
TRACKING
GLOBAL
SEA
LEVEL

1
00:02:08,939 --> 00:01:00,510
[Music]

2
00:02:41,460 --> 00:02:08,949
so

3
00:02:41,470 --> 00:02:48,830
[Music]

4
00:02:48,840 --> 00:02:52,200
so

5
00:04:40,830 --> 00:03:19,860
[Music]

6
00:04:40,840 --> 00:04:45,140
so

7
00:04:45,150 --> 00:04:54,830
[Music]

8
00:05:29,670 --> 00:04:56,950
do

9
00:05:33,510 --> 00:05:31,749
i love looking at data and processing

10
00:05:35,909 --> 00:05:33,520
data we're looking at a

11
00:05:37,510 --> 00:05:35,919
one-third replica of the central six

12
00:05:37,990 --> 00:05:37,520
microfrey like satellite there is

13
00:05:39,590 --> 00:05:38,000

multiple

14
00:05:42,070 --> 00:05:39,600
instruments on the satellite we have the

15
00:05:43,189 --> 00:05:42,080
altimeter we have the radiometer my name

16
00:05:44,870 --> 00:05:43,199
is shaylen desai

17
00:05:46,469 --> 00:05:44,880
and my role on the satellite is to

18
00:05:47,430 --> 00:05:46,479
combine the data from all these

19
00:05:48,870 --> 00:05:47,440
different instruments

20
00:05:50,790 --> 00:05:48,880
that contribute to the measurement of

21
00:05:51,670 --> 00:05:50,800
sea server site the earth surface is

22
00:05:54,390 --> 00:05:51,680
covered by

23
00:05:56,230 --> 00:05:54,400
70 oceans we have millions of people of

24
00:05:58,469 --> 00:05:56,240
course living near coastlines so the

25
00:06:00,550 --> 00:05:58,479
channel 6 satellite is intended to take

26
00:06:02,150 --> 00:06:00,560
a snapshot of the state of the oceans

27
00:06:03,029 --> 00:06:02,160
the hills and the valleys of the ocean

28
00:06:05,590 --> 00:06:03,039
surface

29
00:06:07,270 --> 00:06:05,600
around the globe this antenna is sending

30
00:06:09,270 --> 00:06:07,280
a signal to the oceans

31
00:06:10,629 --> 00:06:09,280
and that signal is bouncing back when we

32
00:06:11,270 --> 00:06:10,639
combine the measurements from the last

33
00:06:13,590 --> 00:06:11,280
30 years

34
00:06:15,350 --> 00:06:13,600
this is the fourth of the series that

35
00:06:17,670 --> 00:06:15,360
i've been involved in we're able to

36
00:06:18,870 --> 00:06:17,680
to see how much has sea level changed

37
00:06:21,029 --> 00:06:18,880
over 30 years

38
00:06:22,550 --> 00:06:21,039

i was born in zimbabwe moved to the

39
00:06:24,629 --> 00:06:22,560
united states and

40
00:06:26,150 --> 00:06:24,639
came to college i grew up in a country

41
00:06:26,870 --> 00:06:26,160
that was landlocked and had absolutely

42
00:06:28,870 --> 00:06:26,880
nothing to do

43
00:06:30,390 --> 00:06:28,880
with the oceans and there i am helping

44
00:06:31,029 --> 00:06:30,400
to put together measurements of the

45
00:06:32,870 --> 00:06:31,039
oceans

46
00:06:35,189 --> 00:06:32,880
for the last 20 years because of that

47
00:06:37,430 --> 00:06:35,199
large surface area covered by the oceans

48
00:06:38,390 --> 00:06:37,440
it influences climate and then affects

49
00:06:40,469 --> 00:06:38,400
the entire planet

50
00:06:41,990 --> 00:06:40,479
for example if there's an el nino on the

51
00:06:44,309 --> 00:06:42,000
western coast of the americas

52
00:06:46,150 --> 00:06:44,319
is actually resulting in a drought in

53
00:06:46,629 --> 00:06:46,160
the country that i grew up in in zuma

54
00:06:50,710 --> 00:06:46,639
where

55
00:06:51,630 --> 00:06:50,720
oceans will influence you in some form

56
00:06:57,830 --> 00:06:51,640
or the other

57
00:07:01,990 --> 00:07:00,710
hi i'm brecken with nasa's jet

58
00:07:05,189 --> 00:07:02,000
propulsion laboratory

59
00:07:07,430 --> 00:07:05,199
in southern california you may know nasa

60
00:07:09,990 --> 00:07:07,440
best for exploring other planets

61
00:07:11,830 --> 00:07:10,000
but we are also keeping a close eye on

62
00:07:14,309 --> 00:07:11,840
our own planet earth

63
00:07:15,830 --> 00:07:14,319

nasa is about to launch the us and

64
00:07:18,550 --> 00:07:15,840
european sentinel 6

65
00:07:19,749 --> 00:07:18,560
michael frylick satellite this satellite

66
00:07:22,790 --> 00:07:19,759
aims to collect the most

67
00:07:24,469 --> 00:07:22,800
accurate data yet on sea level and how

68
00:07:27,110 --> 00:07:24,479
it changes over time

69
00:07:27,589 --> 00:07:27,120
jpl manages sentinel 6 michael freilix

70
00:07:31,270 --> 00:07:27,599
mission

71
00:07:32,710 --> 00:07:31,280
for nasa shailen desai is a measurement

72
00:07:34,390 --> 00:07:32,720
system engineer

73
00:07:36,070 --> 00:07:34,400
he combines data from different

74
00:07:37,830 --> 00:07:36,080
instruments on the sentinel-6

75
00:07:40,390 --> 00:07:37,840
mycophyllic satellite

76
00:07:41,270 --> 00:07:40,400
this data helps measure sea surface

77
00:07:43,670 --> 00:07:41,280
height

78
00:07:45,510 --> 00:07:43,680
and he joins us live today to answer

79
00:07:47,189 --> 00:07:45,520
some of your questions

80
00:07:48,710 --> 00:07:47,199
if you have any questions you'd like to

81
00:07:50,629 --> 00:07:48,720
ask you can leave them

82
00:07:51,909 --> 00:07:50,639
right here in the comments or post them

83
00:07:55,029 --> 00:07:51,919
to social media

84
00:07:57,990 --> 00:07:55,039
with the hashtag scenethesees

85
00:08:00,070 --> 00:07:58,000
thank you so much for joining us shaylyn

86
00:08:02,710 --> 00:08:00,080
there we go

87
00:08:05,189 --> 00:08:02,720
great so let's get started how does the

88
00:08:08,790 --> 00:08:05,199

sentinel 6 microphilic satellite measure

89
00:08:12,150 --> 00:08:10,950
so one way to think of this is think of

90
00:08:14,790 --> 00:08:12,160
someone that

91
00:08:16,390 --> 00:08:14,800
gave you an empty bucket and added some

92
00:08:18,550 --> 00:08:16,400
water to that bucket

93
00:08:20,230 --> 00:08:18,560
and then challenge you to provide

94
00:08:20,950 --> 00:08:20,240
provide you with providing him with a

95
00:08:23,350 --> 00:08:20,960
measurement

96
00:08:25,189 --> 00:08:23,360
of the height of that water without

97
00:08:27,670 --> 00:08:25,199
actually getting wet

98
00:08:28,550 --> 00:08:27,680
so one approach to doing this would be

99
00:08:30,790 --> 00:08:28,560
to measure

100
00:08:33,029 --> 00:08:30,800
the height of the top of the bucket from

101
00:08:35,670 --> 00:08:33,039
the outside of the bucket

102
00:08:37,190 --> 00:08:35,680
and then to measure the height from the

103
00:08:38,870 --> 00:08:37,200
water to the top of the bucket from the

104
00:08:39,990 --> 00:08:38,880
inside of the bucket

105
00:08:42,389 --> 00:08:40,000
