
SEA
LEVEL
RISE
FROM
SPACE

1
00:01:28,950 --> 00:00:10,010
[Music]

2
00:01:33,350 --> 00:01:31,350
from an early age i saw images of the

3
00:01:35,190 --> 00:01:33,360
earth from above

4
00:01:36,710 --> 00:01:35,200
and you just realize how much is going

5
00:01:38,710 --> 00:01:36,720
on in the ocean the variability that's

6
00:01:40,630 --> 00:01:38,720
there the changes that are occurring

7
00:01:42,710 --> 00:01:40,640
it really became a passion of mine to

8
00:01:44,149 --> 00:01:42,720
understand what's happening in the ocean

9
00:01:46,630 --> 00:01:44,159
my name has been hamilton and i'm

10
00:01:48,230 --> 00:01:46,640
studying sea level rise from space

11
00:01:49,990 --> 00:01:48,240
so sea level rise is really interesting

12
00:01:51,429 --> 00:01:50,000
because the impacts are local but it's a

13
00:01:52,950 --> 00:01:51,439

global problem so

14
00:01:55,030 --> 00:01:52,960
i've done a lot of work looking at sea

15
00:01:56,950 --> 00:01:55,040
level rise in particular locations

16
00:01:58,709 --> 00:01:56,960
but on much broader scales and with the

17
00:02:00,389 --> 00:01:58,719
satellites we have this global view

18
00:02:01,590 --> 00:02:00,399
so here we can see the satellites

19
00:02:03,109 --> 00:02:01,600
orbiting the earth and where they are

20
00:02:04,469 --> 00:02:03,119
right now having overlap between the

21
00:02:05,590 --> 00:02:04,479
different missions allows us to make a

22
00:02:06,950 --> 00:02:05,600
direct comparison

23
00:02:08,869 --> 00:02:06,960
it's really the information we gain from

24
00:02:10,229 --> 00:02:08,879
all these satellites that tell us about

25
00:02:11,910 --> 00:02:10,239
sea level change and allow us to get an

26
00:02:12,390 --> 00:02:11,920
understanding of what's happening on an

27
00:02:14,150 --> 00:02:12,400
entire

28
00:02:15,910 --> 00:02:14,160
climate system and that really long

29
00:02:17,270 --> 00:02:15,920
record that'll exceed 30 years with the

30
00:02:18,869 --> 00:02:17,280
sentinel-6 satellite

31
00:02:20,869 --> 00:02:18,879
allows us to have a better understanding

32
00:02:22,229 --> 00:02:20,879
of how the earth's climate is changing

33
00:02:24,470 --> 00:02:22,239
so this is an animation of the sentinel

34
00:02:26,550 --> 00:02:24,480
6 spacecraft and how it collects

35
00:02:28,390 --> 00:02:26,560
information about the the sea surface

36
00:02:30,070 --> 00:02:28,400
you can see the radar pulse that's

37
00:02:31,430 --> 00:02:30,080
bounced off the surface of the ocean

38
00:02:33,190 --> 00:02:31,440

that measures the time it takes for that

39
00:02:33,830 --> 00:02:33,200
pulse to get back and from that we can

40
00:02:35,830 --> 00:02:33,840
pull out

41
00:02:37,509 --> 00:02:35,840
the measurement of sea surface height

42
00:02:39,270 --> 00:02:37,519
it's not just scientific curiosity it

43
00:02:40,630 --> 00:02:39,280
really impacts the daily lives of people

44
00:02:41,350 --> 00:02:40,640
and their ability to plan for their

45
00:02:43,350 --> 00:02:41,360
future

46
00:02:45,430 --> 00:02:43,360
as i started to live in coastal areas

47
00:02:47,270 --> 00:02:45,440
and see flooding that was occurring

48
00:02:49,190 --> 00:02:47,280
i got to see firsthand the effects of

49
00:02:50,790 --> 00:02:49,200
sea level rise and climate change

50
00:02:52,309 --> 00:02:50,800
you start to realize the importance of

51
00:02:52,710 --> 00:02:52,319
understanding what sea level is doing

52
00:02:55,750 --> 00:02:52,720
now

53
00:03:01,589 --> 00:02:55,760
what sea level might be doing in the

54
00:03:06,949 --> 00:03:04,710
hi i'm richard finoeva with nasa's

55
00:03:08,149 --> 00:03:06,959
jet propulsion laboratory in southern

56
00:03:10,470 --> 00:03:08,159
california

57
00:03:11,509 --> 00:03:10,480
now you may know nasa best for exploring

58
00:03:14,070 --> 00:03:11,519
other planets

59
00:03:15,750 --> 00:03:14,080
but we are also keeping a close eye on

60
00:03:19,110 --> 00:03:15,760
our own planet earth

61
00:03:21,990 --> 00:03:19,120
nasa is about to launch the usn european

62
00:03:23,830 --> 00:03:22,000
sentinel 6 michael frylak satellite this

63
00:03:26,550 --> 00:03:23,840

satellite aims to collect the most

64
00:03:28,390 --> 00:03:26,560
accurate data yet on sea level and how

65
00:03:30,789 --> 00:03:28,400
it changes over time

66
00:03:32,149 --> 00:03:30,799
jpl manages the sentinel 6 michael

67
00:03:34,869 --> 00:03:32,159
freilick mission for

68
00:03:36,949 --> 00:03:34,879
nasa ben hamilton is a research

69
00:03:39,509 --> 00:03:36,959
scientist here at jpl who is studying

70
00:03:41,430 --> 00:03:39,519
the rate at which the ocean is rising

71
00:03:42,789 --> 00:03:41,440
and he joins us live today to answer

72
00:03:44,390 --> 00:03:42,799
your questions

73
00:03:45,990 --> 00:03:44,400
if you have any questions you'd like to

74
00:03:48,070 --> 00:03:46,000
ask you can leave them right

75
00:03:50,309 --> 00:03:48,080
here in the comments or post them to

76
00:03:53,110 --> 00:03:50,319
social media with the hashtag

77
00:03:55,990 --> 00:03:53,120
seeing the seas now thank you so much

78
00:03:57,350 --> 00:03:56,000
for joining us today ben

79
00:03:58,470 --> 00:03:57,360
great thanks for having me i'm excited

80
00:04:00,229 --> 00:03:58,480
to answer some questions about this

81
00:04:02,949 --> 00:04:00,239
great satellite mission

82
00:04:05,350 --> 00:04:02,959
great let's get started so how will you

83
00:04:08,070 --> 00:04:05,360
use the data collected from the sentinel

84
00:04:09,750 --> 00:04:08,080
6 mycophyllic satellite

85
00:04:11,670 --> 00:04:09,760
so the satellite gives us a measurement

86
00:04:12,949 --> 00:04:11,680
of what we call sea surface height so it

87
00:04:13,750 --> 00:04:12,959
measures the height of the ocean from

88
00:04:15,030 --> 00:04:13,760

space

89
00:04:16,469 --> 00:04:15,040
and it's actually an incredible

90
00:04:17,030 --> 00:04:16,479
measurement that's being made so from

91
00:04:19,590 --> 00:04:17,040
way up

92
00:04:20,870 --> 00:04:19,600
on orbit above the ocean we can get an

93
00:04:23,110 --> 00:04:20,880
idea of the height of

94
00:04:24,629 --> 00:04:23,120
