
SEA LEVEL
SCIENCE
Aug. 26, 2015 9:30 a.m. PT (12:30 p.m. ET, 1630 UTC)
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Eric Rignot
Glaciologist, JPL and U. of California, Irvine
EARTH
RIGHT NOW
NASA

1
00:00:05,030 --> 00:00:02,790
okay thank you uh this is steve cole

2
00:00:06,710 --> 00:00:05,040
from nasa's office of communications in

3
00:00:08,790 --> 00:00:06,720
washington dc

4
00:00:11,110 --> 00:00:08,800
we're here today to discuss global sea

5
00:00:13,910 --> 00:00:11,120
level rise and the continuing challenge

6
00:00:16,470 --> 00:00:13,920
of predicting how fast and how much sea

7
00:00:17,910 --> 00:00:16,480
level will rise in the future our panel

8
00:00:20,790 --> 00:00:17,920
of experts will be giving you an

9
00:00:23,109 --> 00:00:20,800
up-to-date outlook on current conditions

10
00:00:25,429 --> 00:00:23,119
what the latest science is telling us

11
00:00:28,630 --> 00:00:25,439
and what nasa is doing to improve our

12
00:00:30,310 --> 00:00:28,640
understanding of this complex issue

13
00:00:32,389 --> 00:00:30,320

our presenters will be speaking to a

14
00:00:34,549 --> 00:00:32,399
number of graphics during their remarks

15
00:00:36,870 --> 00:00:34,559
all of these are available online let me

16
00:00:38,069 --> 00:00:36,880
give you the url so you can follow along

17
00:00:39,630 --> 00:00:38,079
with that

18
00:00:43,510 --> 00:00:39,640
it's

19
00:00:43,520 --> 00:00:45,190
dot go.nasa.gov

20
00:00:50,549 --> 00:00:46,709
slash

21
00:00:53,910 --> 00:00:50,559
rising seas briefing one word

22
00:00:55,910 --> 00:00:53,920
rising seas briefing

23
00:00:57,510 --> 00:00:55,920
after the presentations by our panelists

24
00:01:00,069 --> 00:00:57,520
we'll open it up to questions from the

25
00:01:01,750 --> 00:01:00,079
media on the phone lines and to those

26
00:01:03,430 --> 00:01:01,760
listening online

27
00:01:04,950 --> 00:01:03,440
if you'd like to ask a question via

28
00:01:08,390 --> 00:01:04,960
social media

29
00:01:10,830 --> 00:01:08,400
use the hashtag asknasa

30
00:01:13,350 --> 00:01:10,840
and we'll take those questions via

31
00:01:15,190 --> 00:01:13,360
twitter we have three experts on sea

32
00:01:16,469 --> 00:01:15,200
level rise science to talk with you

33
00:01:19,109 --> 00:01:16,479
today

34
00:01:21,910 --> 00:01:19,119
first will be steve naram

35
00:01:25,350 --> 00:01:21,920
lead for nasa's c-level change team at

36
00:01:28,469 --> 00:01:25,360
the university of colorado in boulder

37
00:01:30,630 --> 00:01:28,479
eric reno glaciologist at the university

38
00:01:34,710 --> 00:01:30,640

of california irvine

39
00:01:37,429 --> 00:01:34,720
and nasa's jet propulsion laboratory

40
00:01:39,910 --> 00:01:37,439
and josh willis climate scientist also

41
00:01:41,510 --> 00:01:39,920
at nasa's jet propulsion laboratory in

42
00:01:43,270 --> 00:01:41,520
california

43
00:01:45,429 --> 00:01:43,280
we're going to start with opening

44
00:01:47,510 --> 00:01:45,439
opening remarks from mike frylett who is

45
00:01:49,429 --> 00:01:47,520
director of the earth science division

46
00:01:51,030 --> 00:01:49,439
here at nasa headquarters

47
00:01:52,230 --> 00:01:51,040
over to you mike

48
00:01:54,550 --> 00:01:52,240
thanks steve

49
00:01:57,510 --> 00:01:54,560
good afternoon to all of you on the on

50
00:01:59,270 --> 00:01:57,520
the phone and thanks for joining us

51
00:02:01,510 --> 00:01:59,280
sea level rise is one of the most

52
00:02:02,550 --> 00:02:01,520
visible signatures of our changing

53
00:02:05,670 --> 00:02:02,560
climate

54
00:02:08,550 --> 00:02:05,680
and rising seas have profound impacts on

55
00:02:10,070 --> 00:02:08,560
our nation our economy and all of

56
00:02:12,869 --> 00:02:10,080
humanity

57
00:02:15,750 --> 00:02:12,879
more than 150 million people most of

58
00:02:17,510 --> 00:02:15,760
them in asia live within one meter of

59
00:02:19,990 --> 00:02:17,520
present sea level

60
00:02:23,190 --> 00:02:20,000
many more people are threatened by storm

61
00:02:25,670 --> 00:02:23,200
surges and extreme coastal phenomena

62
00:02:28,309 --> 00:02:25,680
whose impacts are made even worse when

63
00:02:29,910 --> 00:02:28,319

the events are superimposed on higher

64
00:02:32,309 --> 00:02:29,920
sea levels

65
00:02:35,030 --> 00:02:32,319
sea level rise will measurably change

66
00:02:37,830 --> 00:02:35,040
the shape of our coastline especially in

67
00:02:40,309 --> 00:02:37,840
low-lying states such as florida

68
00:02:42,070 --> 00:02:40,319
it may entirely eliminate some pacific

69
00:02:45,110 --> 00:02:42,080
island nations

70
00:02:47,910 --> 00:02:45,120
and sea level rise will greatly impact

71
00:02:51,750 --> 00:02:47,920
low-lying major cities like dakar

72
00:02:53,910 --> 00:02:51,760
bangladesh singapore and tokyo

73
00:02:57,350 --> 00:02:53,920
indeed even today

74
00:03:00,229 --> 00:02:57,360
normal spring high tides cause street

75
00:03:02,869 --> 00:03:00,239
flooding in sections of miami something

76
00:03:04,949 --> 00:03:02,879
that didn't happen regularly just a few

77
00:03:07,830 --> 00:03:04,959
decades ago

78
00:03:10,229 --> 00:03:07,840
thanks to precision global spaceborne

79
00:03:13,910 --> 00:03:10,239
measurements that have been acquired by

80
00:03:16,470 --> 00:03:13,920
us at nasa and our partners since 1992

81
00:03:18,309 --> 00:03:16,480
we now know with some certainty that

82
00:03:21,190 --> 00:03:18,319
global mean sea levels have been

83
00:03:23,350 --> 00:03:21,200
increasing at a rate of more than three

84
00:03:24,589 --> 00:03:23,360
millimeters per year

85
00:03:26,869 --> 00:03:24,599
these measurements from

86
00:03:30,149 --> 00:03:26,879
satellite-mounted instruments called

87
00:03:32,470 --> 00:03:30,159
altimeters are amazing feats of nasa

88
00:03:35,030 --> 00:03:32,480

technology and science

89
00:03:37,589 --> 00:03:35,040
with measurement precisions of one part

90
00:03:40,229 --> 00:03:37,599
intended eighth that's one part in a

91
00:03:42,550 --> 00:03:40,239
hundred million the instruments are so

92
00:03:45,830 --> 00:03:42,560
sensitive that if they were mounted on a

93
00:03:48,710 --> 00:03:45,840
commercial jetliner flying at 40 000

94
00:03:52,470 --> 00:03:48,720
feet they could detect the bump caused

95
00:03:55,270 --> 00:03:52,480
by a dime lying flat on the ground

96
00:03:58,070 --> 00:03:55,280
not only can we track global average sea

97
00:04:01,270 --> 00:03:58,080
level changes but we also know that some

98
00:04:04,550 --> 00:04:01,280
geographical regions are experiencing

99
00:04:08,070 --> 00:04:04,560
much greater rates of change and rises

100
00:04:10,229 --> 00:04:08,080
and some regions sea level is falling

101
00:04:11,830 --> 00:04:10,239
systematically

102
00:04:14,550 --> 00:04:11,840
so what you're going to hear from my

103
00:04:16,870 --> 00:04:14,560
colleagues today is that by combining

104
00:04:19,430 --> 00:04:16,880
space-born direct measurements of sea

105
00:04:21,990 --> 00:04:19,440