then when you difference those

106
00:08:43,190 --> 00:08:42,399
measurements you end up with the height

107
00:08:44,949 --> 00:08:43,200
of the water

108
00:08:46,949 --> 00:08:44,959
with respect to the bottom of where the

109
00:08:49,829 --> 00:08:46,959
bucket is sitting

110
00:08:51,590 --> 00:08:49,839
similar to that bucket we have the 7-6

111
00:08:52,870 --> 00:08:51,600
satellite which is basically the top of

112
00:08:54,790 --> 00:08:52,880
the bucket

113
00:08:56,310 --> 00:08:54,800

that from which we measure the height of

114
00:08:57,910 --> 00:08:56,320
the satellite with respect to the center

115
00:08:59,670 --> 00:08:57,920
of the earth

116
00:09:01,670 --> 00:08:59,680
and then after that we have instruments

117
00:09:04,389 --> 00:09:01,680
on the satellite that are measuring

118
00:09:05,990 --> 00:09:04,399
the height or the distance between the

119
00:09:07,190 --> 00:09:06,000
surface of the oceans

120
00:09:09,269 --> 00:09:07,200
with respect to the height of the

121
00:09:10,630 --> 00:09:09,279
satellite when you difference those two

122
00:09:12,070 --> 00:09:10,640
measurements

123
00:09:14,230 --> 00:09:12,080
that then provides you with the

124
00:09:16,550 --> 00:09:14,240
measurement of the sea silver site with

125
00:09:18,870 --> 00:09:16,560
respect to the center of the earth

126
00:09:20,550 --> 00:09:18,880
then as the satellite is traveling

127
00:09:21,590 --> 00:09:20,560
around the earth in a circle around the

128
00:09:23,350 --> 00:09:21,600
earth

129
00:09:24,870 --> 00:09:23,360
at a speed of about six kilometers per

130
00:09:27,350 --> 00:09:24,880
second or almost four

131
00:09:28,150 --> 00:09:27,360
miles per second the satellite is then

132
00:09:30,790 --> 00:09:28,160
taking these

133
00:09:32,550 --> 00:09:30,800
these measurements of sea silver site

134
00:09:35,590 --> 00:09:32,560
directly beneath the satellite

135
00:09:35,990 --> 00:09:35,600
as it travels around the earth the

136
00:09:38,550 --> 00:09:36,000
satellite

137
00:09:40,710 --> 00:09:38,560
then takes a then goes around the earth

138
00:09:44,310 --> 00:09:40,720

about 127 times

139
00:09:46,070 --> 00:09:44,320
in about 10 days and essentially covers

140
00:09:47,829 --> 00:09:46,080
or takes measurements of the sea surface

141
00:09:49,350 --> 00:09:47,839
as the earth is rotating beneath it

142
00:09:52,230 --> 00:09:49,360
takes measurements of the sea service

143
00:09:54,550 --> 00:09:52,240
height and after 127 times around the

144
00:09:56,230 --> 00:09:54,560
earth it returns to the same location

145
00:09:58,550 --> 00:09:56,240
the end result is that you end up with a

146
00:10:01,990 --> 00:09:58,560
snapshot of the global oceans

147
00:10:04,870 --> 00:10:02,000
every 10 days and then

148
00:10:06,389 --> 00:10:04,880
about that snapshot how do the different

149
00:10:07,670 --> 00:10:06,399
instruments on the sentinel 6

150
00:10:11,350 --> 00:10:07,680
mycophyllic satellite

151
00:10:13,990 --> 00:10:11,360
contribute to this measurement

152
00:10:15,590 --> 00:10:14,000
so on the satellite we have uh for

153
00:10:17,430 --> 00:10:15,600
example when you want to measure the top

154
00:10:19,030 --> 00:10:17,440
of the bucket with respect to the floor

155
00:10:20,870 --> 00:10:19,040
the analogy to measure the height of the

156
00:10:21,750 --> 00:10:20,880
satellite we have what we call tracking

157
00:10:23,990 --> 00:10:21,760
systems

158
00:10:24,870 --> 00:10:24,000
on the satellite for example a gps

159
00:10:27,030 --> 00:10:24,880
receiver

160
00:10:29,190 --> 00:10:27,040
is one of the instruments that helps you

161
00:10:30,230 --> 00:10:29,200
provide the height and location of the

162
00:10:32,230 --> 00:10:30,240
satellite

163
00:10:34,069 --> 00:10:32,240

the other instrument that is a tracking

164
00:10:34,550 --> 00:10:34,079
system as well is a french system called

165
00:10:37,190 --> 00:10:34,560
the

166
00:10:37,670 --> 00:10:37,200
doris system this is almost like a

167
00:10:40,550 --> 00:10:37,680
reverse

168
00:10:42,310 --> 00:10:40,560
gps where instead of receiving signals

169
00:10:43,269 --> 00:10:42,320
like gps-like signals from gps

170
00:10:45,030 --> 00:10:43,279
satellites

171
00:10:46,470 --> 00:10:45,040
you're receiving signals from ground

172
00:10:47,110 --> 00:10:46,480
ground beacons on the surface of the

173
00:10:48,790 --> 00:10:47,120
earth

174
00:10:50,949 --> 00:10:48,800
and together those two tracking systems

175
00:10:52,470 --> 00:10:50,959
then provide you an accurate measurement

176
00:10:54,389 --> 00:10:52,480
of where the satellite is or the height

177
00:10:56,150 --> 00:10:54,399
of the satellite with respect to the

178
00:10:58,150 --> 00:10:56,160
center of the earth

179
00:10:59,590 --> 00:10:58,160
then we have the primary instrument on

180
00:11:00,870 --> 00:10:59,600
the setup which is called a radar

181
00:11:04,630 --> 00:11:00,880
altimeter

182
00:11:06,389 --> 00:11:04,640
this uh instrument is sending a signal

183
00:11:08,790 --> 00:11:06,399
from the satellite to the surface of the

184
00:11:10,630 --> 00:11:08,800
oceans and that signal

185
00:11:13,430 --> 00:11:10,640
is then bouncing off the surface of the

186
00:11:15,030 --> 00:11:13,440
oceans reflecting back to the instrument

187
00:11:17,430 --> 00:11:15,040
and the instrument is then measuring the

188
00:11:19,430 --> 00:11:17,440

time it takes for that signal to travel

189
00:11:20,710 --> 00:11:19,440
from the time it left the instrument to

190
00:11:22,470 --> 00:11:20,720
the time it returned

191
00:11:23,910 --> 00:11:22,480
and because we know the speed of that

192
00:11:25,990 --> 00:11:23,920
signal

193
00:11:27,670 --> 00:11:26,000
that that that measurement of time for

194
00:11:28,630 --> 00:11:27,680
the signal to bounce back then provides

195
00:11:30,150 --> 00:11:28,640
you

196
00:11:31,990 --> 00:11:30,160
a measure of the distance between the

197
00:11:33,509 --> 00:11:32,000
satellite and the sea surface

198
00:11:35,110 --> 00:11:33,519
so given now our knowledge of the

199
00:11:35,829 --> 00:11:35,120
altitude of the satellite so the top of

200
00:11:37,190 --> 00:11:35,839
the bucket

201
00:11:38,630 --> 00:11:37,200
and the measurement of the distance

202
00:11:39,990 --> 00:11:38,640
between the satellite and the ocean

203
00:11:41,269 --> 00:11:40,000
surface which is the measurement of

