00:04:36,950 --> 00:04:35,840
the earth's atmosphere is a mixture of

109
00:04:41,110 --> 00:04:36,960
gases

110
00:04:43,909 --> 00:04:41,120
that's because they trap heat from the

111
00:04:45,749 --> 00:04:43,919
sun and warm the earth

112
00:04:48,550 --> 00:04:45,759
that's good because without greenhouse

113
00:04:49,990 --> 00:04:48,560

gases our planet would freeze and life

114
00:04:51,990 --> 00:04:50,000
as most of us know it would be

115
00:04:54,230 --> 00:04:52,000
impossible

116
00:04:57,030 --> 00:04:54,240
these greenhouse gases mainly water

117
00:04:58,950 --> 00:04:57,040
vapor and carbon dioxide naturally cycle

118
00:04:59,909 --> 00:04:58,960
between the land and atmosphere and

119
00:05:02,150 --> 00:04:59,919
ocean

120
00:05:03,909 --> 00:05:02,160
and over the ages these greenhouse gases

121
00:05:06,070 --> 00:05:03,919
have reached a delicate balance that

122
00:05:07,909 --> 00:05:06,080
results in temperatures that we like a

123
00:05:09,590 --> 00:05:07,919
lot

124
00:05:10,469 --> 00:05:09,600
it's been that way for thousands of

125
00:05:16,629 --> 00:05:10,479
years

126
00:05:21,110 --> 00:05:16,639
people began burning fossil fuels

127
00:05:23,189 --> 00:05:21,120
those fossil fuels coal oil natural gas

128
00:05:26,150 --> 00:05:23,199
contain carbon that's been locked away

129
00:05:28,469 --> 00:05:26,160
from the natural cycle for eons

130
00:05:31,189 --> 00:05:28,479
but when we burn them that carbon joins

131
00:05:33,430 --> 00:05:31,199
with oxygen to make carbon dioxide that

132
00:05:35,430 --> 00:05:33,440
goes into the atmosphere

133
00:05:37,270 --> 00:05:35,440
it throws the natural balance out of

134
00:05:38,710 --> 00:05:37,280
whack

135
00:05:41,350 --> 00:05:38,720
the more carbon dioxide in the

136
00:05:43,670 --> 00:05:41,360
atmosphere the more heat that is trapped

137
00:05:47,990 --> 00:05:43,680
and the warmer it gets

138
00:05:49,830 --> 00:05:48,000

climate changes and the higher the ocean

139
00:05:51,990 --> 00:05:49,840
will rise

140
00:05:54,230 --> 00:05:52,000
the more we learn about carbon dioxide

141
00:05:55,909 --> 00:05:54,240
and other greenhouse gases the better we

142
00:05:57,350 --> 00:05:55,919
can deal with the changes caused by

143
00:06:02,670 --> 00:05:57,360
global warming

144
00:06:02,680 --> 00:06:16,790
[Music]