level with a host of other measurements

106
00:04:25,030 --> 00:04:22,000
from satellites and from sensors in the

107
00:04:27,350 --> 00:04:25,040
oceans themselves nasa scientists are

108
00:04:30,070 --> 00:04:27,360
not only tracking changes in ocean

109
00:04:32,710 --> 00:04:30,080
heights but are also determining the

110
00:04:34,550 --> 00:04:32,720
reasons for these changes

111
00:04:37,189 --> 00:04:34,560
we're developing quantitative

112
00:04:39,990 --> 00:04:37,199
understanding of how much global mean

113
00:04:42,870 --> 00:04:40,000

sea level rise results from thermal

114
00:04:46,790 --> 00:04:42,880
expansion of a warming ocean

115
00:04:49,510 --> 00:04:46,800
and how much results from adding water

116
00:04:51,590 --> 00:04:49,520
to the ocean by melting land-bound ice

117
00:04:54,070 --> 00:04:51,600
sheets and glaciers

118
00:04:57,270 --> 00:04:54,080
we're understanding why sea level rises

119
00:04:59,670 --> 00:04:57,280
falling oic level is falling rather than

120
00:05:02,310 --> 00:04:59,680
rising in some places and we're

121
00:05:04,310 --> 00:05:02,320
constructing models to predict sea level

122
00:05:07,189 --> 00:05:04,320
changes in the coming decades and

123
00:05:09,830 --> 00:05:07,199
centuries under a variety of different

124
00:05:12,150 --> 00:05:09,840
assumed climate regimes

125
00:05:13,749 --> 00:05:12,160
today we're really in a challenging and

126
00:05:15,670 --> 00:05:13,759
exciting time

127
00:05:17,590 --> 00:05:15,680
thanks to spaceborne and other

128
00:05:20,310 --> 00:05:17,600
monitoring programs that have been

129
00:05:23,590 --> 00:05:20,320
instituted over the past two decades we

130
00:05:26,629 --> 00:05:23,600
have sufficient data in hand to describe

131
00:05:30,390 --> 00:05:26,639
in some detail how sea level has evolved

132
00:05:34,070 --> 00:05:30,400
over the last human generation or so

133
00:05:37,110 --> 00:05:34,080
these multi-decadal data sets also serve

134
00:05:39,990 --> 00:05:37,120
as an excellent test bed for theories

135
00:05:43,909 --> 00:05:40,000
and models that purport to describe why

136
00:05:45,189 --> 00:05:43,919
sea level changes in time and in space

137
00:05:47,189 --> 00:05:45,199
as you'll hear

138
00:05:49,510 --> 00:05:47,199

nasa and our interagency and

139
00:05:51,270 --> 00:05:49,520
international partners have many new

140
00:05:53,670 --> 00:05:51,280
satellite missions that will be

141
00:05:56,310 --> 00:05:53,680
launching in the next few years

142
00:05:58,230 --> 00:05:56,320
some of them to continue time series of

143
00:05:59,029 --> 00:05:58,240
precision measurements that we're making

144
00:06:01,510 --> 00:05:59,039
now

145
00:06:03,110 --> 00:06:01,520
and others to make new measurements of

146
00:06:05,350 --> 00:06:03,120
different quantities that will

147
00:06:07,909 --> 00:06:05,360
illuminate key processes the

148
00:06:10,150 --> 00:06:07,919
interactions between processes that

149
00:06:11,510 --> 00:06:10,160
control our complex planet and

150
00:06:13,590 --> 00:06:11,520
environment

151
00:06:16,230 --> 00:06:13,600
let there be no doubt

152
00:06:18,230 --> 00:06:16,240
this is relevant science and it will

153
00:06:20,950 --> 00:06:18,240
result in understanding that yields

154
00:06:23,430 --> 00:06:20,960
direct societal benefit

155
00:06:26,629 --> 00:06:23,440
the effects and the impacts of changing

156
00:06:29,110 --> 00:06:26,639
sea level are being felt now in our

157
00:06:32,070 --> 00:06:29,120
country and throughout the world

158
00:06:34,870 --> 00:06:32,080
and if the recent past his prologue the

159
00:06:37,510 --> 00:06:34,880
challenges and opportunities associated

160
00:06:40,070 --> 00:06:37,520
with changing sea level will become even

161
00:06:43,270 --> 00:06:40,080
more important during the lifetimes of

162
00:06:45,350 --> 00:06:43,280
our children and our grandchildren

163
00:06:48,230 --> 00:06:45,360

and now i'd like to turn it over to

164
00:06:49,670 --> 00:06:48,240
steve nerum

165
00:06:51,430 --> 00:06:49,680
thanks mike

166
00:06:53,029 --> 00:06:51,440
so one of the reasons we wanted to do

167
00:06:54,309 --> 00:06:53,039
this briefing today was that there's

168
00:06:56,230 --> 00:06:54,319
been a lot of new research that's come

169
00:06:58,070 --> 00:06:56,240
out in the last few years

170
00:07:01,350 --> 00:06:58,080
that has presented a different picture

171
00:07:04,390 --> 00:07:01,360
than we had say back in 2012 2013 when

172
00:07:06,070 --> 00:07:04,400
the last ipcc assessment came out

173
00:07:08,070 --> 00:07:06,080
so we want to use this briefing today to

174
00:07:10,550 --> 00:07:08,080
update everyone on where the science

175
00:07:12,710 --> 00:07:10,560
stands now and what nasa is doing to

176
00:07:14,469 --> 00:07:12,720
advance that science

177
00:07:17,350 --> 00:07:14,479
so the main points i want to make today

178
00:07:20,070 --> 00:07:17,360
are that first the data show that seals

179
00:07:21,670 --> 00:07:20,080
rising faster than it was 50 years ago

180
00:07:23,670 --> 00:07:21,680
and it's very likely to get worse in the

181
00:07:25,909 --> 00:07:23,680
future in fact it's already impacting

182
00:07:27,430 --> 00:07:25,919
some low-lying areas

183
00:07:28,950 --> 00:07:27,440
and the biggest uncertainty for

184
00:07:30,790 --> 00:07:28,960
predicting future sea level rise is

185
00:07:33,189 --> 00:07:30,800
determining how quickly the polar ice

186
00:07:35,830 --> 00:07:33,199
sheets will melt in response to warming

187
00:07:37,589 --> 00:07:35,840
and that's just a very difficult problem

188
00:07:39,110 --> 00:07:37,599

but we do have nasa satellite

189
00:07:40,790 --> 00:07:39,120
measurements that are telling us with

190
00:07:43,110 --> 00:07:40,800
great accuracy how much sea water is

191
00:07:45,430 --> 00:07:43,120
rising and what the causes are

192
00:07:47,909 --> 00:07:45,440
and so an interdisciplinary team of

193
00:07:49,749 --> 00:07:47,919
scientists are using these data from

194
00:07:51,670 --> 00:07:49,759
nasa to better understand the dynamics

195
00:07:53,350 --> 00:07:51,680
of large ice sheets and how they respond

196
00:07:55,350 --> 00:07:53,360
to a warming planet and how this will

197
00:07:57,589 --> 00:07:55,360
affect future sea level rise where you

198
00:08:01,990 --> 00:07:57,599
live

199
00:08:04,230 --> 00:08:02,000
so uh let's go to figure one um which

200
00:08:06,150 --> 00:08:04,240
different curves on it um and let's get

201
00:08:07,830 --> 00:08:06,160
a little deeper into the points that

202
00:08:09,909 --> 00:08:07,840
mike discussed

203
00:08:12,070 --> 00:08:09,919
so first the red curve on here

204
00:08:13,270 --> 00:08:12,080
represents the record of global mean sea

205
00:08:14,390 --> 00:08:13,280
level

206
00:08:16,629 --> 00:08:14,400
from

207
00:08:18,710 --> 00:08:16,639
that is started in 1992 with topex

208
00:08:21,189 --> 00:08:18,720
poseidon and has been continued by

209
00:08:24,070 --> 00:08:21,199