the sea level to an accuracy of about

95
00:04:25,590 --> 00:04:24,639
one inch so it's really an incredible

96
00:04:26,870 --> 00:04:25,600
measurement

97
00:04:29,030 --> 00:04:26,880
and what we're able to do with this is

98
00:04:31,030 --> 00:04:29,040
really monitor how the ocean is changing

99
00:04:33,430 --> 00:04:31,040
on a wide range of time scales

100
00:04:35,350 --> 00:04:33,440
so every 10 days or so we get a complete

101
00:04:36,629 --> 00:04:35,360
view of the global ocean from these

102
00:04:38,790 --> 00:04:36,639
these satellites

103
00:04:40,070 --> 00:04:38,800
and from that we can identify how sea

104
00:04:42,230 --> 00:04:40,080
level is changing on

105
00:04:43,350 --> 00:04:42,240
these relatively short time scales so on

106
00:04:45,510 --> 00:04:43,360
the order of say

107
00:04:47,590 --> 00:04:45,520
months to years but then when you start

108
00:04:49,270 --> 00:04:47,600
to build up this satellite record

109
00:04:51,030 --> 00:04:49,280
you can really start to infer or

110
00:04:53,270 --> 00:04:51,040
understand how sea level is changing on

111
00:04:56,390 --> 00:04:53,280
longer time scales

112
00:04:58,710 --> 00:04:56,400
and why is it so important to

113
00:05:02,629 --> 00:04:58,720

study sea level and can you get a little

114
00:05:04,550 --> 00:05:02,639
bit more into how it's done from space

115
00:05:07,110 --> 00:05:04,560
yeah so as i mentioned in the video sea

116
00:05:07,670 --> 00:05:07,120
level is the impacts of sea level rise

117
00:05:09,110 --> 00:05:07,680
are local

118
00:05:10,390 --> 00:05:09,120
so we feel these on a local level

119
00:05:11,670 --> 00:05:10,400
coastal communities are the ones that

120
00:05:12,629 --> 00:05:11,680
are really feeling the impacts of sea

121
00:05:14,390 --> 00:05:12,639
level rise

122
00:05:16,469 --> 00:05:14,400
but sea level science and understanding

123
00:05:18,710 --> 00:05:16,479
sea level science is a global problem

124
00:05:20,550 --> 00:05:18,720
the processes that are impacting that

125
00:05:21,350 --> 00:05:20,560
cause sea level to change are global in

126
00:05:23,029 --> 00:05:21,360
nature

127
00:05:24,870 --> 00:05:23,039
so this really broad view of the ocean

128
00:05:27,189 --> 00:05:24,880
we have from satellites is critical to

129
00:05:29,590 --> 00:05:27,199
understanding how sea level is changing

130
00:05:30,469 --> 00:05:29,600
both now using that understanding that

131
00:05:32,710 --> 00:05:30,479
we have now

132
00:05:34,469 --> 00:05:32,720
to understand how sea level is going to

133
00:05:36,150 --> 00:05:34,479
to change in the future

134
00:05:38,710 --> 00:05:36,160
so this observation comes from the

135
00:05:40,790 --> 00:05:38,720
satellite through a relatively simple

136
00:05:43,110 --> 00:05:40,800
concept so the satellite sends a radar

137
00:05:44,950 --> 00:05:43,120
pulse down to the surface of the ocean

138
00:05:46,469 --> 00:05:44,960

that radar pulse bounces off the surface

139
00:05:48,710 --> 00:05:46,479
of the ocean and

140
00:05:50,230 --> 00:05:48,720
returns to the satellite and we can

141
00:05:51,590 --> 00:05:50,240
measure the time it takes for that pulse

142
00:05:52,070 --> 00:05:51,600
to get to the ocean and return to the

143
00:05:55,110 --> 00:05:52,080
satellite

144
00:05:56,790 --> 00:05:55,120
from that we can figure out exactly

145
00:05:58,629 --> 00:05:56,800
how high the sea level is at any given

146
00:05:59,990 --> 00:05:58,639
time and that makes it sound a little

147
00:06:01,590 --> 00:06:00,000
bit easy it's actually pretty complex

148
00:06:03,350 --> 00:06:01,600
everything else that goes into that that

149
00:06:04,150 --> 00:06:03,360
measurement because as that radar pulse

150
00:06:05,590 --> 00:06:04,160
travels

151
00:06:07,510 --> 00:06:05,600
through the earth's atmosphere and

152
00:06:08,870 --> 00:06:07,520
interacts with the ocean a number of

153
00:06:11,270 --> 00:06:08,880
things happen to it so

154
00:06:12,629 --> 00:06:11,280
it's delayed the timing is affected uh

155
00:06:13,189 --> 00:06:12,639
when it bounces off the surface of the

156
00:06:16,230 --> 00:06:13,199
ocean

157
00:06:17,830 --> 00:06:16,240
everywhere so it interacts with the

158
00:06:19,110 --> 00:06:17,840
ocean surface in different ways

159
00:06:21,029 --> 00:06:19,120
so we have to make all these different

160
00:06:21,670 --> 00:06:21,039
corrections to that observation or to

161
00:06:23,670 --> 00:06:21,680
that um

162
00:06:25,270 --> 00:06:23,680
that radar pulse and the timing in order

163
00:06:26,710 --> 00:06:25,280

to get to the accuracy that we actually

164
00:06:28,070 --> 00:06:26,720
have for the uh for the satellite

165
00:06:29,189 --> 00:06:28,080
altimeter measurements

166
00:06:30,629 --> 00:06:29,199
and then the other piece of that is we

167
00:06:32,150 --> 00:06:30,639
need to know very accurately where the

168
00:06:33,670 --> 00:06:32,160
satellite actually is

169
00:06:35,430 --> 00:06:33,680
um that may seem like kind of a

170
00:06:36,790 --> 00:06:35,440
no-brainer but at any given time you

171
00:06:39,510 --> 00:06:36,800
really need to know where it is

172
00:06:41,350 --> 00:06:39,520
in reference to uh to the ocean so with

173
00:06:42,950 --> 00:06:41,360
all these different measurements um

174
00:06:44,629 --> 00:06:42,960
and corrections we make we eventually

175
00:06:46,469 --> 00:06:44,639
get to that sea surface height

176
00:06:47,990 --> 00:06:46,479
observation and again the accuracy

177
00:06:48,550 --> 00:06:48,000
that's down to about an inch all the way

178
00:06:50,870 --> 00:06:48,560
up from

179
00:06:52,950 --> 00:06:50,880
from orbit above the surface of the

180
00:06:54,469 --> 00:06:52,960
ocean

181
00:06:56,790 --> 00:06:54,479
great and then can you talk a little bit

182
00:06:59,110 --> 00:06:56,800
more about how changing sea levels

183
00:07:01,029 --> 00:06:59,120
impact coastal towns or cities in the

184
00:07:03,589 --> 00:07:01,039
future

185
00:07:05,189 --> 00:07:03,599
yeah so there's a number of ways that um

186
00:07:06,309 --> 00:07:05,199
rising sea levels impact coastal

187
00:07:07,830 --> 00:07:06,319