145
00:06:21,749 --> 00:06:19,270
nasa studies earth's climate so closely

146
00:06:23,189 --> 00:06:21,759
and with so many missions that we even

147
00:06:25,029 --> 00:06:23,199
have a climate advisor to the

148
00:06:27,350 --> 00:06:25,039
presidential administration

149
00:06:29,350 --> 00:06:27,360
nasa provides real data for decision

150
00:06:31,110 --> 00:06:29,360
makers about our climate

151
00:06:32,469 --> 00:06:31,120
let's hear from nasa's climate advisor

152
00:06:34,469 --> 00:06:32,479
now

153
00:06:36,710 --> 00:06:34,479
my name is dr gaming schmidt and i'm

154
00:06:39,110 --> 00:06:36,720
nasa's senior climate advisor which

155
00:06:41,270 --> 00:06:39,120
means i bring nasa's climate science to

156
00:06:43,909 --> 00:06:41,280
the public and help figure out how to

157
00:06:45,590 --> 00:06:43,919
apply it to saving the planet

158
00:06:48,230 --> 00:06:45,600
i've been a climate scientist with nasa

159
00:06:50,790 --> 00:06:48,240
for more than 25 years and i use earth

160
00:06:54,390 --> 00:06:50,800
data and models to understand the past

161
00:06:55,589 --> 00:06:54,400
present and future of climate change

162
00:06:58,070 --> 00:06:55,599
climate change is one of the most

163
00:07:00,710 --> 00:06:58,080

complex issues facing us today it is a

164
00:07:02,870 --> 00:07:00,720
global problem felt on local scales and

165
00:07:04,629 --> 00:07:02,880
one that will be around for decades and

166
00:07:06,469 --> 00:07:04,639
centuries to come

167
00:07:08,230 --> 00:07:06,479
just as your doctor checks your health

168
00:07:11,430 --> 00:07:08,240
by monitoring your temperature and other

169
00:07:14,070 --> 00:07:11,440
vital signs at nasa we keep an eye on

170
00:07:15,990 --> 00:07:14,080
the planet's vital signs we keep track

171
00:07:18,790 --> 00:07:16,000
of the earth's temperature the patterns

172
00:07:20,790 --> 00:07:18,800
of rainfall ice sheets sea level rise

173
00:07:21,670 --> 00:07:20,800
and the amount of carbon dioxide in our

174
00:07:24,790 --> 00:07:21,680
air

175
00:07:27,110 --> 00:07:24,800
thanks to nasa earth science we know our

176
00:07:28,870 --> 00:07:27,120
planet and its climate are changing

177
00:07:31,350 --> 00:07:28,880
and based on the evidence from the

178
00:07:34,550 --> 00:07:31,360
oceans to the upper atmosphere and from

179
00:07:37,909 --> 00:07:34,560
the tropics to the poles we also know

180
00:07:40,870 --> 00:07:37,919
human activities are driving this change

181
00:07:43,110 --> 00:07:40,880
as our planet's temperature rises that

182
00:07:45,189 --> 00:07:43,120
will impact weather and extremes

183
00:07:48,309 --> 00:07:45,199
this means more severe heat waves more

184
00:07:49,510 --> 00:07:48,319
intense droughts wildfires and hurricane

185
00:07:51,430 --> 00:07:49,520
seasons

186
00:07:53,909 --> 00:07:51,440
many extreme events in recent years have

187
00:07:54,950 --> 00:07:53,919
been made worse by human-caused climate

188
00:07:56,469 --> 00:07:54,960

change

189
00:07:58,950 --> 00:07:56,479
i look forward to helping

190
00:08:01,110 --> 00:07:58,960
decision-makers at all levels find and

191
00:08:04,230 --> 00:08:01,120
use the information they need to move

192
00:08:05,510 --> 00:08:04,240
towards a more climate secure future

193
00:08:09,110 --> 00:08:05,520
for us

194
00:08:13,830 --> 00:08:10,830
and now we're back with leslie and

195
00:08:16,070 --> 00:08:13,840
equation so tell us leslie

196
00:08:19,749 --> 00:08:16,080
how is nasa data showing the connection

197
00:08:20,629 --> 00:08:19,759
between humans and climate change

198
00:08:22,550 --> 00:08:20,639
you know

199
00:08:24,390 --> 00:08:22,560
before we had satellites we we had

200
00:08:26,070 --> 00:08:24,400
measurements of carbon dioxide from

201
00:08:28,230 --> 00:08:26,080
surface stations but only a handful

202
00:08:29,749 --> 00:08:28,240
across the the surface of the earth uh

203
00:08:31,350 --> 00:08:29,759
those are really important in telling us

204
00:08:33,190 --> 00:08:31,360
how things are changing over a long time

205
00:08:35,190 --> 00:08:33,200
period but they can't show us all the

206
00:08:38,469 --> 00:08:35,200
complexity of where emissions are coming

207
00:08:41,029 --> 00:08:38,479
from in 2014 nasa launched its first

208
00:08:43,029 --> 00:08:41,039
dedicated carbon dioxide mission called

209
00:08:44,790 --> 00:08:43,039
the orbiting carbon observatory and

210
00:08:47,190 --> 00:08:44,800
since then we've been getting these

211
00:08:48,710 --> 00:08:47,200
beautiful maps of carbon dioxide that

212
00:08:50,550 --> 00:08:48,720
fill in all of the holes that we had

213
00:08:52,230 --> 00:08:50,560

when we only had that handful of surface

214
00:08:53,670 --> 00:08:52,240
station many years ago

215
00:08:56,389 --> 00:08:53,680
this is giving us so much more

216
00:08:59,030 --> 00:08:56,399
information about human emissions and