json-1 and json-2

210
00:08:25,990 --> 00:08:24,080
so these satellites use precise radars

211
00:08:27,830 --> 00:08:26,000
to power signals off the ocean's surface

212
00:08:30,150 --> 00:08:27,840
in order to determine the height

213
00:08:32,230 --> 00:08:30,160

of the ocean or sea level

214
00:08:34,389 --> 00:08:32,240
so when these measurements are averaged

215
00:08:35,589 --> 00:08:34,399
globally you get the curve you see there

216
00:08:37,909 --> 00:08:35,599
the red line

217
00:08:39,829 --> 00:08:37,919
and these show that sea level

218
00:08:42,389 --> 00:08:39,839
when average globally is increasing at a

219
00:08:44,470 --> 00:08:42,399
rate of about 3.2 millimeters per year

220
00:08:46,070 --> 00:08:44,480
over the last 23 years

221
00:08:51,030 --> 00:08:46,080
with an incredible actually really

222
00:08:54,310 --> 00:08:52,949
now we also have another curve on this

223
00:08:56,389 --> 00:08:54,320
figure one

224
00:08:58,710 --> 00:08:56,399
which is from the grace mission grace

225
00:09:00,550 --> 00:08:58,720
was launched in 2002

226
00:09:02,790 --> 00:09:00,560
and it gives us further insight into

227
00:09:05,269 --> 00:09:02,800
what is causing the observed sea level

228
00:09:07,590 --> 00:09:05,279
change that we've seen in the altimetry

229
00:09:09,430 --> 00:09:07,600
the grace consists of two satellites

230
00:09:11,509 --> 00:09:09,440
already near together

231
00:09:13,910 --> 00:09:11,519
they're about 450 kilometers altitude

232
00:09:16,389 --> 00:09:13,920
but 200 kilometers apart

233
00:09:17,990 --> 00:09:16,399
and there there's a a microwave ranging

234
00:09:19,990 --> 00:09:18,000
this this system on board that measures

235
00:09:22,470 --> 00:09:20,000
the distance between the satellites to

236
00:09:24,310 --> 00:09:22,480
very high precision about one micron

237
00:09:25,829 --> 00:09:24,320
which is smaller than the diameter of a

238
00:09:27,430 --> 00:09:25,839

red blood cell so it's really quite an

239
00:09:29,509 --> 00:09:27,440
achievement

240
00:09:32,150 --> 00:09:29,519
and as the satellites over the earth the

241
00:09:34,829 --> 00:09:32,160
distance between the satellites changes

242
00:09:37,590 --> 00:09:34,839
as ice and water move around on the

243
00:09:39,829 --> 00:09:37,600
earth and so we measure those changes

244
00:09:41,750 --> 00:09:39,839
and then analyze the data to get changes

245
00:09:44,550 --> 00:09:41,760
in mass on the surface of the earth and

246
00:09:47,750 --> 00:09:44,560
and i'll show you those results now

247
00:09:51,110 --> 00:09:47,760
so the green curve on figure one shows

248
00:09:53,750 --> 00:09:51,120
the changes in ocean mass

249
00:09:55,750 --> 00:09:53,760
over average over the whole globe

250
00:09:59,030 --> 00:09:55,760
and they show that ocean mass has been

251
00:10:00,710 --> 00:09:59,040
been increasing at a rate of about 1.9

252
00:10:03,509 --> 00:10:00,720
millimeters per year

253
00:10:04,870 --> 00:10:03,519
so by ocean mass i mean this is changes

254
00:10:06,550 --> 00:10:04,880
due to water

255
00:10:07,430 --> 00:10:06,560
being added or taken away from the

256
00:10:09,670 --> 00:10:07,440
oceans

257
00:10:12,630 --> 00:10:09,680
in this case the mass is increasing so

258
00:10:14,150 --> 00:10:12,640
water is being added to the oceans

259
00:10:16,470 --> 00:10:14,160
but you can also see that there's a lot

260
00:10:18,389 --> 00:10:16,480
of similarity between these two curves

261
00:10:20,790 --> 00:10:18,399
and especially for the short-term

262
00:10:23,110 --> 00:10:20,800
variations and they also show

263
00:10:24,949 --> 00:10:23,120

that changes in water on the land due to

264
00:10:27,190 --> 00:10:24,959
hydrologic changes such as changes in

265
00:10:28,550 --> 00:10:27,200
rainfall patterns due to el nino also

266
00:10:30,310 --> 00:10:28,560
affect this curve

267
00:10:33,829 --> 00:10:30,320
a good example you might see is the dip

268
00:10:36,230 --> 00:10:33,839
there in 2011 which has been tied to

269
00:10:38,230 --> 00:10:36,240
the la nina then and to flooding that

270
00:10:40,550 --> 00:10:38,240
occurred in australia and other areas

271
00:10:43,750 --> 00:10:40,560
around the world

272
00:10:45,509 --> 00:10:43,760
so this is already a big clue for

273
00:10:47,509 --> 00:10:45,519
what has caused the changes in sea level

274
00:10:49,590 --> 00:10:47,519
that we see in the altimetry

275
00:10:51,509 --> 00:10:49,600
now let's move on to figure two which is

276
00:10:53,350 --> 00:10:51,519
also from greece

277
00:10:54,790 --> 00:10:53,360
but grace can look not only at the

278
00:10:57,110 --> 00:10:54,800
oceans but it could also look at the

279
00:10:58,870 --> 00:10:57,120
land to tell us where the

280
00:11:00,550 --> 00:10:58,880
water is coming from

281
00:11:03,750 --> 00:11:00,560
and in this case we're showing grace

282
00:11:05,910 --> 00:11:03,760
estimates of mass change mass loss in

283
00:11:07,910 --> 00:11:05,920
greenland antarctica the blue curve is

284
00:11:10,230 --> 00:11:07,920
antarctica at the top lower covers

285
00:11:12,949 --> 00:11:10,240
greenland the mass loss there

286
00:11:15,829 --> 00:11:12,959
since 2002 when grace was launched is

287
00:11:19,190 --> 00:11:15,839
about 0.25 millimeters per year for

288
00:11:19,910 --> 00:11:19,200

antarctica and 0.74 millimeters per year

289
00:11:21,829 --> 00:11:19,920
for

290
00:11:24,470 --> 00:11:21,839
greenland

291
00:11:25,990 --> 00:11:24,480
so together with these nasa satellite

292
00:11:27,990 --> 00:11:26,000
measurements satellite symmetry and

293
00:11:29,990 --> 00:11:28,000
satellite gravity measurements we can

294
00:11:30,949 --> 00:11:30,000
conclude that roughly one-third of the

295
00:11:32,710 --> 00:11:30,959
rise

296
00:11:35,110 --> 00:11:32,720
of sea level that we see is due to

297
00:11:37,110 --> 00:11:35,120
thermal expansion that's basically when

298
00:11:38,790 --> 00:11:37,120
heat goes into the ocean the water

299
00:11:40,310 --> 00:11:38,800
expands just like the mercury in a

300
00:11:42,310 --> 00:11:40,320
thermometer does

301
00:11:44,150 --> 00:11:42,320
and one-third is due to the ice melt in

302
00:11:45,910 --> 00:11:44,160
greenland in antarctica and then one

303
00:11:47,750 --> 00:11:45,920
third is due to the melting of mountain

304
00:11:51,030 --> 00:11:47,760
glaciers outside of greenland and

305
00:11:55,829 --> 00:11:53,910
so let's go on to uh figure three

306
00:11:57,750 --> 00:11:55,839
so satellite symmetry you know i just

307
00:12:00,870 --> 00:11:57,760
showed you global average sealable

308
00:12:01,670 --> 00:12:00,880
change but it also tells us how

309
00:12:03,670 --> 00:12:01,680
the

310
00:12:05,190 --> 00:12:03,680
sea level is changing regionally since

311
00:12:08,230 --> 00:12:05,200
1992

312
00:12:09,910 --> 00:12:08,240
and so on figure three the bottom plot

313
00:12:14,550 --> 00:12:09,920

shows changes in sea level in

314
00:12:15,590 --> 00:12:14,560
centimeters from 1993 through 2013.