204
00:11:42,790 --> 00:11:41,279
inside the bucket

205
00:11:44,870 --> 00:11:42,800
a difference in those two measurements

206
00:11:46,310 --> 00:11:44,880
then gives you a measurement of the c

207
00:11:48,710 --> 00:11:46,320
server site with respect

208
00:11:50,710 --> 00:11:48,720
to the center of the earth we also have

209
00:11:53,750 --> 00:11:50,720
an instrument on the satellite called

210
00:11:56,310 --> 00:11:53,760
a microwave radiometer and this

211
00:11:58,069 --> 00:11:56,320
radiometer measures the water vapor

212
00:11:59,670 --> 00:11:58,079
content in the atmosphere

213
00:12:01,829 --> 00:11:59,680

the problem with that radar alternative

214
00:12:04,949 --> 00:12:01,839
signal as it is bouncing off the

215
00:12:06,710 --> 00:12:04,959
the surface of the ocean is that it is

216
00:12:09,829 --> 00:12:06,720
delayed or slowed down by

217
00:12:11,590 --> 00:12:09,839
water vapor content in the atmosphere

218
00:12:13,350 --> 00:12:11,600
and so by measuring using the microwave

219
00:12:14,150 --> 00:12:13,360
radiometer to measure that water vapor

220
00:12:16,550 --> 00:12:14,160
content

221
00:12:18,069 --> 00:12:16,560
we then know how much how much the

222
00:12:19,190 --> 00:12:18,079
signal has been slowed down by that

223
00:12:21,509 --> 00:12:19,200
water vapor

224
00:12:22,710 --> 00:12:21,519
after we account for that that radar

225
00:12:24,949 --> 00:12:22,720
signal then provides you

226
00:12:26,870 --> 00:12:24,959
a more accurate measurement of the

227
00:12:29,910 --> 00:12:26,880
distance between the sea surface

228
00:12:34,870 --> 00:12:31,750
so those are the main instruments that

229
00:12:35,990 --> 00:12:34,880
currently deceased oversight

230
00:12:37,430 --> 00:12:36,000
and you know there's something in the

231
00:12:37,990 --> 00:12:37,440
video that you said about water that

232
00:12:40,069 --> 00:12:38,000
really stuck

233
00:12:42,310 --> 00:12:40,079
with me you described the ocean as

234
00:12:44,069 --> 00:12:42,320
having hills and valleys

235
00:12:46,310 --> 00:12:44,079
can you elaborate more on what this

236
00:12:49,350 --> 00:12:46,320
means

237
00:12:50,949 --> 00:12:49,360
sure there are many contributions

238
00:12:53,509 --> 00:12:50,959

to the sea service height that we

239
00:12:56,150 --> 00:12:53,519
observe from us from satellites

240
00:12:58,629 --> 00:12:56,160
each of these these contributions can be

241
00:13:01,190 --> 00:12:58,639
thought of as layers on an onion

242
00:13:01,910 --> 00:13:01,200
for example as you peel as you peel the

243
00:13:05,670 --> 00:13:01,920
onion

244
00:13:07,110 --> 00:13:05,680
start seeing the smaller and smaller

245
00:13:08,470 --> 00:13:07,120
layers and the still the smaller and

246
00:13:11,030 --> 00:13:08,480
smaller contributions

247
00:13:13,110 --> 00:13:11,040
uh to the observed sea server site uh

248
00:13:13,990 --> 00:13:13,120
the largest layer of the sea server-side

249
00:13:15,829 --> 00:13:14,000
onion as you might

250
00:13:17,590 --> 00:13:15,839
like to think of it is what we call the

251
00:13:19,269 --> 00:13:17,600
mean sea surface so this means sea

252
00:13:20,790 --> 00:13:19,279
surface is the average

253
00:13:22,790 --> 00:13:20,800
of the sea surface that you might take

254
00:13:23,829 --> 00:13:22,800
by taking measurements of a very long

255
00:13:27,190 --> 00:13:23,839
time let's say over

256
00:13:28,790 --> 00:13:27,200
very many years after you peel off that

257
00:13:29,670 --> 00:13:28,800
onion and so after you know what that

258
00:13:31,670 --> 00:13:29,680
effect is

259
00:13:33,350 --> 00:13:31,680
then you start seeing smaller effects so

260
00:13:36,790 --> 00:13:33,360
another effect might be

261
00:13:39,430 --> 00:13:36,800
for example the effect of tides

262
00:13:40,470 --> 00:13:39,440
tides are caused by the gravitational

263
00:13:43,110 --> 00:13:40,480

pull of the

264
00:13:44,790 --> 00:13:43,120
sun and the moon so for example if the

265
00:13:46,310 --> 00:13:44,800
moon is directly overhead it'll pull on

266
00:13:48,790 --> 00:13:46,320
the water and cause

267
00:13:49,910 --> 00:13:48,800
a high on the on the water so a hill and

268
00:13:52,550 --> 00:13:49,920
nearby will then be

269
00:13:53,750 --> 00:13:52,560
the valleys so this this effect of tires

270
00:13:56,550 --> 00:13:53,760
comes from both the sun

271
00:13:57,910 --> 00:13:56,560
and the moon after you take uh into

272
00:14:00,150 --> 00:13:57,920
account those effects

273
00:14:01,990 --> 00:14:00,160
of of that layer of the sea server side

274
00:14:04,629 --> 00:14:02,000
onion then you can start seeing smaller

275
00:14:05,910 --> 00:14:04,639
effects like as an example you can see

276
00:14:08,870 --> 00:14:05,920
the effects of

277
00:14:10,069 --> 00:14:08,880
warmer and colder water so for example

278
00:14:11,350 --> 00:14:10,079
if you look think about the water in

279
00:14:13,590 --> 00:14:11,360
their bucket again

280
00:14:14,790 --> 00:14:13,600
if you heated up their water then that

281
00:14:16,870 --> 00:14:14,800
water would expand

282
00:14:18,870 --> 00:14:16,880
and the water would then appear to be

283
00:14:21,350 --> 00:14:18,880
higher than what it was when it was

284
00:14:24,069 --> 00:14:21,360
at a cooler temperature similar to for

285
00:14:26,470 --> 00:14:24,079
example if you're in a swimming pool

286
00:14:28,069 --> 00:14:26,480
you might find sometimes in a pool that

287
00:14:29,269 --> 00:14:28,079
there's different pockets of different

288
00:14:31,269 --> 00:14:29,279

temperatures of water you might

289
00:14:33,269 --> 00:14:31,279
encounter a warmer pocket of water

290
00:14:34,710 --> 00:14:33,279
or a colder pocket of water while the

291
00:14:36,069 --> 00:14:34,720
ocean is that big swimming pool where

292
00:14:38,389 --> 00:14:36,079
you also have

293
00:14:40,069 --> 00:14:38,399
warmer and colder pockets of water and

294
00:14:41,750 --> 00:14:40,079
the warmer water as i said as you warm

295
00:14:44,470 --> 00:14:41,760
the water it expands so the warmer

296
00:14:44,870 --> 00:14:44,480
water is higher and the cooler water is

297
00:14:48,150 --> 00:14:44,880
then

298
00:14:50,230 --> 00:14:48,160
look like uh

299
00:14:53,350 --> 00:14:50,240
also have also converted to these hills

300
00:14:56,870 --> 00:14:55,590
that is a great analogy and now whenever

301
00:14:57,670 --> 00:14:56,880