217
00:09:01,590 --> 00:08:59,040
where carbon dioxide comes from but also

218
00:09:03,829 --> 00:09:01,600
where on the land and in the ocean

219
00:09:05,350 --> 00:09:03,839
carbon dioxide is naturally absorbed and

220
00:09:06,550 --> 00:09:05,360
that's really important because the

221
00:09:08,710 --> 00:09:06,560
oceans in the land are playing this

222
00:09:10,310 --> 00:09:08,720
really important role in mitigating

223
00:09:12,710 --> 00:09:10,320
climate change by absorbing about half

224
00:09:15,190 --> 00:09:12,720
of human emissions so we're learning so

225
00:09:17,110 --> 00:09:15,200
much more about how carbon dioxide is

226
00:09:20,389 --> 00:09:17,120
changing across the globe from this

227
00:09:25,829 --> 00:09:23,910
amazing and wonderful satellite images

228
00:09:28,070 --> 00:09:25,839
um equesia tell us a little bit about

229
00:09:30,150 --> 00:09:28,080
how climate change impacts our planet's

230
00:09:32,230 --> 00:09:30,160
weather including things like fire

231
00:09:35,030 --> 00:09:32,240
seasons hurricanes and other natural

232
00:09:38,630 --> 00:09:36,870
well there are a wide range of impacts

233
00:09:40,389 --> 00:09:38,640
to the weather and this is going to vary

234
00:09:42,710 --> 00:09:40,399
from place to place so

235
00:09:45,990 --> 00:09:42,720
you have some places that may get drier

236
00:09:48,470 --> 00:09:46,000
um some places may uh be getting wetter

237
00:09:50,870 --> 00:09:48,480
seasons like these fire seasons and even

238
00:09:54,070 --> 00:09:50,880

blooming seasons can potentially shift

239
00:09:55,509 --> 00:09:54,080
so they maybe start earlier they may be

240
00:09:58,790 --> 00:09:55,519
longer

241
00:10:01,110 --> 00:09:58,800
you also have changes within the seasons

242
00:10:03,190 --> 00:10:01,120
themselves so for example

243
00:10:05,509 --> 00:10:03,200
you could probably get less snow during

244
00:10:07,509 --> 00:10:05,519
your winters and with that i'm thinking

245
00:10:09,110 --> 00:10:07,519
of new york city right i'm born and

246
00:10:11,910 --> 00:10:09,120
raised in new york city

247
00:10:13,590 --> 00:10:11,920
and as a kid i remember having to trek

248
00:10:15,590 --> 00:10:13,600
through snow like there was just always

249
00:10:17,030 --> 00:10:15,600
snow throughout the winter it was always

250
00:10:21,030 --> 00:10:17,040
there just like a

251
00:10:23,030 --> 00:10:21,040
picture perfect snowy uh wonderland but

252
00:10:25,509 --> 00:10:23,040
now as time has gone on and i've gotten

253
00:10:28,870 --> 00:10:25,519
older i realized that

254
00:10:30,550 --> 00:10:28,880
we don't seem to have as much snow

255
00:10:32,710 --> 00:10:30,560
throughout the season

256
00:10:35,829 --> 00:10:32,720
more so now we have these uh especially

257
00:10:37,990 --> 00:10:35,839
in recent years we have these severe

258
00:10:39,670 --> 00:10:38,000
uh events where we just get a heavy

259
00:10:41,990 --> 00:10:39,680
snowfall event and we just get dumped

260
00:10:44,829 --> 00:10:42,000
with all the snow within a few days or

261
00:10:47,829 --> 00:10:44,839
so within the season

262
00:10:49,670 --> 00:10:47,839
so nice thanks aquisha that was an

263
00:10:52,310 --> 00:10:49,680

awesome example

264
00:10:54,069 --> 00:10:52,320
so it's earth day and guess what

265
00:10:55,990 --> 00:10:54,079
nasa will be launching astronauts to

266
00:10:57,829 --> 00:10:56,000
space tomorrow

267
00:10:59,990 --> 00:10:57,839
these space explorers have a unique

268
00:11:02,470 --> 00:11:00,000
perspective of our home planet and that

269
00:11:07,190 --> 00:11:02,480
very few people get to experience

270
00:11:13,590 --> 00:11:09,910
when you look out into the depths of

271
00:11:15,190 --> 00:11:13,600
space you realize just the vast ocean of

272
00:11:18,389 --> 00:11:15,200
darkness

273
00:11:21,030 --> 00:11:18,399
and we're on this little island

274
00:11:22,310 --> 00:11:21,040
without a doubt when you are climbing on

275
00:11:23,590 --> 00:11:22,320
your rocket when you're launching into

276
00:11:24,949 --> 00:11:23,600
space when the engine cuts out and you

277
00:11:26,710 --> 00:11:24,959
get to look back at earth

278
00:11:28,389 --> 00:11:26,720
absolutely every sacrifice is worth it

279
00:11:29,750 --> 00:11:28,399
every dream is worth it the entire road

280
00:11:32,389 --> 00:11:29,760
there is worth it every bit of it is

281
00:11:36,949 --> 00:11:34,069
did almost

282
00:11:38,230 --> 00:11:36,959
i daresay grieved me to think about how

283
00:11:45,910 --> 00:11:38,240
in the world

284
00:11:51,269 --> 00:11:48,550
i will never forget that that sight

285
00:11:53,590 --> 00:11:51,279
the thin blue line of the atmosphere the

286
00:11:56,790 --> 00:11:53,600
curve of the horizon that's when it

287
00:12:00,490 --> 00:11:56,800
became real really at a gut level

288
00:12:05,430 --> 00:12:02,230

[Music]