communities so

188
00:07:09,749 --> 00:07:07,840

one of these that has been in the news a

189
00:07:10,550 --> 00:07:09,759
lot lately is is through increased storm

190
00:07:12,230 --> 00:07:10,560
surge so

191
00:07:13,670 --> 00:07:12,240
basically you can treat the sea level

192
00:07:15,350 --> 00:07:13,680
rise that we've been seeing as an

193
00:07:15,990 --> 00:07:15,360
increase in the baseline over which

194
00:07:18,390 --> 00:07:16,000
these storms

195
00:07:20,070 --> 00:07:18,400
travel so with higher sea levels in

196
00:07:21,749 --> 00:07:20,080
these coastal areas

197
00:07:23,430 --> 00:07:21,759
a storm moves over top of it and the

198
00:07:25,350 --> 00:07:23,440
storm surge that you feel from these

199
00:07:26,870 --> 00:07:25,360
hurricanes and larger storms

200
00:07:29,430 --> 00:07:26,880
is just that much greater than it was

201
00:07:32,230 --> 00:07:29,440
previously the other way that we see

202
00:07:33,430 --> 00:07:32,240
the impacts of higher sea level is

203
00:07:34,150 --> 00:07:33,440
through something called high tide

204
00:07:38,950 --> 00:07:34,160
flooding

205
00:07:41,510 --> 00:07:38,960
that occurs at high tides

206
00:07:43,830 --> 00:07:41,520
so these coastal communities were built

207
00:07:45,270 --> 00:07:43,840
knowing where high tide typically is so

208
00:07:47,110 --> 00:07:45,280
many years ago

209
00:07:48,710 --> 00:07:47,120
we built up these different areas

210
00:07:49,350 --> 00:07:48,720
expecting high tide to be in a certain

211
00:07:51,189 --> 00:07:49,360
place

212
00:07:52,629 --> 00:07:51,199
and again now with that increase in that

213
00:07:54,390 --> 00:07:52,639

foundation of sea level through

214
00:07:56,790 --> 00:07:54,400
long-term sea level rise

215
00:07:57,990 --> 00:07:56,800
we've increased the height of high tide

216
00:08:00,790 --> 00:07:58,000
so now what was

217
00:08:02,469 --> 00:08:00,800
uh before a relatively safe high tide

218
00:08:03,909 --> 00:08:02,479
with no coastal flooding now it doesn't

219
00:08:06,150 --> 00:08:03,919
really take much to get past

220
00:08:06,950 --> 00:08:06,160
that threshold from a normal high tide

221
00:08:09,830 --> 00:08:06,960
and to flooding

222
00:08:11,670 --> 00:08:09,840
uh conditions um so sea level rises is

223
00:08:14,230 --> 00:08:11,680
already impacting these coastal

224
00:08:15,430 --> 00:08:14,240
coastal communities it's a problem now

225
00:08:17,589 --> 00:08:15,440
it's worsening

226
00:08:19,029 --> 00:08:17,599
and it's expected to worsen in the

227
00:08:19,909 --> 00:08:19,039
future and more areas that aren't

228
00:08:22,629 --> 00:08:19,919
necessarily

229
00:08:24,230 --> 00:08:22,639
experiencing coastal flooding or sea

230
00:08:25,830 --> 00:08:24,240
level rise impacts now

231
00:08:28,550 --> 00:08:25,840
likely will in the future as sea level

232
00:08:30,790 --> 00:08:28,560
continues to increase

233
00:08:32,070 --> 00:08:30,800
and before this broadcast we kind of

234
00:08:34,949 --> 00:08:32,080
talked about for how you had

235
00:08:36,550 --> 00:08:34,959
first-hand experience seeing this so can

236
00:08:37,269 --> 00:08:36,560
you talk more about your personal

237
00:08:40,630 --> 00:08:37,279
journey

238
00:08:42,230 --> 00:08:40,640

that led you to this mission yeah up

239
00:08:43,509 --> 00:08:42,240
until about two years ago before i

240
00:08:45,110 --> 00:08:43,519
started working at the jet propulsion

241
00:08:47,190 --> 00:08:45,120
laboratory i was living in coastal

242
00:08:48,230 --> 00:08:47,200
virginia and a city called norfolk

243
00:08:50,710 --> 00:08:48,240
virginia

244
00:08:52,310 --> 00:08:50,720
and we my wife and family and i bought a

245
00:08:53,990 --> 00:08:52,320
house across the street from a coastal

246
00:08:55,509 --> 00:08:54,000
inlet and a few times a year we'd see

247
00:08:56,790 --> 00:08:55,519
that water come creeping across the

248
00:08:57,350 --> 00:08:56,800
neighbor's yard on the other side of the

249
00:08:59,990 --> 00:08:57,360
street

250
00:09:01,030 --> 00:09:00,000
into the road it was something that we

251
00:09:03,670 --> 00:09:01,040
really got to experience

252
00:09:05,030 --> 00:09:03,680
firsthand the sea level rise impacts and

253
00:09:07,910 --> 00:09:05,040
the coastal flooding that some of these

254
00:09:10,310 --> 00:09:07,920
communities around the world are seeing

255
00:09:11,990 --> 00:09:10,320
so the the flooding is not necessarily

256
00:09:13,350 --> 00:09:12,000
catastrophic but it just becomes

257
00:09:15,030 --> 00:09:13,360
part of your day-to-day life so it

258
00:09:16,470 --> 00:09:15,040
impacts your ability to

259
00:09:18,470 --> 00:09:16,480
get to work maybe you have to go a

260
00:09:19,910 --> 00:09:18,480
different route than you're used to

261
00:09:20,870 --> 00:09:19,920
it can impact where you park your car

262
00:09:22,630 --> 00:09:20,880
certainly you don't want to keep your

263
00:09:24,870 --> 00:09:22,640

car parked in an area where

264
00:09:26,630 --> 00:09:24,880
it might get flooded it's just something

265
00:09:28,870 --> 00:09:26,640
that you have to learn to adapt to

266
00:09:30,310 --> 00:09:28,880
and plan for as part of your everyday

267
00:09:33,350 --> 00:09:30,320
life so

268
00:09:35,030 --> 00:09:33,360
again with this firsthand experience i

269
00:09:35,430 --> 00:09:35,040
started to understand exactly what it

270
00:09:37,350 --> 00:09:35,440
meant

271
00:09:38,550 --> 00:09:37,360
to try to understand sea level and the

272
00:09:40,790 --> 00:09:38,560
importance of doing so

273
00:09:42,150 --> 00:09:40,800
so as part of my time in norfolk and

274
00:09:44,150 --> 00:09:42,160
these coastal communities i had

275
00:09:45,750 --> 00:09:44,160
the chance to interact and work a lot

276
00:09:46,470 --> 00:09:45,760
with coastal planners and decision

277
00:09:48,470 --> 00:09:46,480
makers

278
00:09:49,829 --> 00:09:48,480
and understand their science needs what

279
00:09:51,670 --> 00:09:49,839
do they really need in terms of

280
00:09:52,630 --> 00:09:51,680
information to make good plans for the

281
00:09:54,630 --> 00:09:52,640
future

282
00:09:56,310 --> 00:09:54,640