it's an onion i'm going to think of the

302
00:15:00,150 --> 00:14:57,680
sea

303
00:15:01,030 --> 00:15:00,160
and can you tell us more about your

304
00:15:04,550 --> 00:15:01,040
career path

305
00:15:09,350 --> 00:15:07,750
sure so i grew up in a small town

306
00:15:11,509 --> 00:15:09,360
in zimbabwe the third largest city in

307
00:15:13,670 --> 00:15:11,519
zimbabwe called guru

308
00:15:15,910 --> 00:15:13,680
as i was growing up i always enjoyed

309
00:15:18,150 --> 00:15:15,920
math and physics

310
00:15:19,590 --> 00:15:18,160
i was fortunate enough that my parents

311
00:15:21,990 --> 00:15:19,600
took us on vacations

312
00:15:22,629 --> 00:15:22,000
that involved traveling on airplanes and

313
00:15:25,750 --> 00:15:22,639

from those

314
00:15:26,710 --> 00:15:25,760
experiences i became intrigued by

315
00:15:28,470 --> 00:15:26,720
airplanes and

316
00:15:31,910 --> 00:15:28,480
and my very first thought when i was

317
00:15:33,829 --> 00:15:31,920
younger was that i aspired to be a pilot

318
00:15:34,949 --> 00:15:33,839
but one of those vacations uh we're

319
00:15:38,710 --> 00:15:34,959
lucky enough to

320
00:15:40,629 --> 00:15:38,720
visit the nasa johnson center in houston

321
00:15:42,069 --> 00:15:40,639
and from that experience then i thought

322
00:15:44,949 --> 00:15:42,079
oh maybe i should become an

323
00:15:47,189 --> 00:15:44,959
astronaut and so combining all of those

324
00:15:49,430 --> 00:15:47,199
experience uh after high school i

325
00:15:50,629 --> 00:15:49,440
left zuma and attended college in the

326
00:15:52,829 --> 00:15:50,639
united states

327
00:15:54,629 --> 00:15:52,839
i attended a purdue university go

328
00:15:58,389 --> 00:15:54,639
boilermakers

329
00:15:59,829 --> 00:15:58,399
at purdue i was i pursued a degree in

330
00:16:01,430 --> 00:15:59,839
aeronautical and astronautical

331
00:16:04,389 --> 00:16:01,440
engineering

332
00:16:04,790 --> 00:16:04,399
in one of those first classes at purdue

333
00:16:09,670 --> 00:16:04,800
the

334
00:16:12,389 --> 00:16:09,680
many wanted to be an astronaut

335
00:16:13,829 --> 00:16:12,399
and about 90 or maybe all of the class

336
00:16:16,069 --> 00:16:13,839
raised their hands

337
00:16:16,870 --> 00:16:16,079
in that instant time i realized that i

338
00:16:18,389 --> 00:16:16,880

needed to find

339
00:16:20,710 --> 00:16:18,399
something a little more unique as a

340
00:16:22,870 --> 00:16:20,720
career path and

341
00:16:23,910 --> 00:16:22,880
and so i kept looking at all the

342
00:16:25,430 --> 00:16:23,920
different classes that i was

343
00:16:28,310 --> 00:16:25,440
experiencing at purdue

344
00:16:29,030 --> 00:16:28,320
and i came across a class that was that

345
00:16:31,430 --> 00:16:29,040
was

346
00:16:33,110 --> 00:16:31,440
teaching satellite navigation and i

347
00:16:35,430 --> 00:16:33,120
became very interested in that and then

348
00:16:37,430 --> 00:16:35,440
decided to pursue a graduate degree

349
00:16:39,110 --> 00:16:37,440
at the university of colorado in boulder

350
00:16:42,629 --> 00:16:39,120
go buffs

351
00:16:44,870 --> 00:16:42,639
and at at

352
00:16:46,389 --> 00:16:44,880
in in those classes i of course studied

353
00:16:48,310 --> 00:16:46,399
satellite navigation

354
00:16:50,069 --> 00:16:48,320
but i also came across a class that

355
00:16:52,069 --> 00:16:50,079
taught the study

356
00:16:54,310 --> 00:16:52,079
of the size and the shape of the earth

357
00:16:55,670 --> 00:16:54,320
using satellites that orbit around the

358
00:16:57,670 --> 00:16:55,680
earth

359
00:16:58,949 --> 00:16:57,680
and from that experience i thought oh i

360
00:17:01,030 --> 00:16:58,959
wanted to perform research

361
00:17:02,310 --> 00:17:01,040
in that field and i came across an

362
00:17:05,429 --> 00:17:02,320
opportunity

363
00:17:06,949 --> 00:17:05,439

to study uh the ocean tides using c

364
00:17:09,270 --> 00:17:06,959
server side measurements

365
00:17:11,270 --> 00:17:09,280
from the very first of the series of

366
00:17:12,949 --> 00:17:11,280
four satellites that precede the central

367
00:17:14,309 --> 00:17:12,959
six microfilex satellite

368
00:17:16,230 --> 00:17:14,319
and that satellite was called the turbix

369
00:17:18,789 --> 00:17:16,240
poseidon satellite so

370
00:17:19,750 --> 00:17:18,799
i i did perform that research on ocean

371
00:17:21,909 --> 00:17:19,760
tides

372
00:17:23,350 --> 00:17:21,919
using the topics poseidon c server side

373
00:17:25,590 --> 00:17:23,360
measurements

374
00:17:26,470 --> 00:17:25,600
and uh given my background in satellite

375
00:17:30,230 --> 00:17:26,480
navigation

376
00:17:32,549 --> 00:17:30,240
i ended up landing a job at jpl

377
00:17:34,549 --> 00:17:32,559
working as a navigation engineer optical

378
00:17:35,190 --> 00:17:34,559
navigation engineer for the deep space

379
00:17:39,110 --> 00:17:35,200
one

380
00:17:42,390 --> 00:17:39,120
satellite and about two years into jpl

381
00:17:43,909 --> 00:17:42,400
i then landed a job again given my

382
00:17:45,510 --> 00:17:43,919
experience with the topics beside and

383
00:17:46,789 --> 00:17:45,520
see server side measurements i landed a

384
00:17:48,310 --> 00:17:46,799
job

385
00:17:49,909 --> 00:17:48,320
as the measurement system engineer for

386
00:17:52,789 --> 00:17:49,919
the json one satellite

387
00:17:53,110 --> 00:17:52,799
and json one is the second of the four

388
00:17:56,630 --> 00:17:53,120

pre

389
00:17:58,470 --> 00:17:56,640
michael frylick

390
00:18:00,310 --> 00:17:58,480
and from that time jason one as a

391
00:18:01,350 --> 00:18:00,320
measurement system engineer i also

392
00:18:04,070 --> 00:18:01,360
became adjacent

393
00:18:04,789 --> 00:18:04,080
measurement system engineer for json2

394
00:18:08,150 --> 00:18:04,799
json3

395
00:18:10,630 --> 00:18:08,160
and now 706 and almost

396
00:18:11,750 --> 00:18:10,640
over 20 years have passed since that

397
00:18:15,510 --> 00:18:11,760
first experience

398
00:18:18,549 --> 00:18:15,520
with jason jason one

399
00:18:20,630 --> 00:18:18,559
wow that is a great story about

400
00:18:22,549 --> 00:18:20,640
following your own path and choosing to

401
00:18:23,909 --> 00:18:22,559
carve out a unique path of your own when

402
00:18:25,029 --> 00:18:23,919
you decide what you want to do in your

403
00:18:27,029 --> 00:18:25,039
career so

404
00:18:28,549 --> 00:18:27,039