289
00:12:08,310 --> 00:12:05,440
all life is connected on this planet and

290
00:12:10,550 --> 00:12:08,320
everything i do is in one way or another

291
00:12:12,150 --> 00:12:10,560
gonna affect someone else that i share

292
00:12:15,670 --> 00:12:12,160
this planet with or some other creature

293
00:12:20,550 --> 00:12:18,389
the most significant realization to me

294
00:12:22,629 --> 00:12:20,560
was looking out and realizing not how

295
00:12:23,990 --> 00:12:22,639
far i was from earth but how close i was

296
00:12:29,269 --> 00:12:24,000
to earth and how connected i was to

297
00:12:29,279 --> 00:12:36,550
i'd give a lot to see that view again

298
00:12:40,310 --> 00:12:38,870
incredible goodness

299
00:12:42,310 --> 00:12:40,320
all right well we are now back with

300
00:12:45,269 --> 00:12:42,320
leslie and aquisha to answer some of

301
00:12:47,829 --> 00:12:45,279
your questions i am really excited about

302
00:12:49,670 --> 00:12:47,839
this so ask your questions by writing in

303
00:12:52,870 --> 00:12:49,680
the comment box wherever you're watching

304
00:12:54,470 --> 00:12:52,880
this or by using the hashtag ask nasa on

305
00:12:57,110 --> 00:12:54,480
social media

306
00:12:59,829 --> 00:12:57,120
alright so let's start going through

307
00:13:02,949 --> 00:12:59,839
these questions our first question is

308
00:13:05,269 --> 00:13:02,959
from bookworm on twitter who asks

309
00:13:09,030 --> 00:13:05,279
how much time is left for humans to see

310
00:13:13,030 --> 00:13:09,040
drastic effects directly

311
00:13:18,470 --> 00:13:16,230
how much time before we see effects

312
00:13:20,629 --> 00:13:18,480
i'm trying to see what context can you

313
00:13:22,470 --> 00:13:20,639

repeat the question i just want to see

314
00:13:25,110 --> 00:13:22,480
if i make sure i answer this

315
00:13:28,069 --> 00:13:25,120
answer before i was asking how much time

316
00:13:30,629 --> 00:13:28,079
for us to see drastic effects so i'm

317
00:13:33,350 --> 00:13:30,639
thinking already of our fire seasons are

318
00:13:36,230 --> 00:13:33,360
getting longer and more extreme we've

319
00:13:38,310 --> 00:13:36,240
got more hurricanes and they are also

320
00:13:39,910 --> 00:13:38,320
more extreme so i'm wondering if we're

321
00:13:42,710 --> 00:13:39,920
already seeing some what we would

322
00:13:44,790 --> 00:13:42,720
consider drastic effects do you think so

323
00:13:47,829 --> 00:13:44,800
too laquisha

324
00:13:50,150 --> 00:13:47,839
oh yes yeah we're already seeing them

325
00:13:52,389 --> 00:13:50,160
as i mentioned earlier cities across the

326
00:13:54,310 --> 00:13:52,399
world are reporting um

327
00:13:57,430 --> 00:13:54,320
differences in extremes especially in

328
00:14:00,069 --> 00:13:57,440
extremes extreme temperatures extreme

329
00:14:02,389 --> 00:14:00,079
precipitation events a lot more flash

330
00:14:03,670 --> 00:14:02,399
flooding so we're seeing a lot of those

331
00:14:05,990 --> 00:14:03,680
changes

332
00:14:08,150 --> 00:14:06,000
happening now especially within cities

333
00:14:10,150 --> 00:14:08,160
and urban environments

334
00:14:12,389 --> 00:14:10,160
yeah absolutely

335
00:14:15,110 --> 00:14:12,399
so we have two similar questions about

336
00:14:17,750 --> 00:14:15,120
the sun influence for you leslie

337
00:14:21,269 --> 00:14:17,760
mike morales on youtube and jeremy on

338
00:14:23,350 --> 00:14:21,279

facebook both would like to know if in

339
00:14:27,030 --> 00:14:23,360
climate science we account for sun

340
00:14:29,350 --> 00:14:27,040
cycles in geologic history and further

341
00:14:31,829 --> 00:14:29,360
how do we prove that global warming is

342
00:14:33,990 --> 00:14:31,839
not a result of the sun just burning

343
00:14:35,910 --> 00:14:34,000
hotter

344
00:14:37,750 --> 00:14:35,920
so this is a good question and one of

345
00:14:39,910 --> 00:14:37,760
the climate scientists get asked a lot

346
00:14:41,350 --> 00:14:39,920
and so we do have a lot of information

347
00:14:43,509 --> 00:14:41,360
to back this up there's a couple

348
00:14:46,550 --> 00:14:43,519
different things i'd like to point to um

349
00:14:49,110 --> 00:14:46,560
first is um some great work that's done

350
00:14:52,790 --> 00:14:49,120
by uh climate modelers uh some of them

351
00:14:54,230 --> 00:14:52,800
in new york at um acquisitions lab guess

352
00:14:56,710 --> 00:14:54,240
and what they will do is model

353
00:14:58,629 --> 00:14:56,720
simulations that look at every possible

354
00:15:01,750 --> 00:14:58,639
driver of climate change could it be

355
00:15:03,670 --> 00:15:01,760
natural variability from variations in

356
00:15:05,990 --> 00:15:03,680
in solar cycles like you're mentioning

357
00:15:07,189 --> 00:15:06,000
could it be changes uh due to volcanic

358
00:15:09,189 --> 00:15:07,199
aerosols

359
00:15:11,509 --> 00:15:09,199
can we explain the changes that we're

360
00:15:13,430 --> 00:15:11,519
seeing through natural means and when we

361
00:15:15,590 --> 00:15:13,440
do those detailed realistic modeling

362
00:15:18,629 --> 00:15:15,600
studies we realize that none of those

363
00:15:20,710 --> 00:15:18,639

changes can match up to the the dramatic

364
00:15:23,189 --> 00:15:20,720
and abrupt climate change that we're

365
00:15:24,870 --> 00:15:23,199
seeing when we add in greenhouse gas

366
00:15:26,470 --> 00:15:24,880
forcing when we add in the heat that's

367
00:15:28,710 --> 00:15:26,480
being trapped by

368
00:15:30,870 --> 00:15:28,720
gases like carbon dioxide and methane

369
00:15:33,030 --> 00:15:30,880
then we can explain very clearly what

370
00:15:35,189 --> 00:15:33,040
we're seeing the second way that we know

371
00:15:37,590 --> 00:15:35,199
this isn't solar cycles or some natural

372
00:15:40,150 --> 00:15:37,600
explanation is that greenhouse gases

373
00:15:42,230 --> 00:15:40,160
leave a unique uh fingerprint in terms

374
00:15:43,910 --> 00:15:42,240
of the change that we're seeing when we

375
00:15:45,749 --> 00:15:43,920
have greenhouse gases trapping heat

376
00:15:47,749 --> 00:15:45,759
close to the surface that means the

377
00:15:49,509 --> 00:15:47,759
lower part of the atmosphere gets warmer