and to ensure these coastal communities

283
00:09:57,910 --> 00:09:56,320
are able to live

284
00:09:59,670 --> 00:09:57,920
life successfully and happily into the

285
00:10:01,350 --> 00:09:59,680
future so

286
00:10:02,630 --> 00:10:01,360
taking that information we can take it

287
00:10:04,389 --> 00:10:02,640
all the way back to the observations

288
00:10:06,230 --> 00:10:04,399

that we make from these satellites

289
00:10:07,590 --> 00:10:06,240
understanding exactly what information

290
00:10:08,870 --> 00:10:07,600
they need trying to improve our

291
00:10:10,790 --> 00:10:08,880
understanding now

292
00:10:12,470 --> 00:10:10,800
of of what sea level is doing and again

293
00:10:13,990 --> 00:10:12,480
these satellites including the sentinel

294
00:10:16,069 --> 00:10:14,000
six michael frylick satellite

295
00:10:18,150 --> 00:10:16,079
are critical to that uh that mission of

296
00:10:19,750 --> 00:10:18,160
trying to understand sea level rise now

297
00:10:21,750 --> 00:10:19,760
and once we understand the processes

298
00:10:24,790 --> 00:10:21,760
that are driving sea level change now

299
00:10:26,150 --> 00:10:24,800
we can use that understanding to project

300
00:10:29,110 --> 00:10:26,160
out to understand what might be

301
00:10:30,949 --> 00:10:29,120
happening to sea level in the future

302
00:10:32,550 --> 00:10:30,959
well thank you for answering those are

303
00:10:34,310 --> 00:10:32,560
my questions ben we're going to get to

304
00:10:35,990 --> 00:10:34,320
some social media questions now for you

305
00:10:39,509 --> 00:10:36,000
to answer

306
00:10:41,590 --> 00:10:39,519
and the first one sounds good it's from

307
00:10:43,509 --> 00:10:41,600
moon to mars on twitter and they are

308
00:10:45,910 --> 00:10:43,519
asking will you be able to use

309
00:10:46,790 --> 00:10:45,920
any data from other nasa missions

310
00:10:50,150 --> 00:10:46,800
studying ice

311
00:10:51,590 --> 00:10:50,160
for your water measurement yeah that's

312
00:10:53,030 --> 00:10:51,600
that's a really good question so we have

313
00:10:56,310 --> 00:10:53,040

this whole observation

314
00:10:58,069 --> 00:10:56,320
network of satellites and situ

315
00:10:59,190 --> 00:10:58,079
observations that we use to understand

316
00:11:01,750 --> 00:10:59,200
sea level so

317
00:11:03,509 --> 00:11:01,760
a lot of these satellites allow us to

318
00:11:06,710 --> 00:11:03,519
understand specific processes

319
00:11:08,550 --> 00:11:06,720
that affect sea level so it's although

320
00:11:09,990 --> 00:11:08,560
the altimeters measure total sea level

321
00:11:11,990 --> 00:11:10,000
or sea surface height

322
00:11:13,750 --> 00:11:12,000
we like to try to understand exactly

323
00:11:15,670 --> 00:11:13,760
what processes what physical processes

324
00:11:17,509 --> 00:11:15,680
are actually contributing to that change

325
00:11:18,790 --> 00:11:17,519
in sea surface height that we see

326
00:11:20,550 --> 00:11:18,800
so just to name a couple of these

327
00:11:21,750 --> 00:11:20,560
satellites the grace follow on satellite

328
00:11:23,829 --> 00:11:21,760
for instance

329
00:11:24,790 --> 00:11:23,839
gives us really good measurements of the

330
00:11:28,389 --> 00:11:24,800
change in

331
00:11:30,230 --> 00:11:28,399
ice over glaciers and the ice sheets

332
00:11:31,990 --> 00:11:30,240
and from that we know that the water

333
00:11:34,630 --> 00:11:32,000
when it melts it goes into the ocean

334
00:11:36,470 --> 00:11:34,640
it gets distributed about the world's

335
00:11:37,750 --> 00:11:36,480
oceans in different ways

336
00:11:39,350 --> 00:11:37,760
and then from that we can make better

337
00:11:41,030 --> 00:11:39,360
sense of the observations we have from

338
00:11:43,670 --> 00:11:41,040

the satellite altimeters

339
00:11:45,190 --> 00:11:43,680
icesat-2 is another example icesat-2 is

340
00:11:47,509 --> 00:11:45,200
actually capable of measuring

341
00:11:48,630 --> 00:11:47,519
sea surface height it's a little bit of

342
00:11:50,150 --> 00:11:48,640
a different measurement than what we see

343
00:11:51,590 --> 00:11:50,160
from the radar altimeters from

344
00:11:53,190 --> 00:11:51,600
706 michael freilick but it's

345
00:11:55,430 --> 00:11:53,200
complementary and allows us to really

346
00:11:57,190 --> 00:11:55,440
understand how sea level is changing

347
00:11:58,470 --> 00:11:57,200
on different resolutions so on different

348
00:11:59,910 --> 00:11:58,480
spatial scales

349
00:12:01,269 --> 00:11:59,920
i'm getting closer to the coast

350
00:12:03,030 --> 00:12:01,279
understanding how sea level is changing

351
00:12:04,870 --> 00:12:03,040
very close to the coast

352
00:12:06,230 --> 00:12:04,880
and i i obviously just named two

353
00:12:07,829 --> 00:12:06,240
satellites but there's a whole

354
00:12:10,310 --> 00:12:07,839
again a whole network of observations

355
00:12:11,910 --> 00:12:10,320
that we rely on in addition to

356
00:12:13,670 --> 00:12:11,920
our solid altimeter measurements to

357
00:12:15,990 --> 00:12:13,680
really understand what's happening

358
00:12:18,069 --> 00:12:16,000
in the ocean and happening in sea level

359
00:12:19,590 --> 00:12:18,079
change

360
00:12:21,829 --> 00:12:19,600
and that actually kind of leads me into

361
00:12:23,269 --> 00:12:21,839
this next question from cody on youtube

362
00:12:24,949 --> 00:12:23,279
who asked do you know

363
00:12:28,150 --> 00:12:24,959

how many of these sentinel satellites

364
00:12:31,269 --> 00:12:28,160
will be deployed in orbit

365
00:12:32,790 --> 00:12:31,279
yeah so um in terms of this kind of core

366
00:12:34,629 --> 00:12:32,800
satellite altimeter mission there's

367
00:12:36,389 --> 00:12:34,639
going to be this the sentinel 6a michael

368
00:12:37,910 --> 00:12:36,399
freilick which we're discussing here

369
00:12:39,829 --> 00:12:37,920
and in a few years i think the

370
00:12:41,430 --> 00:12:39,839
anticipated launch date is 2025 we'll

371
00:12:43,590 --> 00:12:41,440
have the cindel 6b

372
00:12:45,110 --> 00:12:43,600
um satellite altimeter which is going to

373
00:12:47,190 --> 00:12:45,120
launch and with

374