with that is it okay if i start asking

405
00:18:30,150 --> 00:18:28,559
you some more social media questions

406
00:18:33,430 --> 00:18:30,160
that we have online

407
00:18:33,909 --> 00:18:33,440
yeah absolutely great one of them is

408
00:18:35,669 --> 00:18:33,919
from

409
00:18:36,950 --> 00:18:35,679
elaine on twitter who kind of has a

410
00:18:39,590 --> 00:18:36,960
follow-up to

411
00:18:42,070 --> 00:18:39,600
your career path she asks some people

412
00:18:42,789 --> 00:18:42,080
have never seen an ocean or tide what

413
00:18:45,029 --> 00:18:42,799

was it like

414
00:18:45,830 --> 00:18:45,039
growing up in a landlocked country and

415
00:18:47,590 --> 00:18:45,840
did you ever

416
00:18:51,669 --> 00:18:47,600
think you'd be working on an ocean

417
00:18:54,710 --> 00:18:53,590
um the short answer i'll take the last

418
00:18:57,270 --> 00:18:54,720
question first

419
00:18:58,470 --> 00:18:57,280
the short show dances i never envisioned

420
00:19:01,510 --> 00:18:58,480
working on an

421
00:19:03,990 --> 00:19:01,520
ocean ocean observing mission

422
00:19:05,110 --> 00:19:04,000
it's only uh when i was provided that

423
00:19:07,909 --> 00:19:05,120
first opportunity

424
00:19:09,750 --> 00:19:07,919
in graduate school to study ocean tides

425
00:19:10,230 --> 00:19:09,760
using the topics besides satellites that

426
00:19:13,430 --> 00:19:10,240
uh

427
00:19:15,990 --> 00:19:13,440
that that even came across my mind

428
00:19:17,990 --> 00:19:16,000
uh growing up in zimbabwe as you said

429
00:19:20,950 --> 00:19:18,000
it's a landlocked country so

430
00:19:22,310 --> 00:19:20,960
our experience with oceans was very

431
00:19:24,230 --> 00:19:22,320
limited but of course we do have the

432
00:19:26,870 --> 00:19:24,240
victoria falls in zibabra

433
00:19:28,549 --> 00:19:26,880
so that's quite spectacular but again on

434
00:19:29,590 --> 00:19:28,559
some of those vacations uh that my

435
00:19:32,870 --> 00:19:29,600
parents uh

436
00:19:34,070 --> 00:19:32,880
took me on we did visit some some oceans

437
00:19:36,950 --> 00:19:34,080
uh i was

438
00:19:39,029 --> 00:19:36,960

for example uh we visited the mozambique

439
00:19:40,870 --> 00:19:39,039
coast uh we've also on one of our

440
00:19:43,270 --> 00:19:40,880
vacants traveled to hawaii

441
00:19:44,710 --> 00:19:43,280
uh so and we've been to california as

442
00:19:46,549 --> 00:19:44,720
well so

443
00:19:48,630 --> 00:19:46,559
so i i definitely had experience with

444
00:19:50,710 --> 00:19:48,640
the oceans i definitely find the oceans

445
00:19:51,990 --> 00:19:50,720
as a calming influence but i certainly

446
00:19:53,750 --> 00:19:52,000
never thought i would be

447
00:19:56,150 --> 00:19:53,760
contributing to measuring the global

448
00:20:00,230 --> 00:19:57,830
well i actually do have the next

449
00:20:02,070 --> 00:20:00,240
question directly about the sentinel 6

450
00:20:02,789 --> 00:20:02,080
micro freiles since it's set to gather

451
00:20:06,630 --> 00:20:02,799
data on

452
00:20:10,390 --> 00:20:06,640
90 of the ocean natalie on twitter asks

453
00:20:16,149 --> 00:20:13,669
yeah so uh the 706 uh satellite um

454
00:20:17,830 --> 00:20:16,159
the orbit of the satellite or the path

455
00:20:21,029 --> 00:20:17,840
that he travels around the earth

456
00:20:22,230 --> 00:20:21,039
is inclined about degrees from the

457
00:20:24,390 --> 00:20:22,240
equator

458
00:20:26,549 --> 00:20:24,400
this means that all of the measurements

459
00:20:30,230 --> 00:20:26,559
are limited to the latitudes

460
00:20:31,270 --> 00:20:30,240
between 67 degrees south and 67 degrees

461
00:20:33,750 --> 00:20:31,280
north

462
00:20:35,270 --> 00:20:33,760
and so we are unable to observe at least

463
00:20:37,270 --> 00:20:35,280

not with the center on six microphilic

464
00:20:39,430 --> 00:20:37,280
saturn we're not able to observe

465
00:20:40,870 --> 00:20:39,440
the oceans which we have the remaining

466
00:20:44,549 --> 00:20:40,880
oceans which are primarily

467
00:20:46,710 --> 00:20:44,559
north of 66 67 degrees north latitude so

468
00:20:47,669 --> 00:20:46,720
from 67 degrees north to 90 degrees

469
00:20:49,909 --> 00:20:47,679
north

470
00:20:51,510 --> 00:20:49,919
we are unable to view those and a large

471
00:20:52,390 --> 00:20:51,520
fraction of that is of course ice

472
00:20:53,990 --> 00:20:52,400
covered so

473
00:20:56,070 --> 00:20:54,000
with this particular satellite it's

474
00:20:58,870 --> 00:20:56,080
challenging to observe that however

475
00:20:59,510 --> 00:20:58,880
nasa does have a mission called icesat-2

476
00:21:03,669 --> 00:20:59,520
which

477
00:21:06,390 --> 00:21:03,679
ice cover

478
00:21:07,830 --> 00:21:06,400
and and so we can use uh one of those

479
00:21:12,230 --> 00:21:07,840
missions as well to observe

480
00:21:14,310 --> 00:21:12,240
uh ice in those northern latitudes

481
00:21:16,549 --> 00:21:14,320
so all work together now speaking of

482
00:21:17,830 --> 00:21:16,559
your history too that you touched on in

483
00:21:21,029 --> 00:21:17,840
an earlier question

484
00:21:25,669 --> 00:21:21,039
lewis on youtube asks is this the first

485
00:21:27,990 --> 00:21:25,679
joint nasa esa mission do you know

486
00:21:30,230 --> 00:21:28,000
this is certainly not the first joint

487
00:21:32,470 --> 00:21:30,240
nasa esa mission i believe nasa and esa

488
00:21:35,909 --> 00:21:32,480

have collaborated on other nasa missions

489
00:21:37,750 --> 00:21:35,919
but at least uh on this this center you

490
00:21:40,710 --> 00:21:37,760
know this heritage that central vi

491
00:21:42,549 --> 00:21:40,720
microphonic is built upon we've had uh

492
00:21:45,430 --> 00:21:42,559
european partnerships between

493
00:21:47,750 --> 00:21:45,440
uh between the u.s and europe since

494
00:21:49,750 --> 00:21:47,760
topics poseidon topex poseidon

495
00:21:51,669 --> 00:21:49,760
was a collaboration between the french

496
00:21:54,549 --> 00:21:51,679
space agency class

497
00:21:55,029 --> 00:21:54,559
and nasa and the follow on jason one was

498
00:21:57,990 --> 00:21:55,039
also

499
00:21:58,710 --> 00:21:58,000
between kanes and nasa jason ii then

500
00:22:00,870 --> 00:21:58,720
introduced

501
00:22:01,750 --> 00:22:00,880
new partners in addition to nasa and the

502
00:22:04,230 --> 00:22:01,760
french basin

503
00:22:05,190 --> 00:22:04,240
we introduced noaa which is a u.s and

504