378
00:15:51,590 --> 00:15:49,519
the heat's trapped close to us where we

379
00:15:53,749 --> 00:15:51,600
live but the top part of the atmosphere

380
00:15:55,509 --> 00:15:53,759
actually gets a little bit cooler so not

381
00:15:57,269 --> 00:15:55,519
only do we know from climate models and

382
00:15:58,949 --> 00:15:57,279
from ruling out that showing that

383
00:16:01,350 --> 00:15:58,959
natural explanations cannot explain

384
00:16:03,509 --> 00:16:01,360
climate change we also have other types

385
00:16:05,110 --> 00:16:03,519
of observations that back up that this

386
00:16:06,949 --> 00:16:05,120
is in fact a signature that is

387
00:16:08,790 --> 00:16:06,959
consistent really with the greenhouse

388
00:16:11,350 --> 00:16:08,800

gases and not for these alternative

389
00:16:13,590 --> 00:16:11,360
explanations that you might hear

390
00:16:15,749 --> 00:16:13,600
great explanation i think of a sleeping

391
00:16:18,550 --> 00:16:15,759
bag when i'm thinking about the way that

392
00:16:20,150 --> 00:16:18,560
it's insulating the inside and cooler on

393
00:16:22,150 --> 00:16:20,160
the outside

394
00:16:25,269 --> 00:16:22,160
so we'll go to the next question maria

395
00:16:27,990 --> 00:16:25,279
on youtube asks or rather says hello

396
00:16:29,350 --> 00:16:28,000
from portugal hello maria

397
00:16:32,230 --> 00:16:29,360
how does climate change affect the

398
00:16:34,230 --> 00:16:32,240
glaciers at the earth's poles and what

399
00:16:36,870 --> 00:16:34,240
influences do changes in the glaciers

400
00:16:38,710 --> 00:16:36,880
have in the lives of ordinary people

401
00:16:41,829 --> 00:16:38,720
well i can ask answer this one maria

402
00:16:44,230 --> 00:16:41,839
this is my area of specialty

403
00:16:45,829 --> 00:16:44,240
so the poles are really really important

404
00:16:47,430 --> 00:16:45,839
for a lot of different reasons they

405
00:16:48,790 --> 00:16:47,440
reflect sunlight through something

406
00:16:50,389 --> 00:16:48,800
called albedo

407
00:16:52,710 --> 00:16:50,399
they help us maintain

408
00:16:54,629 --> 00:16:52,720
circular currents in the ocean and in

409
00:16:57,269 --> 00:16:54,639
the atmosphere that we're used to normal

410
00:16:59,590 --> 00:16:57,279
weather patterns they also store a lot

411
00:17:02,710 --> 00:16:59,600
of water for us which is really neat

412
00:17:04,630 --> 00:17:02,720
that we have almost like our own freezer

413
00:17:06,710 --> 00:17:04,640

and refrigerator available that we can

414
00:17:09,909 --> 00:17:06,720
store water in long term

415
00:17:12,789 --> 00:17:09,919
so when glaciers or ice sheets start to

416
00:17:14,630 --> 00:17:12,799
melt then we start to see fresh water

417
00:17:16,870 --> 00:17:14,640
moving into the ocean we start to have

418
00:17:19,510 --> 00:17:16,880
less reflectivity on the surface of the

419
00:17:21,429 --> 00:17:19,520
planet and air currents change and

420
00:17:25,029 --> 00:17:21,439
that's part of why we're seeing things

421
00:17:27,270 --> 00:17:25,039
like the polar vortex dipping into texas

422
00:17:29,669 --> 00:17:27,280
so a lot of the dynamics that are

423
00:17:31,190 --> 00:17:29,679
changing in the polls do affect the

424
00:17:33,350 --> 00:17:31,200
whole planet

425
00:17:37,110 --> 00:17:33,360
and really remind us what is our theme

426
00:17:39,110 --> 00:17:37,120
today that we're all connected by earth

427
00:17:39,909 --> 00:17:39,120
all right great question so

428
00:17:43,190 --> 00:17:39,919
does

429
00:17:45,190 --> 00:17:43,200
nexon facebook kim asks

430
00:17:48,230 --> 00:17:45,200
what happened to the glaciers in north

431
00:17:49,590 --> 00:17:48,240
america that formed the great lakes

432
00:17:53,750 --> 00:17:49,600
do either one of you want to address

433
00:17:57,669 --> 00:17:55,190
it's a good one

434
00:17:59,430 --> 00:17:57,679
i actually i so i i don't know kimberly

435
00:18:01,110 --> 00:17:59,440
if you know this this is a little

436
00:18:02,789 --> 00:18:01,120
outside my area so you may be the expert

437
00:18:05,110 --> 00:18:02,799
on this one too

438
00:18:07,549 --> 00:18:05,120

so a lot of the ice sheets um that used

439
00:18:09,669 --> 00:18:07,559
to be around in what we call

440
00:18:11,590 --> 00:18:09,679
paleoclimatology times including the

441
00:18:15,270 --> 00:18:11,600
laurentide ice sheet

442
00:18:17,830 --> 00:18:15,280
receded with change in the climate over

443
00:18:19,830 --> 00:18:17,840
time but remember even though we know

444
00:18:21,750 --> 00:18:19,840
that the climate has changed in the past

445
00:18:23,110 --> 00:18:21,760
and things like the great lakes were

446
00:18:25,990 --> 00:18:23,120
formed

447
00:18:28,549 --> 00:18:26,000
we also know that the rate of change is

448
00:18:30,310 --> 00:18:28,559
so much higher now kind of like aquisha

449
00:18:32,150 --> 00:18:30,320
was saying earlier whereas it may have

450
00:18:34,950 --> 00:18:32,160
taken thousands of years for these ice

451
00:18:40,470 --> 00:18:34,960
sheets to melt and recede now it's

452
00:18:44,710 --> 00:18:41,350
okay

453
00:18:46,950 --> 00:18:44,720
tio on youtube asks did the climate

454
00:18:49,350 --> 00:18:46,960
change before or how did the climate

455
00:18:50,950 --> 00:18:49,360
change before humans we've touched on

456
00:18:53,510 --> 00:18:50,960
this a little bit but let's talk a

457
00:18:57,029 --> 00:18:53,520
little bit more about it

458
00:18:58,950 --> 00:18:57,039
leslie did you want to start us off sure

459
00:19:00,390 --> 00:18:58,960
you know and question mentioned this you

460
00:19:03,350 --> 00:19:00,400
there was there were not there's always

461
00:19:04,870 --> 00:19:03,360
been natural uh changes in climate and

462
00:19:07,110 --> 00:19:04,880
some of those are related to the natural

463
00:19:08,950 --> 00:19:07,120

drivers that uh we had a question about

464
00:19:11,750 --> 00:19:08,960
a minute or two ago we have natural

465
00:19:14,549 --> 00:19:11,760
variations in things like um solar

466
00:19:15,669 --> 00:19:14,559
energy volcanic aerosols there are

467
00:19:17,510 --> 00:19:15,679
certain things that are changing

468