00:12:48,470 --> 00:12:47,200
this whole suite of saturday altimeters

375
00:12:50,150 --> 00:12:48,480
so the first

376
00:12:52,150 --> 00:12:50,160
kind of modern era satellite altimeter

377
00:12:53,350 --> 00:12:52,160
was launched in 1992 was the topex

378
00:12:55,670 --> 00:12:53,360
poseidon satellite

379
00:12:56,710 --> 00:12:55,680
from there we had jason one jason two

380
00:12:59,030 --> 00:12:56,720
jason three

381
00:13:00,949 --> 00:12:59,040
and then on up to the sentinel six um

382
00:13:02,629 --> 00:13:00,959
six six eight michael freilich

383
00:13:04,710 --> 00:13:02,639
so with this satellite we're gonna pass

384
00:13:06,470 --> 00:13:04,720
three decades in length

385
00:13:08,470 --> 00:13:06,480
with senel6b we're going to start to

386
00:13:10,949 --> 00:13:08,480
approach four decades in length

387
00:13:12,629 --> 00:13:10,959
and that long continuous record we have

388
00:13:13,509 --> 00:13:12,639

from the satellite altimeters is really

389
00:13:16,150 --> 00:13:13,519
important

390
00:13:17,750 --> 00:13:16,160
um so with that long record we can start

391
00:13:19,350 --> 00:13:17,760
to separate what might be natural

392
00:13:20,550 --> 00:13:19,360
oscillations in sea level from what

393
00:13:21,990 --> 00:13:20,560
might be

394
00:13:24,310 --> 00:13:22,000
the sea level rise associated with

395
00:13:25,750 --> 00:13:24,320
global warming or anthropogenic effects

396
00:13:27,030 --> 00:13:25,760
so there's all these different signals

397
00:13:28,949 --> 00:13:27,040
that cause sea level to change on

398
00:13:31,829 --> 00:13:28,959
shorter time scales

399
00:13:33,350 --> 00:13:31,839
to name a few one in particular el nino

400
00:13:35,350 --> 00:13:33,360
is one that many have heard of so el

401
00:13:36,949 --> 00:13:35,360
nino can cause very large changes in the

402
00:13:40,150 --> 00:13:36,959
pacific ocean

403
00:13:41,670 --> 00:13:40,160
to occur on a year-to-year basis

404
00:13:43,189 --> 00:13:41,680
and we're interested and certainly

405
00:13:44,150 --> 00:13:43,199
interested in observing that but we also

406
00:13:46,310 --> 00:13:44,160
want to separate

407
00:13:47,750 --> 00:13:46,320
that signal those natural oscillations

408
00:13:49,110 --> 00:13:47,760
from longer term

409
00:13:50,470 --> 00:13:49,120
sea level rise that's really critical

410
00:13:51,990 --> 00:13:50,480
from a planning perspective we want to

411
00:13:53,910 --> 00:13:52,000
know what sea level might be

412
00:13:55,509 --> 00:13:53,920
many years into the future so this long

413
00:13:56,710 --> 00:13:55,519

continuous record that we have from the

414
00:13:58,310 --> 00:13:56,720
satellite altimetry

415
00:14:00,230 --> 00:13:58,320
is really hugely important from a

416
00:14:02,550 --> 00:14:00,240
scientific perspective

417
00:14:04,150 --> 00:14:02,560
so it yeah again to answer your question

418
00:14:07,590 --> 00:14:04,160
those are kind of the next two in this

419
00:14:09,750 --> 00:14:07,600
this train of um of modern altimeters

420
00:14:11,829 --> 00:14:09,760
and how much data how many years worth

421
00:14:13,990 --> 00:14:11,839
of data would you like to see personally

422
00:14:15,590 --> 00:14:14,000
come through

423
00:14:17,590 --> 00:14:15,600
i mean the longer we can keep this

424
00:14:19,269 --> 00:14:17,600
record going the the better i mean

425
00:14:21,189 --> 00:14:19,279
the easier these problems become

426
00:14:23,189 --> 00:14:21,199
scientifically i've done a lot of work

427
00:14:25,030 --> 00:14:23,199
myself looking at tie gauges and trying

428
00:14:26,389 --> 00:14:25,040
to give context to the satellite record

429
00:14:27,509 --> 00:14:26,399
using tie gauges

430
00:14:29,189 --> 00:14:27,519
tie gauges are very difficult

431
00:14:30,389 --> 00:14:29,199
observations to use just because they're

432
00:14:31,990 --> 00:14:30,399
so sparse

433
00:14:33,509 --> 00:14:32,000
and they're obviously located on land

434
00:14:35,030 --> 00:14:33,519
that's where tie gauges are located so

435
00:14:37,110 --> 00:14:35,040
you get different effects that

436
00:14:38,389 --> 00:14:37,120
cause trends at those tie gauge

437
00:14:39,590 --> 00:14:38,399
locations so it's a very difficult

438
00:14:41,110 --> 00:14:39,600

comparison to make

439
00:14:42,629 --> 00:14:41,120
but these are active research efforts

440
00:14:44,949 --> 00:14:42,639
and really the whole goal here is to try

441
00:14:47,030 --> 00:14:44,959
to understand how sea level has changed

442
00:14:48,230 --> 00:14:47,040
over as long a period as possible

443
00:14:50,310 --> 00:14:48,240
so then when we're talking about our

444
00:14:52,069 --> 00:14:50,320
satellite record we can get better

445
00:14:53,590 --> 00:14:52,079
context to it and understand the changes

446
00:14:55,030 --> 00:14:53,600
we're seeing now and how they differ

447
00:14:57,110 --> 00:14:55,040
from changes in the past

448
00:14:58,389 --> 00:14:57,120
now if we have a nice long record from

449
00:15:00,710 --> 00:14:58,399
the side altimetry

450
00:15:02,550 --> 00:15:00,720
specifically then we don't have to to

451
00:15:03,829 --> 00:15:02,560
rely quite to the same extent on tie

452
00:15:05,509 --> 00:15:03,839
gauges and doing these

453
00:15:07,189 --> 00:15:05,519
harder studies we can look directly at

454
00:15:08,710 --> 00:15:07,199
the satellite record it's a very

455
00:15:09,670 --> 00:15:08,720
accurate observation we have really good

456
00:15:11,590 --> 00:15:09,680
estimates of how

457
00:15:12,949 --> 00:15:11,600
sea level is changing both globally and

458
00:15:15,350 --> 00:15:12,959
regionally and

459
00:15:16,870 --> 00:15:15,360
then we can uh can use that again to

460
00:15:18,069 --> 00:15:16,880
understand what's happening now and then

461
00:15:18,790 --> 00:15:18,079
understand what's happening into the

462
00:15:20,470 --> 00:15:18,800
future

463
00:15:21,990 --> 00:15:20,480

so to answer your question as long as

464
00:15:23,269 --> 00:15:22,000
possible if we could keep keep this

465
00:15:26,150 --> 00:15:23,279
record going i think it would be a great

466
00:15:29,590 --> 00:15:26,160
help scientifically

467