00:22:07,510 --> 00:22:05,200
noaa

505
00:22:08,390 --> 00:22:07,520
atmospheric uh administration here in

506
00:22:09,990 --> 00:22:08,400
the us

507
00:22:11,590 --> 00:22:10,000
and we have the european version of that

508
00:22:13,190 --> 00:22:11,600
which is called umedsat

509
00:22:15,110 --> 00:22:13,200
and those four partners then worked on

510
00:22:17,110 --> 00:22:15,120
jason two and jason iii

511
00:22:18,710 --> 00:22:17,120
and then center six michael freileck is

512
00:22:20,710 --> 00:22:18,720
at least on this series channel six

513
00:22:21,990 --> 00:22:20,720

michael freya uh is then the first of

514
00:22:25,510 --> 00:22:22,000
which uh esa then

515
00:22:28,950 --> 00:22:25,520
joined those collaborations it's a

516
00:22:31,110 --> 00:22:28,960
real international collaboration there

517
00:22:32,070 --> 00:22:31,120
absolutely that's actually uh one of the

518
00:22:35,029 --> 00:22:32,080
most uh

519
00:22:36,549 --> 00:22:35,039
most probably the most fun part of

520
00:22:38,630 --> 00:22:36,559
working on these missions is those

521
00:22:41,430 --> 00:22:38,640
collaborations because

522
00:22:42,310 --> 00:22:41,440
you it brings in these these diverse

523
00:22:44,630 --> 00:22:42,320
perspectives

524
00:22:45,990 --> 00:22:44,640
on how to investigate and look look at

525
00:22:47,830 --> 00:22:46,000
these data

526
00:22:49,350 --> 00:22:47,840
uh because they are quite different but

527
00:22:52,789 --> 00:22:49,360
you certainly do

528
00:22:54,630 --> 00:22:52,799
you appreciate different perspectives

529
00:22:56,470 --> 00:22:54,640
on on looking at this information and

530
00:22:58,710 --> 00:22:56,480
you build relationships

531
00:23:00,230 --> 00:22:58,720
uh one of the people uh from the

532
00:23:01,110 --> 00:23:00,240
french-based agency i've been working

533
00:23:02,630 --> 00:23:01,120
with him

534
00:23:04,549 --> 00:23:02,640
for over 20 years on all of these

535
00:23:05,190 --> 00:23:04,559
missions and and we're also working on

536
00:23:14,390 --> 00:23:05,200
on

537
00:23:15,669 --> 00:23:14,400
do you think our knowledge of the c is

538
00:23:18,470 --> 00:23:15,679

ever changing

539
00:23:22,789 --> 00:23:18,480
and how do we update this knowledge is

540
00:23:25,909 --> 00:23:22,799
there a central c database

541
00:23:27,510 --> 00:23:25,919
um so these these data that we collect

542
00:23:29,510 --> 00:23:27,520
from all these missions

543
00:23:31,510 --> 00:23:29,520
are certainly collected by different

544
00:23:34,710 --> 00:23:31,520
agencies and assembled

545
00:23:36,789 --> 00:23:34,720
in i would say more user-friendly forms

546
00:23:39,510 --> 00:23:36,799
for example you can get grids of these

547
00:23:41,990 --> 00:23:39,520
10-day snapshots of sea surface height

548
00:23:43,350 --> 00:23:42,000
measured by these satellites these are

549
00:23:46,390 --> 00:23:43,360
the public is able to

550
00:23:48,230 --> 00:23:46,400
get these data sets um there are

551
00:23:49,669 --> 00:23:48,240
of course we have tide gauges around

552
00:23:51,269 --> 00:23:49,679
earth which are individual instruments

553
00:23:52,230 --> 00:23:51,279
measuring c subside at the individual

554
00:23:55,029 --> 00:23:52,240
spots

555
00:23:56,230 --> 00:23:55,039
there are also places where we can pick

556
00:23:57,750 --> 00:23:56,240
up those data

557
00:23:59,750 --> 00:23:57,760
in fact we use those tight gauge

558
00:24:02,710 --> 00:23:59,760
measurements to help to

559
00:24:03,750 --> 00:24:02,720
determine or validate the accuracy of

560
00:24:04,789 --> 00:24:03,760
the measurements coming from the

561
00:24:06,549 --> 00:24:04,799
satellites

562
00:24:08,070 --> 00:24:06,559
so there are certainly databases of all

563
00:24:12,310 --> 00:24:08,080

of these c server sites

564
00:24:15,430 --> 00:24:13,430
you might have to repeat the first

565
00:24:18,549 --> 00:24:15,440
question for me

566
00:24:19,669 --> 00:24:18,559
of course she wants to know if the

567
00:24:23,430 --> 00:24:19,679
knowledge of c

568
00:24:24,870 --> 00:24:23,440
is ever changing uh certainly

569
00:24:27,830 --> 00:24:24,880
as i mentioned you know that peeling the

570
00:24:30,230 --> 00:24:27,840
onion analogy is certainly uh

571
00:24:32,070 --> 00:24:30,240
appropriate here because as the the

572
00:24:34,789 --> 00:24:32,080
length of these measurements the

573
00:24:35,590 --> 00:24:34,799
duration of these measurements increases

574
00:24:37,110 --> 00:24:35,600
we're able to

575
00:24:39,909 --> 00:24:37,120
peel those layers of the end into the

576
00:24:42,870 --> 00:24:39,919
smaller and smaller layers of that onion

577
00:24:44,549 --> 00:24:42,880
as we learn about the top layers of the

578
00:24:46,710 --> 00:24:44,559
largest effects and we learn how

579
00:24:47,990 --> 00:24:46,720
and we and we know how to model them or

580
00:24:49,830 --> 00:24:48,000
account for them

581
00:24:51,590 --> 00:24:49,840
uh we are then able to then look at

582
00:24:56,230 --> 00:24:51,600
these as these smaller features

583
00:24:58,310 --> 00:24:56,240
or smaller amplitude features

584
00:25:00,950 --> 00:24:58,320
now jeff on facebook has more technical

585
00:25:02,310 --> 00:25:00,960
question what is the spatial resolution

586
00:25:05,830 --> 00:25:02,320
that will be attained with

587
00:25:09,350 --> 00:25:07,909
so as i mentioned most users of these

588
00:25:13,590 --> 00:25:09,360

measurements typically

589
00:25:15,430 --> 00:25:13,600
use as i said the path of the cell is is

590
00:25:17,430 --> 00:25:15,440
around the earth and the ground speed of

591
00:25:20,390 --> 00:25:17,440
about six kilometers per second

592
00:25:21,750 --> 00:25:20,400
most users or scientific users will use

593
00:25:23,590 --> 00:25:21,760
the c surface side measurements of the

594
00:25:24,870 --> 00:25:23,600
average to the one second intervals

595
00:25:27,190 --> 00:25:24,880
along the satellite so

596
00:25:29,269 --> 00:25:27,200
along the satellite ground track you'll

597
00:25:30,710 --> 00:25:29,279
basically those users will use a c-serve

598
00:25:33,350 --> 00:25:30,720
side measurements that's about

599
00:25:35,510 --> 00:25:33,360
every six kilometers or every 3.7 miles

600
00:25:37,430 --> 00:25:35,520
along the ground track of the satellite

601
00:25:38,549 --> 00:25:37,440
and i also mentioned the satellite takes

602
00:25:41,990 --> 00:25:38,559