00:19:20,630 --> 00:19:17,520
naturally that force the climate system

469
00:19:23,669 --> 00:19:20,640
so we do see more subtle and and longer

470
00:19:26,549 --> 00:19:23,679
term shifts in in temperature and things

471
00:19:28,789 --> 00:19:26,559
like ice um and and so so those are some

472
00:19:30,710 --> 00:19:28,799
of the kinds of uh changes that we've

473
00:19:33,590 --> 00:19:30,720
seen in the past of course we have

474
00:19:35,350 --> 00:19:33,600
limited information about um changes

475
00:19:36,789 --> 00:19:35,360
that happened you know thousands of

476
00:19:38,070 --> 00:19:36,799
years ago because we don't have we

477
00:19:40,390 --> 00:19:38,080
didn't have satellites certainly we

478
00:19:42,470 --> 00:19:40,400
didn't have surface instruments um but

479
00:19:44,630 --> 00:19:42,480
we do find evidence of those in ice

480
00:19:47,270 --> 00:19:44,640
cores or sometimes in ocean in sediments

481
00:19:48,950 --> 00:19:47,280
on the ocean floor so we we have some

482
00:19:51,190 --> 00:19:48,960
knowledge of what the climate was like a

483
00:19:53,190 --> 00:19:51,200
long time ago we know ecosystems were

484
00:19:54,789 --> 00:19:53,200
different we know um different species

485
00:19:57,430 --> 00:19:54,799
exist in different places because of

486
00:20:00,070 --> 00:19:57,440
that um and and so you know we have some

487
00:20:01,750 --> 00:20:00,080
pieces of information but again um you

488
00:20:03,270 --> 00:20:01,760

know the the point that's been brought

489
00:20:05,190 --> 00:20:03,280
up several times that i think is

490
00:20:07,190 --> 00:20:05,200
important is um we know there's this

491
00:20:09,029 --> 00:20:07,200
natural variability but on top of that

492
00:20:10,310 --> 00:20:09,039
this very massive signal that's caused

493
00:20:12,870 --> 00:20:10,320
this this

494
00:20:15,830 --> 00:20:12,880
very rapid rise in in temperatures and

495
00:20:18,390 --> 00:20:15,840
and the rate of change that we're seeing

496
00:20:19,830 --> 00:20:18,400
thanks leslie amazing answer

497
00:20:21,990 --> 00:20:19,840
i want to skip to the next one because i

498
00:20:22,870 --> 00:20:22,000
think cliche this is perfect for you i

499
00:20:24,789 --> 00:20:22,880
hope

500
00:20:27,669 --> 00:20:24,799
zay on twitter asks

501
00:20:30,870 --> 00:20:27,679
can you see climate change from space

502
00:20:32,950 --> 00:20:30,880
and maybe i could even add what data and

503
00:20:36,070 --> 00:20:32,960
tools do we have to see climate change

504
00:20:40,230 --> 00:20:37,990
yes we can see

505
00:20:42,549 --> 00:20:40,240
climate change from space um as leslie

506
00:20:43,990 --> 00:20:42,559
had touched on earlier um

507
00:20:47,190 --> 00:20:44,000
nasa does have a lot of missions where

508
00:20:49,190 --> 00:20:47,200
there's monitoring monitoring the co2

509
00:20:50,630 --> 00:20:49,200
ocean temperatures land surface

510
00:20:52,390 --> 00:20:50,640
temperature so

511
00:20:56,070 --> 00:20:52,400
with satellite which the great thing

512
00:20:57,350 --> 00:20:56,080
about satellite data is that it

513
00:20:58,950 --> 00:20:57,360

measures

514
00:21:01,110 --> 00:20:58,960
information about the surface of the

515
00:21:03,669 --> 00:21:01,120
earth but in the electromagnetic

516
00:21:05,990 --> 00:21:03,679
spectrum so because of that it's not

517
00:21:07,830 --> 00:21:06,000
simply just taking a photograph but

518
00:21:10,870 --> 00:21:07,840
there's information

519
00:21:12,549 --> 00:21:10,880
within these pixels um they're assigned

520
00:21:13,990 --> 00:21:12,559
these things called digital numbers and

521
00:21:16,470 --> 00:21:14,000
we're able to

522
00:21:18,310 --> 00:21:16,480
transform those into other

523
00:21:20,549 --> 00:21:18,320
variables that we're interested in so we

524
00:21:22,870 --> 00:21:20,559
can take these numbers and we can

525
00:21:25,270 --> 00:21:22,880
calculate uh land surface temperature

526
00:21:27,590 --> 00:21:25,280
and observe temperature changes

527
00:21:29,590 --> 00:21:27,600
not just on a global scale but on local

528
00:21:31,270 --> 00:21:29,600
scales within cities

529
00:21:33,830 --> 00:21:31,280
we can also look at things like

530
00:21:35,990 --> 00:21:33,840
precipitation as well so there's a lot

531
00:21:38,710 --> 00:21:36,000
of ways that we can monitor climate

532
00:21:40,549 --> 00:21:38,720
change but also derive different

533
00:21:42,870 --> 00:21:40,559
variables to help us understand more

534
00:21:44,549 --> 00:21:42,880
things about the climate

535
00:21:46,310 --> 00:21:44,559
factors

536
00:21:47,830 --> 00:21:46,320
nice that's awesome thank you for that

537
00:21:48,549 --> 00:21:47,840
explanation

538
00:21:51,590 --> 00:21:48,559

so

539
00:21:53,990 --> 00:21:51,600
christian on facebook now asks are there

540
00:21:56,149 --> 00:21:54,000
runaway effects of climate change that

541
00:21:58,230 --> 00:21:56,159
we should be wary of

542
00:22:00,630 --> 00:21:58,240
um he says for instance we hear a lot of

543
00:22:02,070 --> 00:22:00,640
mixed news on snow cover melting and

544
00:22:04,390 --> 00:22:02,080
reducing the amount of heat being

545
00:22:05,830 --> 00:22:04,400
reflected back into space so i touched

546
00:22:07,430 --> 00:22:05,840
on that a little bit

547
00:22:09,029 --> 00:22:07,440
leslie do you want to pick it up and

548
00:22:10,630 --> 00:22:09,039
talk more about runaway effects of

549
00:22:12,870 --> 00:22:10,640
climate change

550
00:22:14,230 --> 00:22:12,880
yeah it's it's a good question um and

551
00:22:15,750 --> 00:22:14,240
and it's something i will say i think

552
00:22:17,669 --> 00:22:15,760
there's debate about this and i don't

553
00:22:18,950 --> 00:22:17,679
think that we totally know the answer

554
00:22:20,710 --> 00:22:18,960
this is something we're still working

555
00:22:22,390 --> 00:22:20,720
hard to address and this is something we

556
00:22:24,950 --> 00:22:22,400
started with satellites we actually have

557
00:22:26,710 --> 00:22:24,960
field campaigns that go out and measure

558
00:22:29,110 --> 00:22:26,720
in great detail to make sure we can

559
00:22:31,430 --> 00:22:29,120
understand the processes this is one of