00:15:31,430 --> 00:15:29,600
and robert and tina on youtube kind of

468
00:15:33,030 --> 00:15:31,440
have a follow-up question from what i

469
00:15:35,670 --> 00:15:33,040
asked have past

470
00:15:37,590 --> 00:15:35,680
c-level records been compared to current

471
00:15:39,269 --> 00:15:37,600
ones

472
00:15:41,269 --> 00:15:39,279
yeah so i touched on this a little bit

473
00:15:42,629 --> 00:15:41,279
so a very active area of research is

474
00:15:45,189 --> 00:15:42,639
comparing

475
00:15:46,790 --> 00:15:45,199
tie gauge records to the satellite

476
00:15:47,749 --> 00:15:46,800
records and we see from the the

477
00:15:49,590 --> 00:15:47,759
satellite records

478
00:15:51,269 --> 00:15:49,600
and that comparison to the tie gauges

479
00:15:52,870 --> 00:15:51,279
that the rate of sea level rise on

480
00:15:54,310 --> 00:15:52,880
global scales has really

481
00:15:56,389 --> 00:15:54,320
increased compared to what we see what

482
00:15:58,870 --> 00:15:56,399
we have seen over the 20th century

483
00:16:01,030 --> 00:15:58,880
so again doing that comparison we really

484
00:16:03,269 --> 00:16:01,040
do um do understand how sea level

485
00:16:04,870 --> 00:16:03,279
is the the era of sea level rise that

486
00:16:06,470 --> 00:16:04,880
we're in now is somewhat unique at least

487
00:16:08,069 --> 00:16:06,480
in terms of the 20th century

488
00:16:09,749 --> 00:16:08,079

there's other efforts research efforts

489
00:16:11,990 --> 00:16:09,759
that go further back beyond

490
00:16:13,269 --> 00:16:12,000
the the beginning of the 20th century

491
00:16:15,269 --> 00:16:13,279
i'm not necessarily an expert on those

492
00:16:16,550 --> 00:16:15,279
so i won't speak to those directly but

493
00:16:18,870 --> 00:16:16,560
there are a lot of different ways that

494
00:16:19,430 --> 00:16:18,880
we can take observations of the past and

495
00:16:21,030 --> 00:16:19,440
try to

496
00:16:23,509 --> 00:16:21,040
give context to what we see during the

497
00:16:25,509 --> 00:16:23,519
satellite era

498
00:16:26,870 --> 00:16:25,519
and then scott on youtube has a

499
00:16:27,829 --> 00:16:26,880
different sort of question he wants to

500
00:16:30,550 --> 00:16:27,839
know

501
00:16:34,150 --> 00:16:30,560
will this same radar technology pick up

502
00:16:38,870 --> 00:16:36,230
i'm not aware of it being used for uh

503
00:16:40,870 --> 00:16:38,880
for animal migration uh the um

504
00:16:42,470 --> 00:16:40,880
effect of spatial resolution of the

505
00:16:44,310 --> 00:16:42,480
satellite altimeters is not really

506
00:16:45,990 --> 00:16:44,320
uh useful for for that kind of

507
00:16:47,189 --> 00:16:46,000
observation for that kind of very very

508
00:16:50,069 --> 00:16:47,199
fine scale

509
00:16:50,870 --> 00:16:50,079
um observation some of the future

510
00:16:52,550 --> 00:16:50,880
altimeters

511
00:16:54,230 --> 00:16:52,560
uh there's one called the surface water

512
00:16:54,949 --> 00:16:54,240
and ocean topography mission which is

513
00:16:56,069 --> 00:16:54,959

coming up

514
00:16:58,629 --> 00:16:56,079
in a few years that's going to be much

515
00:17:00,870 --> 00:16:58,639
higher resolution observations of the

516
00:17:02,470 --> 00:17:00,880
um of the ocean still not uh not to the

517
00:17:03,110 --> 00:17:02,480
point where we'd see animal migration

518
00:17:06,069 --> 00:17:03,120
but

519
00:17:07,909 --> 00:17:06,079
um yeah we we certainly do try to get as

520
00:17:09,189 --> 00:17:07,919
high resolution observation as possible

521
00:17:11,350 --> 00:17:09,199
that allow us to see some of those

522
00:17:13,909 --> 00:17:11,360
smaller scale features

523
00:17:16,549 --> 00:17:13,919
and then dan on youtube is asking are

524
00:17:18,789 --> 00:17:16,559
you able to measure rising co2 levels in

525
00:17:21,429 --> 00:17:18,799
the ocean

526
00:17:22,390 --> 00:17:21,439
so not with um the satellites that we

527
00:17:24,150 --> 00:17:22,400
typically have

528
00:17:25,909 --> 00:17:24,160
or the satellite tumors that we've had

529
00:17:27,270 --> 00:17:25,919
over the past few years so

530
00:17:28,950 --> 00:17:27,280
we rely on other complementary

531
00:17:30,950 --> 00:17:28,960
observations from other satellites in

532
00:17:32,710 --> 00:17:30,960
order to make this

533
00:17:33,990 --> 00:17:32,720
make these observations and to

534
00:17:35,909 --> 00:17:34,000
understand sea level

535
00:17:37,750 --> 00:17:35,919
um the cindel 6a michael freilix

536
00:17:38,950 --> 00:17:37,760
satellite is um

537
00:17:40,230 --> 00:17:38,960
a little bit different than the past

538
00:17:42,070 --> 00:17:40,240

satellites it is making additional

539
00:17:42,549 --> 00:17:42,080
observations including some observations

540
00:17:45,430 --> 00:17:42,559
of the

541
00:17:46,950 --> 00:17:45,440
the atmosphere um so it is providing

542
00:17:48,150 --> 00:17:46,960
additional detail beyond what we had in

543
00:17:49,590 --> 00:17:48,160
the other satellite missions

544
00:17:51,110 --> 00:17:49,600
again that's a little outside there my

545
00:17:53,270 --> 00:17:51,120
area of expertise where i focus

546
00:17:54,789 --> 00:17:53,280
predominantly on sea level

547
00:17:57,270 --> 00:17:54,799
thanks for trying to answer that and

548
00:18:00,230 --> 00:17:57,280
elizabeth on youtube is asking

549
00:18:01,190 --> 00:18:00,240
are you looking mostly at coastal sea

550
00:18:04,470 --> 00:18:01,200
levels

551
00:18:06,390 --> 00:18:04,480
or are areas far from land also of

552
00:18:09,510 --> 00:18:06,400
interest

553
00:18:10,630 --> 00:18:09,520
yeah that's a great question so

554
00:18:12,789 --> 00:18:10,640
maybe it goes back to what i said

555
00:18:13,430 --> 00:18:12,799
earlier that the impacts of sea level

556
00:18:16,230 --> 00:18:13,440
rise

557
00:18:17,669 --> 00:18:16,240
are local and coastal so obviously we're

558
00:18:18,150 --> 00:18:17,679
very concerned about the sea level

559
00:18:19,830 --> 00:18:18,160
signal

560
00:18:21,350 --> 00:18:19,840
that gets expressed at the coast how sea

561
00:18:22,630 --> 00:18:21,360
level is rising the actual coast because

562
00:18:23,830 --> 00:18:22,640