315
00:12:17,990 --> 00:12:15,600
and you can see there's kind of a

316
00:12:20,310 --> 00:12:18,000
distinctive pattern there in the pacific

317
00:12:22,870 --> 00:12:20,320
and this is that has been associated

318
00:12:26,470 --> 00:12:22,880
with the pacific decadal oscillation or

319
00:12:28,710 --> 00:12:26,480
pdo the pdo is a natural cycle that is

320
00:12:31,269 --> 00:12:28,720
superimposed or think of happening on

321
00:12:33,590 --> 00:12:31,279
top of the long term changes

322
00:12:34,550 --> 00:12:33,600
from climate

323
00:12:38,870 --> 00:12:34,560
so

324
00:12:40,629 --> 00:12:38,880
satellite altimetry the top plot shows

325
00:12:41,829 --> 00:12:40,639
the last two years and there's an

326
00:12:43,670 --> 00:12:41,839
indication

327
00:12:45,509 --> 00:12:43,680
that this pattern is changing it's

328
00:12:47,670 --> 00:12:45,519
actually flipping its sign

329
00:12:50,829 --> 00:12:47,680
over the last few years and josh willis

330
00:12:52,629 --> 00:12:50,839
will discuss the implications of this uh

331
00:12:54,230 --> 00:12:52,639
later

332
00:12:55,670 --> 00:12:54,240
the regional sea level change is also

333
00:12:57,190 --> 00:12:55,680
expected to be affected by the melting

334
00:12:58,790 --> 00:12:57,200
of the ice sheets with

335
00:13:00,550 --> 00:12:58,800
with less sealable change near the ice

336
00:13:02,069 --> 00:13:00,560
sheets and more farther away from the

337
00:13:03,590 --> 00:13:02,079
air sheets and refer to that as ice

338
00:13:04,870 --> 00:13:03,600

sheet fingerprints

339
00:13:06,389 --> 00:13:04,880
and uh

340
00:13:08,150 --> 00:13:06,399
the uh that's another

341
00:13:09,829 --> 00:13:08,160
impact on the regional sea level change

342
00:13:12,470 --> 00:13:09,839
that you might see in your backyard but

343
00:13:14,310 --> 00:13:12,480
also scientists at nasa and other

344
00:13:15,590 --> 00:13:14,320
institutions are also studying vertical

345
00:13:17,350 --> 00:13:15,600
land movement

346
00:13:19,110 --> 00:13:17,360
and how it can exacerbate sea level

347
00:13:21,990 --> 00:13:19,120
change in some locations such as new

348
00:13:23,990 --> 00:13:22,000
orleans and one way to do that is to use

349
00:13:25,910 --> 00:13:24,000
gps receivers on land that are very

350
00:13:26,949 --> 00:13:25,920
precise and measure the vertical land

351
00:13:28,230 --> 00:13:26,959
movement

352
00:13:31,590 --> 00:13:28,240
that's another area of important

353
00:13:33,910 --> 00:13:31,600
research for sea level change

354
00:13:36,230 --> 00:13:33,920
so we've already experienced about 0.8

355
00:13:38,150 --> 00:13:36,240
degrees centigrade of warming and

356
00:13:40,790 --> 00:13:38,160
paleoclimate research suggests sea level

357
00:13:43,030 --> 00:13:40,800
will rise about 2.3 meters for every

358
00:13:44,870 --> 00:13:43,040
degree centigrade of warming

359
00:13:46,710 --> 00:13:44,880
but we're uncertain how quickly the ice

360
00:13:49,509 --> 00:13:46,720
sheets will melt so we need to bed

361
00:13:51,670 --> 00:13:49,519
understand i see dynamics and eric

362
00:13:53,990 --> 00:13:51,680
brigno and josh willis will address this

363
00:13:55,829 --> 00:13:54,000

in a minute

364
00:13:57,110 --> 00:13:55,839
so i've been focusing here on nasa

365
00:13:58,949 --> 00:13:57,120
satellite measurements i'd really like

366
00:14:00,550 --> 00:13:58,959
to summarize not only the ones i talked

367
00:14:02,310 --> 00:14:00,560
about but all of the measurements that

368
00:14:03,670 --> 00:14:02,320
are helping contribute to understanding

369
00:14:04,870 --> 00:14:03,680
sea level change what's going to happen

370
00:14:06,550 --> 00:14:04,880
in the future

371
00:14:08,230 --> 00:14:06,560
so i talked about satellite gravity we

372
00:14:11,110 --> 00:14:08,240
have the grace mission that launched in

373
00:14:13,189 --> 00:14:11,120
2002 also nasa is planning on launching

374
00:14:14,790 --> 00:14:13,199
the grace following mission in 2017 that

375
00:14:17,750 --> 00:14:14,800
will continue those measurements

376
00:14:20,150 --> 00:14:17,760
for ocean altimetry we've had topex json

377
00:14:22,230 --> 00:14:20,160
1 jason 2 and hopefully jason 3 will

378
00:14:24,710 --> 00:14:22,240
launch in 2016 to continue that time

379
00:14:26,790 --> 00:14:24,720
series in addition nasa is developing

380
00:14:28,629 --> 00:14:26,800
the swat mission for launch in 2020 that

381
00:14:32,069 --> 00:14:28,639
will measure sea level across a wide

382
00:14:35,189 --> 00:14:32,079
swath of the oceans 120 kilometers wide

383
00:14:37,750 --> 00:14:35,199
plus we have ice altimetry icesat and

384
00:14:39,590 --> 00:14:37,760
soon in 2018 icesat-2 will continue

385
00:14:40,550 --> 00:14:39,600
measurements of the height of the ice

386
00:14:42,949 --> 00:14:40,560
sheets

387
00:14:45,670 --> 00:14:42,959
and how it contributes how it tells us

388
00:14:47,509 --> 00:14:45,680

what is contributing to seatable change

389
00:14:49,829 --> 00:14:47,519
and finally nissa is a sar mission

390
00:14:51,910 --> 00:14:49,839
that's going to launch in late 2020 and

391
00:14:53,910 --> 00:14:51,920
among other things it tells us

392
00:14:55,110 --> 00:14:53,920
the velocity of the outlet glaciers of

393
00:14:56,949 --> 00:14:55,120
the ice sheets

394
00:14:58,470 --> 00:14:56,959
and that's not a clue to how the ice

395
00:15:00,790 --> 00:14:58,480
sheets are evolving

396
00:15:02,710 --> 00:15:00,800
with the warming

397
00:15:05,670 --> 00:15:02,720
so just to finish up i'd like to mention

398
00:15:07,350 --> 00:15:05,680
that in 2014 nasa formed a new sea level

399
00:15:09,590 --> 00:15:07,360
change team that i'm the leader of

400
00:15:12,389 --> 00:15:09,600
that's composed of an italian team of

401
00:15:14,870 --> 00:15:12,399
scientists with expertise in glaciology

402
00:15:16,389 --> 00:15:14,880
hydrology oceanography geophysics and a

403
00:15:18,470 --> 00:15:16,399
variety of other fields

404
00:15:19,829 --> 00:15:18,480