about

603
00:25:44,390 --> 00:25:42,000
cover the

604
00:25:45,990 --> 00:25:44,400
full the full earth before coming to the

605
00:25:48,870 --> 00:25:46,000
same spot so

606
00:25:50,310 --> 00:25:48,880
so the resolution across track so in

607
00:25:53,269 --> 00:25:50,320
longitude let's say

608
00:25:55,110 --> 00:25:53,279
is essentially 360 degrees divided by

609
00:25:58,950 --> 00:25:55,120
254

610
00:26:01,669 --> 00:25:58,960
is the resolution then in that direction

611
00:26:02,149 --> 00:26:01,679
and then this is another question that

612
00:26:04,710 --> 00:26:02,159
kind of

613
00:26:06,470 --> 00:26:04,720

complements one we had earlier lewis on

614
00:26:11,909 --> 00:26:06,480
youtube is asking

615
00:26:16,710 --> 00:26:13,909
uh certainly as i described earlier i

616
00:26:19,110 --> 00:26:16,720
said two is measuring ice for example

617
00:26:20,630 --> 00:26:19,120
um the cenote six microfarad is

618
00:26:22,470 --> 00:26:20,640
measuring the oceans and

619
00:26:24,310 --> 00:26:22,480
all of this is tied to the earth's water

620
00:26:27,190 --> 00:26:24,320
cycle for example right so

621
00:26:28,149 --> 00:26:27,200
we have water from from from the ice

622
00:26:30,149 --> 00:26:28,159
sheets

623
00:26:32,470 --> 00:26:30,159
might be melting and providing that

624
00:26:34,070 --> 00:26:32,480
adding content to the oceans

625
00:26:35,830 --> 00:26:34,080
or for example we might have water in

626
00:26:37,190 --> 00:26:35,840
rivers and lakes there are then if the

627
00:26:38,070 --> 00:26:37,200
rivers are flowing to the oceans they're

628
00:26:40,390 --> 00:26:38,080
also contributing

629
00:26:41,590 --> 00:26:40,400
to the oceans and then evaporation from

630
00:26:43,510 --> 00:26:41,600
the oceans

631
00:26:45,350 --> 00:26:43,520
has water going into the atmosphere

632
00:26:47,430 --> 00:26:45,360
which then ends up coming down

633
00:26:49,350 --> 00:26:47,440
back down as rain so all of these

634
00:26:52,149 --> 00:26:49,360
emissions are certainly interlinked

635
00:26:53,510 --> 00:26:52,159
icesat-2 is is not the only one we also

636
00:26:55,669 --> 00:26:53,520
nasa also has a mission

637
00:26:56,710 --> 00:26:55,679
called the grace mission which is is

638
00:27:03,110 --> 00:26:56,720

measuring

639
00:27:04,149 --> 00:27:03,120
um water storage is effectively water on

640
00:27:07,190 --> 00:27:04,159
the continents

641
00:27:10,230 --> 00:27:07,200
uh water storage and effectively as mass

642
00:27:11,830 --> 00:27:10,240
changes on the continent so all of these

643
00:27:14,310 --> 00:27:11,840
satellites that nasa is

644
00:27:16,549 --> 00:27:14,320
is is contributing to are all

645
00:27:18,789 --> 00:27:16,559
interlinked in in some way

646
00:27:20,070 --> 00:27:18,799
you understand the earth's water cycle

647
00:27:24,470 --> 00:27:20,080
since water is of course

648
00:27:28,549 --> 00:27:27,430
and then lewis on nasa climate facebook

649
00:27:31,190 --> 00:27:28,559
is asking

650
00:27:33,269 --> 00:27:31,200
what level of precision does taking air

651
00:27:37,669 --> 00:27:33,279
moisture into account add

652
00:27:41,190 --> 00:27:37,679
are we talking centimeters or meters

653
00:27:42,310 --> 00:27:41,200
so the the delay caused by the water

654
00:27:45,269 --> 00:27:42,320
vapor content

655
00:27:47,590 --> 00:27:45,279
in the atmosphere has a magnitude that

656
00:27:49,750 --> 00:27:47,600
ranges anywhere between

657
00:27:51,669 --> 00:27:49,760
five centimeters to up to 40 centimeters

658
00:27:53,750 --> 00:27:51,679
but averaging probably i think in around

659
00:27:55,669 --> 00:27:53,760
the 10 to 20 centimeter range

660
00:27:59,909 --> 00:27:55,679
is is the improvement you get by being

661
00:28:03,350 --> 00:28:02,310
then we have another question talking on

662
00:28:05,110 --> 00:28:03,360
youtube asks

663
00:28:06,870 --> 00:28:05,120

how is this satellite going to help

664
00:28:09,510 --> 00:28:06,880
research about icebergs

665
00:28:11,190 --> 00:28:09,520
and rising water levels in the poles and

666
00:28:14,789 --> 00:28:11,200
what makes this satellite unique

667
00:28:18,149 --> 00:28:16,630
this satellite uh has some instruments

668
00:28:19,830 --> 00:28:18,159
that certainly have uh

669
00:28:21,909 --> 00:28:19,840
enhancements to some of the instruments

670
00:28:23,669 --> 00:28:21,919
so there's certainly a long heritage of

671
00:28:25,350 --> 00:28:23,679
instrumentation that central six michael

672
00:28:27,190 --> 00:28:25,360
filette builds upon

673
00:28:29,110 --> 00:28:27,200
but some of the instruments have newer

674
00:28:31,750 --> 00:28:29,120
features the the

675
00:28:33,990 --> 00:28:31,760
receiver that's receiving gps signals

676
00:28:36,389 --> 00:28:34,000
for example is also receiving

677
00:28:37,830 --> 00:28:36,399
signals from the european version of gps

678
00:28:39,269 --> 00:28:37,840
which is called galileo

679
00:28:41,669 --> 00:28:39,279
so it's it's tracking these different

680
00:28:42,630 --> 00:28:41,679
types of constellations the radiometer

681
00:28:46,070 --> 00:28:42,640
also is

682
00:28:48,789 --> 00:28:46,080
is is which is measuring the water vapor

683
00:28:49,590 --> 00:28:48,799
as an instrument that helps improve the

684
00:28:52,149 --> 00:28:49,600
stability

685
00:28:53,590 --> 00:28:52,159
or the the how much the error might

686
00:28:55,669 --> 00:28:53,600
change with time so it's

687
00:28:56,870 --> 00:28:55,679
ensuring that that error does not change

688
00:28:58,630 --> 00:28:56,880

with time so

689
00:29:00,870 --> 00:28:58,640
if that error does change with time it

690
00:29:01,750 --> 00:29:00,880
might impact our understanding of sea

691
00:29:03,909 --> 00:29:01,760
level

692
00:29:04,789 --> 00:29:03,919
the altimeter on the satellite is also

693
00:29:07,029 --> 00:29:04,799
quite enhanced

694
00:29:09,110 --> 00:29:07,039
uh in that it it's it's expected to

695
00:29:10,870 --> 00:29:09,120
provide higher resolution

696
00:29:13,269 --> 00:29:10,880
of the c surface side measurements and

697
00:29:14,870 --> 00:29:13,279
and a higher accuracy of that

698
00:29:18,710 --> 00:29:14,880
measurement of the distance between the

699
00:29:22,070 --> 00:29:21,190
and then we have time for two more

700
00:29:25,110 --> 00:29:22,080
questions

701
00:29:28,389 --> 00:29:25,120
one is from sarah p on facebook who asks

702