that tells us something about how these

563
00:18:25,590 --> 00:18:23,840

coastal communities are going to be

564
00:18:28,230 --> 00:18:25,600
impacted into the future

565
00:18:29,990 --> 00:18:28,240
but the processes that affect sea level

566
00:18:32,150 --> 00:18:30,000
rise are really large scale

567
00:18:34,549 --> 00:18:32,160
a lot of them are very large scale so

568
00:18:35,909 --> 00:18:34,559
again as an example el nino for instance

569
00:18:39,190 --> 00:18:35,919
that's really a pacific

570
00:18:40,789 --> 00:18:39,200
ocean basin wide effect that causes sea

571
00:18:43,590 --> 00:18:40,799
level rise

572
00:18:45,669 --> 00:18:43,600
on very very large scales so we we

573
00:18:46,150 --> 00:18:45,679
really need to have this very big global

574
00:18:47,669 --> 00:18:46,160
view

575
00:18:49,110 --> 00:18:47,679
of the ocean that these satellites

576
00:18:51,510 --> 00:18:49,120
provide in order to understand the

577
00:18:54,390 --> 00:18:51,520
processes and how that gets communicated

578
00:18:55,750 --> 00:18:54,400
to the coast so our view of sea level

579
00:18:57,430 --> 00:18:55,760
and our study of sea level is really

580
00:18:58,630 --> 00:18:57,440
global in nature and then we do whatever

581
00:18:59,909 --> 00:18:58,640
we can to take that

582
00:19:01,990 --> 00:18:59,919
global view and that global

583
00:19:04,630 --> 00:19:02,000
understanding and translate it to what's

584
00:19:07,110 --> 00:19:04,640
actually happening at the coast

585
00:19:08,870 --> 00:19:07,120
now michael on youtube is asking for a

586
00:19:09,830 --> 00:19:08,880
very specific location does the

587
00:19:12,950 --> 00:19:09,840
satellite data

588
00:19:14,870 --> 00:19:12,960

include the great lakes

589
00:19:16,150 --> 00:19:14,880
yes so we do have some observations over

590
00:19:18,710 --> 00:19:16,160
the great lakes um

591
00:19:19,990 --> 00:19:18,720
i can't necessarily speak to those i i

592
00:19:21,350 --> 00:19:20,000
haven't looked at them myself but the

593
00:19:22,870 --> 00:19:21,360
satellites

594
00:19:24,630 --> 00:19:22,880
and the altimeters there is a certain

595
00:19:26,870 --> 00:19:24,640
amount of work being done looking at

596
00:19:28,470 --> 00:19:26,880
at the great lakes um again as we go

597
00:19:30,150 --> 00:19:28,480
forward into some of the future missions

598
00:19:31,590 --> 00:19:30,160
the swat mission for instance

599
00:19:33,350 --> 00:19:31,600
um and so some of the other future

600
00:19:34,549 --> 00:19:33,360
satellites that we're launching um we're

601
00:19:35,510 --> 00:19:34,559
going to get much better views of some

602
00:19:39,029 --> 00:19:35,520
of these inland

603
00:19:41,669 --> 00:19:39,039
um water bodies

604
00:19:42,789 --> 00:19:41,679
that's great and forza jersey on youtube

605
00:19:45,110 --> 00:19:42,799
is asking

606
00:19:47,590 --> 00:19:45,120
how long do our coastal cities have to

607
00:19:49,190 --> 00:19:47,600
adapt

608
00:19:51,190 --> 00:19:49,200
yeah that's an interesting question i

609
00:19:53,029 --> 00:19:51,200
mean it's somewhat of a

610
00:19:55,750 --> 00:19:53,039
case-by-case basis i mean for for

611
00:19:57,669 --> 00:19:55,760
example norfolk where i lived previously

612
00:19:59,029 --> 00:19:57,679
people are still living very happily in

613
00:20:01,669 --> 00:19:59,039

norfolk i mean i'm

614
00:20:03,110 --> 00:20:01,679
certainly not a doom and gloom um a

615
00:20:05,270 --> 00:20:03,120
representation of life

616
00:20:06,950 --> 00:20:05,280
in norfolk and these coastal communities

617
00:20:08,789 --> 00:20:06,960
people often live there because they

618
00:20:10,710 --> 00:20:08,799
like the water so it's it's a matter of

619
00:20:12,789 --> 00:20:10,720
trying to understand how to adapt and

620
00:20:14,789 --> 00:20:12,799
still successfully live with that water

621
00:20:16,390 --> 00:20:14,799
going forward um that being said the

622
00:20:17,990 --> 00:20:16,400
adaptation strategies for

623
00:20:19,430 --> 00:20:18,000
a city like norfolk for instance are not

624
00:20:22,070 --> 00:20:19,440
going to be the same for other

625
00:20:23,590 --> 00:20:22,080
areas in other areas you may have to

626
00:20:25,590 --> 00:20:23,600
talk about coastal migration so moving

627
00:20:27,270 --> 00:20:25,600
away from the coastline

628
00:20:29,830 --> 00:20:27,280
or out sorry migration moving away from

629
00:20:32,549 --> 00:20:29,840
the coastline

630
00:20:33,110 --> 00:20:32,559
it's it's not a one-size-fits-all answer

631
00:20:34,710 --> 00:20:33,120
to that

632
00:20:36,549 --> 00:20:34,720
um with the satellites we actually do

633
00:20:38,470 --> 00:20:36,559
get a good view of how

634
00:20:39,590 --> 00:20:38,480
sea level rise varies regionally so

635
00:20:41,350 --> 00:20:39,600
again it's not equal

636
00:20:42,870 --> 00:20:41,360
everywhere some areas are experiencing

637
00:20:43,750 --> 00:20:42,880
sea level rise at faster rates than

638
00:20:45,909 --> 00:20:43,760

others

639
00:20:48,310 --> 00:20:45,919
as an example so in the western tropical

640
00:20:49,830 --> 00:20:48,320
pacific some of those low-lying islands

641
00:20:51,669 --> 00:20:49,840
over the past three decades they've seen

642
00:20:53,510 --> 00:20:51,679
very high rates of sea level rise

643
00:20:55,270 --> 00:20:53,520
we've measured those with the altimeters

644
00:20:56,070 --> 00:20:55,280
on the other hand off the u.s west coast

645
00:20:58,070 --> 00:20:56,080
we've seen

646
00:20:59,510 --> 00:20:58,080
lower than the global average sea level

647
00:21:01,029 --> 00:20:59,520
rise so it's been kind of suppressed by

648
00:21:04,230 --> 00:21:01,039
different climate signals that are

649
00:21:06,070 --> 00:21:04,240
that are present in the ocean um so

650
00:21:07,270 --> 00:21:06,080
again that's it's it's hard to answer

651
00:21:09,510 --> 00:21:07,280
that question um

652
00:21:10,950 --> 00:21:09,520
certainly there's local planners the the

653
00:21:11,350 --> 00:21:10,960
planning efforts are done on a local

654
00:21:15,029 --> 00:21:11,360
level

655
00:21:16,549 --> 00:21:15,039
trying to understand how to adapt to um