and you need all these fields as you

405
00:15:21,829 --> 00:15:19,839
might expect from what i've been talking

406
00:15:24,629 --> 00:15:21,839
about here to actually understand all of

407
00:15:25,590 --> 00:15:24,639
the factors that affect future saleable

408
00:15:27,189 --> 00:15:25,600
rides

409
00:15:28,710 --> 00:15:27,199
so the primary objective of this team is

410
00:15:30,470 --> 00:15:28,720
to improve our knowledge of ice mass

411
00:15:32,069 --> 00:15:30,480
loss and regional sealable change so we

412
00:15:34,949 --> 00:15:32,079
can better predict future sealable

413
00:15:36,389 --> 00:15:34,959

change and its regional variation

414
00:15:38,230 --> 00:15:36,399
later this year the team will introduce

415
00:15:39,189 --> 00:15:38,240
a web portal containing research from

416
00:15:40,710 --> 00:15:39,199
the team

417
00:15:43,189 --> 00:15:40,720
but another excellent source for

418
00:15:46,790 --> 00:15:43,199
saleable information can be found

419
00:15:48,310 --> 00:15:46,800
at the url climate.data.gov

420
00:15:50,470 --> 00:15:48,320
so now uh

421
00:15:52,230 --> 00:15:50,480
eric righto and josh willis are both

422
00:15:53,910 --> 00:15:52,240
members of this new team so i like to

423
00:15:57,350 --> 00:15:53,920
pass this off to them so they can give

424
00:15:58,790 --> 00:15:57,360
their perspective on the briefing today

425
00:16:01,110 --> 00:15:58,800
eric

426
00:16:03,350 --> 00:16:01,120
hi thank you steve um we're going to

427
00:16:05,910 --> 00:16:03,360
turn our attention a little bit on ice

428
00:16:08,230 --> 00:16:05,920
sheets ice sheets are contributing to

429
00:16:10,310 --> 00:16:08,240
sea level rise sooner and more

430
00:16:12,710 --> 00:16:10,320
significantly than anticipated

431
00:16:15,269 --> 00:16:12,720
as steve said about one third of the

432
00:16:18,230 --> 00:16:15,279
observed global sea level rise is due to

433
00:16:20,389 --> 00:16:18,240
the melting of ice sheets into the ocean

434
00:16:21,990 --> 00:16:20,399
we know that with future warming ice

435
00:16:23,590 --> 00:16:22,000
sheets will dominate sea level rise

436
00:16:26,629 --> 00:16:23,600
because they hold a much larger volume

437
00:16:28,870 --> 00:16:26,639
of ice than glaciers and ice caps

438
00:16:32,069 --> 00:16:28,880

paleo climate records suggest very

439
00:16:34,470 --> 00:16:32,079
clearly that with future warming we may

440
00:16:36,949 --> 00:16:34,480
lock ourselves into multiple meters sea

441
00:16:39,910 --> 00:16:36,959
level rise we're talking about 6 meter

442
00:16:41,509 --> 00:16:39,920
18 feet and higher of sea level rise

443
00:16:43,430 --> 00:16:41,519
as steve mentioned the time scales of

444
00:16:44,790 --> 00:16:43,440
this rise is not well constrained by

445
00:16:46,310 --> 00:16:44,800
those records

446
00:16:48,470 --> 00:16:46,320
sea level may rise half a meter per

447
00:16:51,350 --> 00:16:48,480
century or several meters per century we

448
00:16:53,829 --> 00:16:51,360
just don't know more research is needed

449
00:16:55,350 --> 00:16:53,839
to constrain those race from from past

450
00:16:56,949 --> 00:16:55,360
events

451
00:16:58,710 --> 00:16:56,959
we've never seen an ice sheet collapse

452
00:17:01,350 --> 00:16:58,720
in the past we do not know what it looks

453
00:17:03,110 --> 00:17:01,360
like and past records of collapse of

454
00:17:05,829 --> 00:17:03,120
marine-based ice sheets have been

455
00:17:07,750 --> 00:17:05,839
bulldozed by re-advances

456
00:17:10,230 --> 00:17:07,760
uh how ice sheets melt into the ocean

457
00:17:12,230 --> 00:17:10,240
they melt in three different ways uh one

458
00:17:13,669 --> 00:17:12,240
is from the surface due to warmer air

459
00:17:16,309 --> 00:17:13,679
temperature this is the case in

460
00:17:18,390 --> 00:17:16,319
greenland and for glaciers and ice cap

461
00:17:21,029 --> 00:17:18,400
they also melt from below when ice

462
00:17:22,949 --> 00:17:21,039
enters in contact with ocean waters

463
00:17:25,350 --> 00:17:22,959

and the third way is uh from the

464
00:17:27,750 --> 00:17:25,360
periphery when glaciers break up into

465
00:17:29,510 --> 00:17:27,760
icebergs that melt and decay in the

466
00:17:31,029 --> 00:17:29,520
ocean that's the

467
00:17:32,390 --> 00:17:31,039
important process in greenland and

468
00:17:34,630 --> 00:17:32,400
antarctica

469
00:17:36,150 --> 00:17:34,640
surface melt is well understood and it's

470
00:17:37,190 --> 00:17:36,160
projected to increase refrigerant

471
00:17:38,870 --> 00:17:37,200
warming

472
00:17:40,470 --> 00:17:38,880
several nasa teams

473
00:17:42,789 --> 00:17:40,480
work in the field every summer to look

474
00:17:43,909 --> 00:17:42,799
at the fate of surface melt on and below

475
00:17:47,029 --> 00:17:43,919
the ice sheet

476
00:17:49,669 --> 00:17:47,039
mass balance and more on this will be

477
00:17:52,310 --> 00:17:49,679
discussed on friday

478
00:17:53,750 --> 00:17:52,320
next month you can turn over to figure

479
00:17:56,470 --> 00:17:53,760
seven here

480
00:17:58,710 --> 00:17:56,480
nasa operation icebridge will fly over

481
00:18:00,789 --> 00:17:58,720
greenland to measure how much milk took

482
00:18:02,710 --> 00:18:00,799
place this summer in various parts of

483
00:18:04,630 --> 00:18:02,720
greenland you can see on the figure the

484
00:18:07,190 --> 00:18:04,640
spatial coverage of the flight tracks to

485
00:18:09,029 --> 00:18:07,200
be covered next month to get an idea we

486
00:18:11,350 --> 00:18:09,039
will cover the various ranges of

487
00:18:12,870 --> 00:18:11,360
elevation snow and ice regimes

488
00:18:15,110 --> 00:18:12,880

to characterize the changes over the

489
00:18:17,190 --> 00:18:15,120
entire ice sheet so this data will

490
00:18:19,990 --> 00:18:17,200
inform us about the magnitude of the

491
00:18:22,549 --> 00:18:20,000
2015 summer melt so we can compare it

492
00:18:25,510 --> 00:18:22,559
with satellite data we can evaluate our

493
00:18:27,750 --> 00:18:25,520