560
00:22:32,549 --> 00:22:31,440
the ways that we create climate models

561
00:22:34,950 --> 00:22:32,559
is we

562
00:22:36,789 --> 00:22:34,960
take all the information we have we try

563
00:22:39,190 --> 00:22:36,799

to write equations about how some of

564
00:22:41,110 --> 00:22:39,200
these processes interact with each other

565
00:22:43,029 --> 00:22:41,120
and then we run very long simulations to

566
00:22:44,789 --> 00:22:43,039
look at how things are changing and

567
00:22:47,190 --> 00:22:44,799
sometimes there's there's uncertainty in

568
00:22:49,190 --> 00:22:47,200
the long-term projections um which leads

569
00:22:50,630 --> 00:22:49,200
to uncertainty about you know how much

570
00:22:52,630 --> 00:22:50,640
of these feedbacks effects we're seeing

571
00:22:53,590 --> 00:22:52,640
now versus how much we affect we expect

572
00:22:54,630 --> 00:22:53,600
to see

573
00:22:57,750 --> 00:22:54,640
in 20

574
00:22:59,669 --> 00:22:57,760
50 years right um but this is certainly

575
00:23:02,789 --> 00:22:59,679
a cause for concern so so kimberly

576
00:23:05,510 --> 00:23:02,799
mentioned surface albedo um there but

577
00:23:07,990 --> 00:23:05,520
there are feedbacks often of opposing

578
00:23:09,669 --> 00:23:08,000
signs so let's take water vapor for

579
00:23:12,230 --> 00:23:09,679
example water vapor is a powerful

580
00:23:13,669 --> 00:23:12,240
greenhouse gas but it's not correct it's

581
00:23:15,350 --> 00:23:13,679
not just controlled by people right

582
00:23:18,630 --> 00:23:15,360
there's there's natural processes like

583
00:23:20,870 --> 00:23:18,640
evaporation and rain so a positive

584
00:23:22,549 --> 00:23:20,880
feedback process um would be something

585
00:23:25,510 --> 00:23:22,559
that magnifies the warming so for

586
00:23:27,590 --> 00:23:25,520
example when we um warm the planet we

587
00:23:29,669 --> 00:23:27,600
have more capacity to hold water vapor

588
00:23:31,510 --> 00:23:29,679

we evaporate more water vapor that can

589
00:23:33,590 --> 00:23:31,520
be a positive feedback adding to global

590
00:23:35,190 --> 00:23:33,600
warming at the same time if we put more

591
00:23:37,270 --> 00:23:35,200
clouds in the atmosphere they can also

592
00:23:39,029 --> 00:23:37,280
reflect uh sunlight they can actually

593
00:23:41,190 --> 00:23:39,039
keep some of the sunlight from reaching

594
00:23:44,549 --> 00:23:41,200
the the earth that's a negative feedback

595
00:23:46,230 --> 00:23:44,559
and so the response is the the

596
00:23:47,669 --> 00:23:46,240
adding up all of these

597
00:23:50,310 --> 00:23:47,679
you know complicated positive and

598
00:23:52,070 --> 00:23:50,320
negative feedbacks um and to really

599
00:23:53,269 --> 00:23:52,080
understand the trajectory of the planet

600
00:23:54,470 --> 00:23:53,279
and so that's really where i think we

601
00:23:56,549 --> 00:23:54,480
are right now is really trying to

602
00:23:58,630 --> 00:23:56,559
understand those processes make sure

603
00:24:01,110 --> 00:23:58,640
that we have a good handle on them uh

604
00:24:02,549 --> 00:24:01,120
and then monitor you know for four signs

605
00:24:04,549 --> 00:24:02,559
of abrupt change because this is of

606
00:24:06,070 --> 00:24:04,559
course a concern but it's a very that's

607
00:24:08,230 --> 00:24:06,080
a very good and insightful question that

608
00:24:10,070 --> 00:24:08,240
hits on what underpins a whole lot of

609
00:24:11,750 --> 00:24:10,080
our work

610
00:24:14,310 --> 00:24:11,760
yeah that's a good point there's a lot

611
00:24:16,070 --> 00:24:14,320
of very complicated things that already

612
00:24:17,909 --> 00:24:16,080
happen on earth so

613
00:24:20,390 --> 00:24:17,919

building a model that captures all of

614
00:24:23,669 --> 00:24:20,400
them is such a challenge

615
00:24:26,149 --> 00:24:23,679
so diana on facebook asks

616
00:24:27,830 --> 00:24:26,159
volcanoes have something to do with

617
00:24:31,350 --> 00:24:27,840
climate change

618
00:24:38,470 --> 00:24:34,549
i can take in los angeles too

619
00:24:43,190 --> 00:24:40,789
um so it's a great question so so um

620
00:24:44,549 --> 00:24:43,200
obviously volcanoes erupt naturally and

621
00:24:46,950 --> 00:24:44,559
they have for a really long time that's

622
00:24:48,549 --> 00:24:46,960
some of the reasons we have uh islands

623
00:24:50,390 --> 00:24:48,559
and vacation spots where they are right

624
00:24:52,310 --> 00:24:50,400
because a volcano erupted thousands of

625
00:24:55,510 --> 00:24:52,320
years ago and now there's there's an

626
00:24:58,470 --> 00:24:55,520
island there um so so there's a

627
00:25:00,630 --> 00:24:58,480
volcano's erupting is is not related to

628
00:25:01,669 --> 00:25:00,640
you know a result of climate change but

629
00:25:04,950 --> 00:25:01,679
what's what

630
00:25:06,870 --> 00:25:04,960
volcanoes do is emit large quantities of

631
00:25:09,110 --> 00:25:06,880
aerosols especially powerful uh

632
00:25:10,710 --> 00:25:09,120
eruptions they can spew masses and

633
00:25:12,630 --> 00:25:10,720
masses of aerosols these tiny little

634
00:25:14,950 --> 00:25:12,640
particles that get suspended in the

635
00:25:17,909 --> 00:25:14,960
atmosphere and in the case of really

636
00:25:21,909 --> 00:25:17,919
really big volcanic eruptions they can

637
00:25:23,190 --> 00:25:21,919
emit such powerful ejections of aerosols

638
00:25:24,230 --> 00:25:23,200

that they can actually make it into the

639
00:25:26,230 --> 00:25:24,240
upper part of the atmosphere that we

640
00:25:28,149 --> 00:25:26,240
call the stratosphere that's important

641
00:25:30,070 --> 00:25:28,159
because that means they can stay in the

642
00:25:31,430 --> 00:25:30,080
atmosphere for a very long time they can

643
00:25:34,310 --> 00:25:31,440
kind of hang around and you get this

644
00:25:36,870 --> 00:25:34,320
sort of aerosol haze and that aerosol

645
00:25:38,070 --> 00:25:36,880
haze from volcanoes can actually reflect

646
00:25:39,510 --> 00:25:38,080
sunlight so it can actually have a

647
00:25:41,830 --> 00:25:39,520
cooling effect and we've seen this in

648
00:25:43,990 --> 00:25:41,840