656
00:21:18,789 --> 00:21:16,559
the the sea level rise they may see in

657
00:21:21,350 --> 00:21:18,799
the future

658
00:21:22,070 --> 00:21:21,360
thanks and then we have a last question

659
00:21:24,950 --> 00:21:22,080
here from

660
00:21:26,390 --> 00:21:24,960
ramirez on facebook who is asking will

661
00:21:28,950 --> 00:21:26,400
the satellites measure the

662
00:21:29,430 --> 00:21:28,960
average or instantaneous values of water

663
00:21:35,270 --> 00:21:29,440

height

664
00:21:37,270 --> 00:21:35,280
and can they predict storms and tsunamis

665
00:21:38,470 --> 00:21:37,280
yeah so um those are those are good

666
00:21:41,510 --> 00:21:38,480
questions so

667
00:21:43,110 --> 00:21:41,520
the satellites fly over overhead and

668
00:21:44,630 --> 00:21:43,120
they basically take a measurement

669
00:21:46,149 --> 00:21:44,640
directly below the satellite at any

670
00:21:48,390 --> 00:21:46,159
given time so we're constantly taking

671
00:21:50,230 --> 00:21:48,400
these observations these measurements

672
00:21:52,149 --> 00:21:50,240
over 10 days we can build these up to

673
00:21:53,590 --> 00:21:52,159
have a global map so we still have some

674
00:21:56,310 --> 00:21:53,600
space between the tracks

675
00:21:57,510 --> 00:21:56,320
along which the satellites are measuring

676
00:21:59,669 --> 00:21:57,520
so

677
00:22:00,789 --> 00:21:59,679
um again over time we can build up this

678
00:22:02,230 --> 00:22:00,799
measurement and

679
00:22:04,149 --> 00:22:02,240
what we can do is average these

680
00:22:05,110 --> 00:22:04,159
observations that are taken at an

681
00:22:06,630 --> 00:22:05,120
instant in time

682
00:22:08,710 --> 00:22:06,640
and then try to get an understanding of

683
00:22:10,070 --> 00:22:08,720
how the ocean is changing over longer

684
00:22:11,590 --> 00:22:10,080
time scale so

685
00:22:13,350 --> 00:22:11,600
there's an important metric that we call

686
00:22:15,110 --> 00:22:13,360
global mean sea level we take all these

687
00:22:16,630 --> 00:22:15,120
observations every 10 days we average

688
00:22:17,270 --> 00:22:16,640

them together and we have a single

689
00:22:19,350 --> 00:22:17,280
measurement

690
00:22:21,270 --> 00:22:19,360
for the ocean and you stack these up

691
00:22:24,230 --> 00:22:21,280
over time and you get an idea of how

692
00:22:25,510 --> 00:22:24,240
global sea level is changing over the

693
00:22:27,110 --> 00:22:25,520
satellite record so

694
00:22:28,870 --> 00:22:27,120
the rate of global mean sea level change

695
00:22:31,029 --> 00:22:28,880
is a little over three millimeters per

696
00:22:32,789 --> 00:22:31,039
year since 1992 so we can make that

697
00:22:33,430 --> 00:22:32,799
measurement by stacking up and averaging

698
00:22:35,669 --> 00:22:33,440
all these

699
00:22:37,029 --> 00:22:35,679
these instantaneous measurements in

700
00:22:39,750 --> 00:22:37,039
terms of

701
00:22:40,549 --> 00:22:39,760
storms and tsunamis so yes we can

702
00:22:42,470 --> 00:22:40,559
certainly

703
00:22:43,990 --> 00:22:42,480
use our observations from the satellites

704
00:22:46,789 --> 00:22:44,000
for both of those

705
00:22:48,789 --> 00:22:46,799
um actually one of my phd topics one of

706
00:22:50,470 --> 00:22:48,799
my thesis topics was trying to observe

707
00:22:51,669 --> 00:22:50,480
tsunamis in the open ocean using

708
00:22:53,350 --> 00:22:51,679
altimeters it's a little bit of a

709
00:22:54,950 --> 00:22:53,360
difficult problem giving all the other

710
00:22:57,190 --> 00:22:54,960
types of ocean signals that are there

711
00:22:58,070 --> 00:22:57,200
but we can see these types of features

712
00:23:00,470 --> 00:22:58,080
in the ocean

713
00:23:02,710 --> 00:23:00,480

and certainly um sentinel 6a michael

714
00:23:04,630 --> 00:23:02,720
freilick is going to be useful for

715
00:23:06,390 --> 00:23:04,640
helping to forecast and understand the

716
00:23:08,549 --> 00:23:06,400
development of storms and hurricanes in

717
00:23:10,470 --> 00:23:08,559
the ocean

718
00:23:11,909 --> 00:23:10,480
great thank you so much ben that's all

719
00:23:13,430 --> 00:23:11,919
the time we have for questions today and

720
00:23:14,789 --> 00:23:13,440
thank you for everyone online who

721
00:23:18,549 --> 00:23:14,799
submitted their questions

722
00:23:24,230 --> 00:23:21,669
thanks for having me of course the

723
00:23:26,470 --> 00:23:24,240
sentinel 6 michael phyllic satellite is

724
00:23:28,310 --> 00:23:26,480
truly an international collaboration

725
00:23:29,909 --> 00:23:28,320
it is being jointly developed by the

726
00:23:32,470 --> 00:23:29,919
european space agency

727
00:23:34,390 --> 00:23:32,480
nasa the european organization for the

728
00:23:35,350 --> 00:23:34,400
exploitation of meteorological

729
00:23:37,669 --> 00:23:35,360
satellites

730
00:23:39,029 --> 00:23:37,679
and the national oceanic and atmospheric

731
00:23:41,430 --> 00:23:39,039
administration

732
00:23:42,070 --> 00:23:41,440
with funding support from the european

733
00:23:44,070 --> 00:23:42,080
commission

734
00:23:45,590 --> 00:23:44,080
and technical support from the french

735
00:23:48,230 --> 00:23:45,600
space agency

736
00:23:50,390 --> 00:23:48,240
caness now the sentinel 6 michael

737
00:23:51,830 --> 00:23:50,400
freilix satellite is scheduled to launch

738
00:23:53,909 --> 00:23:51,840

on november 10th

739
00:23:55,350 --> 00:23:53,919
and for the latest on the mission follow

740
00:23:58,470 --> 00:23:55,360
at nasa earth

741
00:24:00,310 --> 00:23:58,480
on twitter facebook and instagram you

742
00:24:03,350 --> 00:24:00,320
can watch all the behind the spacecraft

743
00:24:04,230 --> 00:24:03,360
video profiles on the nasa 360 youtube

744
00:24:06,710 --> 00:24:04,240
channel

745
00:24:09,430 --> 00:24:06,720
and we will be doing q a's with sentinel

746
00:24:11,990 --> 00:24:09,440
6 michael freilix satellite team members

747
00:24:13,750 --> 00:24:12,000
each wednesday afternoon so please

748
00:24:15,190 --> 00:24:13,760
follow and subscribe for those

749
00:24:18,230 --> 00:24:15,200
notifications

750
00:24:19,350 --> 00:24:18,240
and at nasa earth science your home is