surface melt models and this also is

494
00:18:29,830 --> 00:18:27,760
done in preparation for the data to be

495
00:18:32,150 --> 00:18:29,840
collected by icesat-2

496
00:18:34,230 --> 00:18:32,160
to be launched in 2018

497
00:18:37,669 --> 00:18:34,240
icesat-2 will continue his observations

498
00:18:39,669 --> 00:18:37,679
pour to pole on a continuous basis

499
00:18:42,630 --> 00:18:39,679
in contrast to surface melt the

500
00:18:43,669 --> 00:18:42,640
mechanisms of fast ice melt into the

501
00:18:47,909 --> 00:18:43,679
ocean

502
00:18:50,710 --> 00:18:47,919
and the breaking up of calving clips

503
00:18:52,950 --> 00:18:50,720
into icebergs are not well understood

504
00:18:55,029 --> 00:18:52,960
they're not well represented in models

505
00:18:57,909 --> 00:18:55,039
and therefore affected by large

506
00:19:01,029 --> 00:18:57,919
uncertainties this is why current model

507
00:19:02,870 --> 00:19:01,039
projection such as ipcc projections

508
00:19:03,990 --> 00:19:02,880
which represent the state-of-the-art in

509
00:19:05,750 --> 00:19:04,000
modeling

510
00:19:07,750 --> 00:19:05,760
produce relatively conservative

511
00:19:10,310 --> 00:19:07,760
scenarios of ice sheet decay because

512
00:19:12,470 --> 00:19:10,320
those models do not yet include the

513
00:19:15,510 --> 00:19:12,480

mechanism of fast melt in the ocean and

514
00:19:18,150 --> 00:19:15,520
fast ice fracture into the ocean

515
00:19:21,430 --> 00:19:18,160
that would prevail during area of rapid

516
00:19:23,350 --> 00:19:21,440
or catastrophic ice sheet retreat

517
00:19:26,630 --> 00:19:23,360
so to reduce these uncertainties nasa is

518
00:19:28,710 --> 00:19:26,640
supporting research on multiple france

519
00:19:31,110 --> 00:19:28,720
nasa is deploying airborne instruments

520
00:19:33,270 --> 00:19:31,120
to measure glacier depths and the shape

521
00:19:35,590 --> 00:19:33,280
of sub-ice shelf cavities in greenland

522
00:19:38,150 --> 00:19:35,600
and antarctica this is the icebridge

523
00:19:41,029 --> 00:19:38,160
program which is scheduled to last until

524
00:19:43,990 --> 00:19:41,039
uh at least 2019

525
00:19:46,230 --> 00:19:44,000
uh we use uh satellite to serve changes

526
00:19:48,950 --> 00:19:46,240
in mass surface elevation and speed of

527
00:19:51,110 --> 00:19:48,960
the glaciers and more satellites will be

528
00:19:54,150 --> 00:19:51,120
launched as steve mentioned to continue

529
00:19:55,909 --> 00:19:54,160
these observations into the next decades

530
00:19:58,150 --> 00:19:55,919
to improve our understanding of ice

531
00:19:59,990 --> 00:19:58,160
ocean interaction several programs have

532
00:20:02,150 --> 00:20:00,000
been launched including the ocean

533
00:20:04,549 --> 00:20:02,160
melting greenland mission that josh

534
00:20:06,310 --> 00:20:04,559
willis will talk about in a minute

535
00:20:09,190 --> 00:20:06,320
and eventually this knowledge will be

536
00:20:11,830 --> 00:20:09,200
transferred into more reliable ice ocean

537
00:20:14,230 --> 00:20:11,840
atmosphere couple models which are

538
00:20:16,230 --> 00:20:14,240

developed by a growing community of

539
00:20:18,870 --> 00:20:16,240
climate models

540
00:20:20,870 --> 00:20:18,880
numerical models need to be run at much

541
00:20:22,789 --> 00:20:20,880
higher vertical and horizontal

542
00:20:24,310 --> 00:20:22,799
resolution than today they need to use

543
00:20:26,870 --> 00:20:24,320
better boundary conditions than

544
00:20:29,190 --> 00:20:26,880
available today in order to simulate

545
00:20:31,990 --> 00:20:29,200
the full complexity of ice sheet systems

546
00:20:34,549 --> 00:20:32,000
we are not there yet but nasa and other

547
00:20:37,830 --> 00:20:34,559
agencies are contributing to making this

548
00:20:39,830 --> 00:20:37,840
happen sooner rather than later

549
00:20:42,149 --> 00:20:39,840
observations combined with observations

550
00:20:43,909 --> 00:20:42,159
from partner agencies clearly indicate

551
00:20:45,830 --> 00:20:43,919
that significant changes are taking

552
00:20:47,750 --> 00:20:45,840
place today on ice sheets

553
00:20:49,909 --> 00:20:47,760
a number of these changes of an

554
00:20:51,990 --> 00:20:49,919
irreversible character meaning it would

555
00:20:54,149 --> 00:20:52,000
take centuries to reverse the trend of

556
00:20:56,070 --> 00:20:54,159
ice retreat or we cover some ice

557
00:20:57,110 --> 00:20:56,080
elements that have been lost i'm

558
00:20:58,789 --> 00:20:57,120
thinking about

559
00:21:00,630 --> 00:20:58,799
in particular about the progressive

560
00:21:03,110 --> 00:21:00,640
collapse of ice sharks in the antarctic

561
00:21:05,029 --> 00:21:03,120
peninsula which is still ongoing and

562
00:21:07,190 --> 00:21:05,039
moving southward

563
00:21:08,630 --> 00:21:07,200

the iverson retreat of the glaciers in

564
00:21:10,870 --> 00:21:08,640
the emerson sea sector of west

565
00:21:13,990 --> 00:21:10,880
antarctica that we talked about in may

566
00:21:15,510 --> 00:21:14,000
2014 this is still ongoing although we

567
00:21:17,669 --> 00:21:15,520
are witnessing a slight pause in the

568
00:21:20,390 --> 00:21:17,679
rate of retreat of some of his glaciers

569
00:21:22,630 --> 00:21:20,400
uh the retreat is proceeding inland

570
00:21:24,549 --> 00:21:22,640
or the fast retreat of the largest ice

571
00:21:25,750 --> 00:21:24,559
stream in greenland the jakob silent is

572
00:21:28,630 --> 00:21:25,760
very

573
00:21:31,350 --> 00:21:28,640
i now i'm asking you to turn on to

574
00:21:33,830 --> 00:21:31,360
figure 5 and 6

575
00:21:36,230 --> 00:21:33,840
which were acquired

576
00:21:38,310 --> 00:21:36,240
just a few weeks ago we witnessed the

577
00:21:40,310 --> 00:21:38,320
spectacular calving event of jacob

578
00:21:42,789 --> 00:21:40,320
savanni's bre in greenland

579
00:21:43,750 --> 00:21:42,799
which we removed 12 square kilometer of

580
00:21:45,909 --> 00:21:43,760
ice

581
00:21:47,909 --> 00:21:45,919