recent years in that in the most recent

649
00:25:45,590 --> 00:25:44,000
uh big example that people studied a lot

650
00:25:47,669 --> 00:25:45,600
is is mount kinetubo so there's been a

651
00:25:49,990 --> 00:25:47,679
lot of research on some of the effects

652
00:25:52,789 --> 00:25:50,000
of mount pinatubo so there is this this

653
00:25:54,950 --> 00:25:52,799
sort of important temporary effect of

654
00:25:57,909 --> 00:25:54,960
cooling that can come from really only

655
00:25:59,190 --> 00:25:57,919
the largest volcanic eruptions um so but

656
00:26:00,870 --> 00:25:59,200
again what we talked about there in

657
00:26:02,789 --> 00:26:00,880
terms of scale of how long the cooling

658
00:26:04,470 --> 00:26:02,799
would last typically a couple years

659
00:26:06,390 --> 00:26:04,480
maybe you know on the order of a few

660
00:26:08,149 --> 00:26:06,400
years when we talk about human-driven

661
00:26:09,990 --> 00:26:08,159
climate change we're talking about

662
00:26:12,950 --> 00:26:10,000
things that are that are going to last

663
00:26:15,190 --> 00:26:12,960

for centuries or you know much longer

664
00:26:17,029 --> 00:26:15,200
time scales so this is volcanoes are

665
00:26:19,269 --> 00:26:17,039
part of the sort of natural variability

666
00:26:20,870 --> 00:26:19,279
in the climate system uh and and one of

667
00:26:23,269 --> 00:26:20,880
the things that you know is very

668
00:26:25,669 --> 00:26:23,279
interesting to study makes our jobs uh

669
00:26:27,350 --> 00:26:25,679
quite uh quite fun to watch all of these

670
00:26:28,789 --> 00:26:27,360
different changes and try to figure them

671
00:26:31,190 --> 00:26:28,799
out

672
00:26:33,430 --> 00:26:31,200
okay so we only have one minute left and

673
00:26:34,789 --> 00:26:33,440
i want to see if we can just do very

674
00:26:37,350 --> 00:26:34,799
quick summaries because i think this is

675
00:26:40,310 --> 00:26:37,360
an important question atlantean on

676
00:26:42,789 --> 00:26:40,320
youtube asks what makes you think that

677
00:26:46,710 --> 00:26:42,799
it is not too late to stop the worst

678
00:26:50,710 --> 00:26:49,190
we are talking a lot today on earth day

679
00:26:52,390 --> 00:26:50,720
across all different spheres all

680
00:26:54,789 --> 00:26:52,400
different parts of the government about

681
00:26:58,230 --> 00:26:54,799
how important it is for us to do rapid

682
00:27:00,390 --> 00:26:58,240
urgent changes in order to halt some of

683
00:27:02,310 --> 00:27:00,400
the progression of climate change

684
00:27:06,789 --> 00:27:02,320
what is your guys's thought why is it

685
00:27:11,190 --> 00:27:09,190
i can go uh it's not too late because i

686
00:27:13,269 --> 00:27:11,200
just think about the strides we made

687
00:27:14,950 --> 00:27:13,279
just in technology and just the fact

688
00:27:16,950 --> 00:27:14,960

that we're even here on this video

689
00:27:19,510 --> 00:27:16,960
called we couldn't do this how many

690
00:27:21,430 --> 00:27:19,520
decades ago right so i definitely have

691
00:27:22,230 --> 00:27:21,440
faith and hope in

692
00:27:24,630 --> 00:27:22,240
the

693
00:27:27,269 --> 00:27:24,640
seven billion

694
00:27:30,310 --> 00:27:27,279
super powered brains that we have if we

695
00:27:31,590 --> 00:27:30,320
collectively work together um i'm very

696
00:27:33,269 --> 00:27:31,600
hopeful that we can come up with

697
00:27:35,350 --> 00:27:33,279
solutions we've we've done so many

698
00:27:36,070 --> 00:27:35,360
things so far send people you know we

699
00:27:38,630 --> 00:27:36,080
have

700
00:27:40,870 --> 00:27:38,640
we're sending people to mars i mean we

701
00:27:43,909 --> 00:27:40,880
we have the ability to

702
00:27:45,190 --> 00:27:43,919
um to make changes so

703
00:27:47,430 --> 00:27:45,200
that's my idea

704
00:27:49,830 --> 00:27:47,440
well those are amazing questions thank

705
00:27:51,750 --> 00:27:49,840
you all so much and if we didn't answer

706
00:27:53,510 --> 00:27:51,760
your questions here equisha will be

707
00:27:56,870 --> 00:27:53,520
answering more questions tomorrow from

708
00:27:58,950 --> 00:27:56,880
12 to 2 p.m eastern time on the nasa

709
00:28:01,110 --> 00:27:58,960
goddard twitter account so please visit

710
00:28:03,510 --> 00:28:01,120
her there and we if any of the questions

711
00:28:05,430 --> 00:28:03,520
we didn't get to she can answer them

712
00:28:07,110 --> 00:28:05,440
thank you so much leslie and aquisha for

713
00:28:10,549 --> 00:28:07,120

joining us today

714
00:28:14,149 --> 00:28:12,389
well that was really fun thank you so

715
00:28:15,830 --> 00:28:14,159
much for joining us at home

716
00:28:17,669 --> 00:28:15,840
if you want to learn more about nasa's

717
00:28:19,310 --> 00:28:17,679
efforts to study global climate change

718
00:28:20,950 --> 00:28:19,320
you can visit

719
00:28:22,630 --> 00:28:20,960
climate.nasa.gov

720
00:28:25,430 --> 00:28:22,640
throughout today's episode you've seen

721
00:28:27,110 --> 00:28:25,440
how connected our planet and systems are

722
00:28:29,510 --> 00:28:27,120
each of us is part of the gorgeous

723
00:28:31,750 --> 00:28:29,520
mosaic of earth and on this earth day

724
00:28:34,549 --> 00:28:31,760
nasa is asking people around the world

725
00:28:35,750 --> 00:28:34,559
to share how we are all connected by

726
00:28:37,510 --> 00:28:35,760
earth

727
00:28:39,590 --> 00:28:37,520
join us by hosting an image on social

728
00:28:41,750 --> 00:28:39,600
media of the bit of earth that connects

729
00:28:42,789 --> 00:28:41,760
you to our planet feel free to include

730
00:28:44,630 --> 00:28:42,799
yourself

731
00:28:46,710 --> 00:28:44,640
and tag it with

732
00:28:48,070 --> 00:28:46,720
connected by earth

733
00:28:50,389 --> 00:28:48,080
here are a few of the awesome images

734
00:28:52,149 --> 00:28:50,399
that have already been submitted

735
00:28:54,470 --> 00:28:52,159
to stay updated on the research of our

736
00:28:57,590 --> 00:28:54,480
home planet follow nasa earth on

737
00:28:59,990 --> 00:28:57,600
facebook twitter and instagram and thank

738
00:29:01,269 --> 00:29:00,000

you so much for joining us today we'll

739
00:29:20,100 --> 00:29:01,279
see you soon