00:29:29,110 --> 00:29:28,399
can we see from the 30 years of data

703
00:29:34,630 --> 00:29:29,120
collection

704
00:29:38,070 --> 00:29:36,630
that's i think a sensitive topic

705
00:29:39,830 --> 00:29:38,080
probably better left to

706
00:29:41,430 --> 00:29:39,840
to climate scientists but i think from

707
00:29:42,710 --> 00:29:41,440
my perspective i can tell you what the

708
00:29:45,029 --> 00:29:42,720
data tell us

709
00:29:46,710 --> 00:29:45,039
and the data if you take the data from

710
00:29:48,870 --> 00:29:46,720
over from 30 years

711
00:29:50,470 --> 00:29:48,880
we certainly see uh we certainly have

712
00:29:52,789 --> 00:29:50,480
strong evidence that the

713
00:29:54,630 --> 00:29:52,799

observed sea surface measurements are

714
00:29:57,350 --> 00:29:54,640
rising at about a level of about

715
00:29:59,029 --> 00:29:57,360
three millimeters per year and the

716
00:30:01,350 --> 00:29:59,039
climate scientists will tell you that

717
00:30:02,230 --> 00:30:01,360
half of that is caused by ice melting

718
00:30:04,789 --> 00:30:02,240
from

719
00:30:06,310 --> 00:30:04,799
glaciers for example and the other half

720
00:30:07,590 --> 00:30:06,320
from ocean warming so

721
00:30:09,830 --> 00:30:07,600
when i talk about that bucket for

722
00:30:11,590 --> 00:30:09,840
example if you added ice to that that

723
00:30:14,149 --> 00:30:11,600
ice melting would then cause that water

724
00:30:16,310 --> 00:30:14,159
to rise or when you warm that water

725
00:30:17,590 --> 00:30:16,320
it expands the water and causes also

726
00:30:20,310 --> 00:30:17,600
causes the height of the water to

727
00:30:23,669 --> 00:30:22,070
so the data certainly support uh sea

728
00:30:25,510 --> 00:30:23,679
level rising um

729
00:30:29,750 --> 00:30:25,520
and the climate standards will are left

730
00:30:33,909 --> 00:30:32,070
great and i think you'll be the perfect

731
00:30:37,029 --> 00:30:33,919
person to answer this question

732
00:30:39,110 --> 00:30:37,039
from sarah on facebook who asks i'm a

733
00:30:41,830 --> 00:30:39,120
high school teacher in nebraska

734
00:30:44,230 --> 00:30:41,840
my students have a hard time relating

735
00:30:45,269 --> 00:30:44,240
our oceans and issues regarding climate

736
00:30:47,430 --> 00:30:45,279
change

737
00:30:49,350 --> 00:30:47,440
what's the most important piece of data

738
00:30:51,830 --> 00:30:49,360

or research you've seen

739
00:30:56,310 --> 00:30:51,840
that really solidified the importance of

740
00:31:01,190 --> 00:30:58,630
of course seeing seeing the the average

741
00:31:02,470 --> 00:31:01,200
of the sea level rising over 30 years is

742
00:31:04,710 --> 00:31:02,480
quite important

743
00:31:08,950 --> 00:31:04,720
but the el nino event for example

744
00:31:11,269 --> 00:31:08,960
there's a 96 i think or 1996-97

745
00:31:12,870 --> 00:31:11,279
el nino event uh as i mentioned in the

746
00:31:13,430 --> 00:31:12,880
video we show it so at the start of the

747
00:31:15,750 --> 00:31:13,440
show

748
00:31:16,870 --> 00:31:15,760
which is a linear event that caused a

749
00:31:20,389 --> 00:31:16,880
warming of

750
00:31:22,870 --> 00:31:20,399
off the

751
00:31:23,830 --> 00:31:22,880
western coast of the americas and that

752
00:31:25,990 --> 00:31:23,840
el nino event

753
00:31:27,590 --> 00:31:26,000
affected climate in such a way that in

754
00:31:30,230 --> 00:31:27,600
the country that i grew up in that el

755
00:31:33,269 --> 00:31:30,240
nino event ended up causing a drought

756
00:31:35,029 --> 00:31:33,279
in my in in my home country

757
00:31:37,590 --> 00:31:35,039
so these are the types of experiences

758
00:31:40,310 --> 00:31:37,600
i've seen that that helps me

759
00:31:42,470 --> 00:31:40,320
see the strong relationship between uh

760
00:31:43,909 --> 00:31:42,480
the oceans and climate i mean the oceans

761
00:31:47,269 --> 00:31:43,919
cover 70 percent of

762
00:31:49,990 --> 00:31:47,279
of the earth and so that is

763
00:31:50,630 --> 00:31:50,000

going to influence the climate that we

764
00:31:52,230 --> 00:31:50,640
experience

765
00:31:53,750 --> 00:31:52,240
all around the earth whether you're in a

766
00:31:56,389 --> 00:31:53,760
landlord country or living near the

767
00:32:03,190 --> 00:32:00,310
it's all related and it's all connected

768
00:32:05,110 --> 00:32:03,200
absolutely great now that's all the time

769
00:32:07,430 --> 00:32:05,120
for questions we have but thank you so

770
00:32:10,389 --> 00:32:07,440
much for joining us today shaylyn

771
00:32:12,549 --> 00:32:10,399
oh thank you for having me now the

772
00:32:12,870 --> 00:32:12,559
sentinel 6 michael phyllic satellite is

773
00:32:16,389 --> 00:32:12,880
a

774
00:32:18,470 --> 00:32:16,399
mentioned it is being

775
00:32:19,909 --> 00:32:18,480
jointly developed by the european space

776
00:32:21,750 --> 00:32:19,919
agency nasa

777
00:32:23,750 --> 00:32:21,760
the european organization for the

778
00:32:24,710 --> 00:32:23,760
exploitation of meteorological

779
00:32:27,190 --> 00:32:24,720
satellites

780
00:32:28,389 --> 00:32:27,200
and the national oceanic and atmospheric

781
00:32:30,149 --> 00:32:28,399
administration

782
00:32:32,310 --> 00:32:30,159
with funding support from the european

783
00:32:33,509 --> 00:32:32,320
commission and technical support from

784
00:32:36,230 --> 00:32:33,519
the french space

785
00:32:38,310 --> 00:32:36,240
agency canes the sentinel 6 michael

786
00:32:40,630 --> 00:32:38,320
freilix satellite is scheduled to launch

787
00:32:42,950 --> 00:32:40,640
on november 10th for the latest on the

788
00:32:45,509 --> 00:32:42,960

mission follow at nasa earth

789
00:32:46,310 --> 00:32:45,519
on twitter facebook and instagram and

790
00:32:48,389 --> 00:32:46,320
you can watch

791
00:32:51,750 --> 00:32:48,399
all of the behind the spacecraft video

792
00:32:53,750 --> 00:32:51,760
profiles on the nasa 360 youtube channel

793
00:32:55,590 --> 00:32:53,760
we will be doing live q and a's with

794
00:32:56,549 --> 00:32:55,600
sentinel 6 michael freilix satellite

795
00:32:59,110 --> 00:32:56,559
team members

796
00:33:01,430 --> 00:32:59,120
each wednesday afternoon follow and

797
00:33:04,789 --> 00:33:01,440
subscribe for those notifications

798
00:33:07,430 --> 00:33:04,799
and at nasa nurse ask

799
00:33:08,149 --> 00:33:07,440
gotta get this right here at nasa earth

800
00:33:22,830 --> 00:33:08,159
science