in one day and push the carving front of

582
00:21:49,430 --> 00:21:47,919
that glacier farther back than ever

583
00:21:51,190 --> 00:21:49,440
before

584
00:21:54,470 --> 00:21:51,200
the glacier keeps retreating rapidly

585
00:21:56,149 --> 00:21:54,480
into a deep canyon since 2002

586
00:21:57,990 --> 00:21:56,159
and this summer i've seen another series

587
00:22:00,710 --> 00:21:58,000
of spectacular calving events from these

588
00:22:02,950 --> 00:22:00,720

glaciers we are likely to see more of

589
00:22:05,350 --> 00:22:02,960
those carving events in the coming years

590
00:22:07,270 --> 00:22:05,360
as the glacier retreats into deeper ice

591
00:22:09,110 --> 00:22:07,280
this is a marine based glacier it will

592
00:22:10,870 --> 00:22:09,120
remain in contact with the ocean for

593
00:22:13,430 --> 00:22:10,880
decades and centuries as it retreats

594
00:22:14,310 --> 00:22:13,440
further inland and it contains enough

595
00:22:16,390 --> 00:22:14,320
ice

596
00:22:19,110 --> 00:22:16,400
to raise global sea level by half a

597
00:22:21,270 --> 00:22:19,120
meter it's just one glacier in greenland

598
00:22:23,270 --> 00:22:21,280
once all melted to sea

599
00:22:24,870 --> 00:22:23,280
so in summary there are large

600
00:22:26,950 --> 00:22:24,880
uncertainties about the time scale of

601
00:22:28,230 --> 00:22:26,960
sea level rise associated with the decay

602
00:22:29,830 --> 00:22:28,240
of ice sheets

603
00:22:32,470 --> 00:22:29,840
the rates of civil rights could range

604
00:22:34,950 --> 00:22:32,480
from the lower bound of ipcc projection

605
00:22:37,909 --> 00:22:34,960
to its upper range and beyond if we

606
00:22:41,510 --> 00:22:37,919
include extreme scenarios of fast ice

607
00:22:43,190 --> 00:22:41,520
break up and rapid retreat analog to

608
00:22:44,470 --> 00:22:43,200
those experienced in prior warmer

609
00:22:46,390 --> 00:22:44,480
periods

610
00:22:48,630 --> 00:22:46,400
observations suggest that we should be

611
00:22:50,710 --> 00:22:48,640
very cautious to conclude too soon that

612
00:22:52,230 --> 00:22:50,720
conservative scenarios are reasonable

613
00:22:54,710 --> 00:22:52,240

they may not be

614
00:22:56,310 --> 00:22:54,720
and this is at the heart of what we nasa

615
00:22:58,789 --> 00:22:56,320
and other national

616
00:23:00,390 --> 00:22:58,799
and international agencies are working

617
00:23:03,190 --> 00:23:00,400
on right now

618
00:23:04,710 --> 00:23:03,200
and i'll pass it on to josh

619
00:23:07,190 --> 00:23:04,720
thank you eric

620
00:23:09,510 --> 00:23:07,200
i have had some phone troubles up to now

621
00:23:11,110 --> 00:23:09,520
so if i drop out my apologies i'll be

622
00:23:13,590 --> 00:23:11,120
back

623
00:23:16,630 --> 00:23:13,600
as eric mentioned i am the lead

624
00:23:19,270 --> 00:23:16,640
scientist for a new mission to measure

625
00:23:20,630 --> 00:23:19,280
oceans and their impact on the greenland

626
00:23:22,549 --> 00:23:20,640
ice sheet

627
00:23:24,070 --> 00:23:22,559
we started this year the name of the

628
00:23:27,350 --> 00:23:24,080
mission is called oceans melting

629
00:23:29,270 --> 00:23:27,360
greenland or omg for short and before

630
00:23:31,270 --> 00:23:29,280
you ask yes i did

631
00:23:33,669 --> 00:23:31,280
pick that name while i was deleting old

632
00:23:35,909 --> 00:23:33,679
texts off my cell phone

633
00:23:39,909 --> 00:23:35,919
the ocean's melting greenland campaign

634
00:23:41,750 --> 00:23:39,919
will measure oceans and ice loss around

635
00:23:43,909 --> 00:23:41,760
the edges of greenland

636
00:23:46,950 --> 00:23:43,919
for the next five years starting next

637
00:23:48,950 --> 00:23:46,960
year and continuing through 2020

638
00:23:51,350 --> 00:23:48,960

we'll be collecting

639
00:23:53,270 --> 00:23:51,360
observations and if you look at figure

640
00:23:55,350 --> 00:23:53,280
eight you can get an idea of the kinds

641
00:23:57,669 --> 00:23:55,360
of observations we'll be collecting

642
00:23:59,590 --> 00:23:57,679
these include

643
00:24:02,070 --> 00:23:59,600
radar measurements of the height of the

644
00:24:04,230 --> 00:24:02,080
ice near the edges right where it comes

645
00:24:06,390 --> 00:24:04,240
into contact with the water these

646
00:24:07,350 --> 00:24:06,400
glaciers drain the ice sheet into the

647
00:24:08,070 --> 00:24:07,360
oceans

648
00:24:10,230 --> 00:24:08,080
and

649
00:24:12,310 --> 00:24:10,240
as the oceans warm

650
00:24:14,390 --> 00:24:12,320
the impact of the warming water can be

651
00:24:16,950 --> 00:24:14,400
felt right at the ice edge so in

652
00:24:19,669 --> 00:24:16,960
addition omg will also collect

653
00:24:21,590 --> 00:24:19,679
observations of the ocean directly using

654
00:24:23,190 --> 00:24:21,600
expendable probes that are dropped out

655
00:24:25,669 --> 00:24:23,200
of an aircraft

656
00:24:27,750 --> 00:24:25,679
and these will

657
00:24:29,430 --> 00:24:27,760
these will continue to be collected

658
00:24:32,870 --> 00:24:29,440
through 2020

659
00:24:35,029 --> 00:24:32,880
but we also need to understand the

660
00:24:46,710 --> 00:24:35,039
the

661
00:24:49,190 --> 00:24:46,720
waters surrounding it

662
00:24:50,230 --> 00:24:49,200
the ocean actually has warm water

663
00:24:52,630 --> 00:24:50,240

underneath

664
00:24:54,870 --> 00:24:52,640
cold water the warm water is salty so

665
00:24:57,430 --> 00:24:54,880
it's heavier and it sits down at depth

666
00:24:58,950 --> 00:24:57,440
so it has to reach into these canyons

667
00:25:01,350 --> 00:24:58,960
carved into the

668
00:25:03,830 --> 00:25:01,360
continental shelf by ancient glaciers in

669
00:25:06,630 --> 00:25:03,840
order to reach the glaciers and interact

670
00:25:09,350 --> 00:25:06,640
with them so omg is actually also

671
00:25:11,990 --> 00:25:09,360
collecting two different kinds of data

672
00:25:13,029 --> 00:25:12,000
to map the shape and depth of the sea

673
00:25:15,350 --> 00:25:13,039
floor

674
00:25:19,029 --> 00:25:15,360
right now we have just completed the

675
00:25:20,630 --> 00:25:19,039
very first phase of a shipborne campaign

676
00:25:23,669 --> 00:25:20,640
which carries a

677
00:25:25,990 --> 00:25:23,679
multi-beam echo sounder which sweeps out

678
00:25:28,310 --> 00:25:26,000
measurements of depth along the sea

679
00:25:29,990 --> 00:25:28,320
floor and in figure 9 you can see some

680
00:25:31,110 --> 00:25:30,000
of the very early data from this

681
00:25:34,390 --> 00:25:31,120
campaign

682
00:25:35,269 --> 00:25:34,400
collected in a fjord called umanak

683
00:25:37,750 --> 00:25:35,279
which

684
00:25:39,909 --> 00:25:37,760
carries a great deal of ice off of the

685
00:25:42,070 --> 00:25:39,919
glacier off of the ice sheet and into

686
00:25:43,830 --> 00:25:42,080
the water and we now have a much better

687
00:25:46,149 --> 00:25:43,840
idea of how

688
00:25:47,590 --> 00:25:46,159

the pathways by which this warm water

689
00:25:50,950 --> 00:25:47,600
can reach up

690
00:25:54,950 --> 00:25:50,960
next to the glaciers and also

691
00:25:57,750 --> 00:25:54,960
cause increased melting there so omg is

692
00:26:00,070 --> 00:25:57,760
looking to measure both the ocean

693
00:26:01,990 --> 00:26:00,080
warming and the ice melt over the course

694
00:26:04,470 --> 00:26:02,000
of the next five years and try and

695
00:26:06,390 --> 00:26:04,480
determine just how much

696
00:26:08,830 --> 00:26:06,400
just how much the greenland ice sheet is

697
00:26:10,470 --> 00:26:08,840
being melted away at the edges by the

698
00:26:11,430 --> 00:26:10,480
ocean

699
00:26:14,390 --> 00:26:11,440
now

700
00:26:15,830 --> 00:26:14,400
steve earlier talked about sea level

701
00:26:18,070 --> 00:26:15,840
rise and

702
00:26:20,149 --> 00:26:18,080
we also heard from mike freilich about

703
00:26:22,710 --> 00:26:20,159
how we've been measuring sea level rise

704
00:26:24,310 --> 00:26:22,720
over the past 23 years using precision

705
00:26:26,549 --> 00:26:24,320
altimeters

706
00:26:28,549 --> 00:26:26,559
in addition to my work on omg i'm also

707
00:26:30,710 --> 00:26:28,559
the project scientist for the jason 3

708
00:26:31,909 --> 00:26:30,720
mission which we hope to launch

709
00:26:34,390 --> 00:26:31,919
sometime

710
00:26:35,909 --> 00:26:34,400
later this year or early next year

711
00:26:39,110 --> 00:26:35,919
as we work out the

712
00:26:41,190 --> 00:26:39,120
details of how to get back to space with

713
00:26:42,070 --> 00:26:41,200

spacex

714
00:26:52,710 --> 00:26:42,080
the

715
00:26:55,110 --> 00:26:52,720
last 22 years as observed by

716
00:26:56,870 --> 00:26:55,120
satellite altimeters and if you look at

717
00:26:59,590 --> 00:26:56,880
the animation you'll see that almost

718
00:27:02,390 --> 00:26:59,600
everywhere in the ocean is orange or red

719
00:27:05,190 --> 00:27:02,400
indicating a rise and this rise has been

720
00:27:06,390 --> 00:27:05,200
about seven centimeters over the last 22

721
00:27:08,870 --> 00:27:06,400
years

722
00:27:11,430 --> 00:27:08,880
however if you look in more detail there

723
00:27:14,149 --> 00:27:11,440
are regions around the planet where sea

724
00:27:16,630 --> 00:27:14,159
level is not actually rising but has

725
00:27:18,470 --> 00:27:16,640
fallen or has risen much more quickly

726
00:27:20,789 --> 00:27:18,480
than the global average

727
00:27:23,110 --> 00:27:20,799
this is caused for a variety of reasons

728
00:27:25,350 --> 00:27:23,120
and it's one of the main

729
00:27:27,350 --> 00:27:25,360
concerns of oceanographers studying sea

730
00:27:29,750 --> 00:27:27,360
level change using the satellite

731
00:27:31,750 --> 00:27:29,760
altimeter data

732
00:27:35,909 --> 00:27:31,760
the satellite altimeter shows us the

733
00:27:38,149 --> 00:27:35,919
complex nature of the sea level problem

734
00:27:40,630 --> 00:27:38,159
in places like the north atlantic where

735
00:27:42,549 --> 00:27:40,640
as the globe spins around you'll see

736
00:27:44,789 --> 00:27:42,559
a large

737
00:27:46,870 --> 00:27:44,799
warming and cooling or high sea level

738
00:27:49,510 --> 00:27:46,880

and low sea level surrounding either

739
00:27:53,110 --> 00:27:49,520
side of the gulf stream as it veers off

740
00:27:55,990 --> 00:27:53,120
of the united states east coast into and

741
00:27:57,990 --> 00:27:56,000
carries warm water across the atlantic

742
00:27:59,750 --> 00:27:58,000
this actually occurs because of a change

743
00:28:01,750 --> 00:27:59,760
in either the strength or location of

744
00:28:04,549 --> 00:28:01,760
the gulf stream which affects sea level

745
00:28:05,510 --> 00:28:04,559
on the long term

746
00:28:10,630 --> 00:28:05,520
other

747
00:28:13,669 --> 00:28:10,640
decadal oscillation which is a large

748
00:28:16,630 --> 00:28:13,679
scale very long time scale phenomenon in

749
00:28:19,029 --> 00:28:16,640
the pacific ocean which rearranges heat

750
00:28:21,350 --> 00:28:19,039
and causes sea levels to rise more

751
00:28:23,510 --> 00:28:21,360
quickly in some places than others

752
00:28:25,510 --> 00:28:23,520
this can be seen off the west coast of

753
00:28:27,110 --> 00:28:25,520
the united states where sea levels have

754
00:28:30,149 --> 00:28:27,120
actually fallen

755
00:28:32,149 --> 00:28:30,159
for the last 22 years on average now the

756
00:28:34,389 --> 00:28:32,159
pacific decadal oscillation is thought

757
00:28:36,710 --> 00:28:34,399
to be part of a natural cycle occurring

758
00:28:39,029 --> 00:28:36,720
in the pacific ocean so in the long run

759
00:28:41,350 --> 00:28:39,039
we expect the sea levels on the west

760
00:28:44,070 --> 00:28:41,360
coast to catch up to the global mean and

761
00:28:46,230 --> 00:28:44,080
probably even exceed the global means so

762
00:28:48,070 --> 00:28:46,240
we could be looking at much faster than

763
00:28:50,149 --> 00:28:48,080

average sea level rise on the united

764
00:28:52,870 --> 00:28:50,159
states east coast sometime in the next

765
00:28:54,549 --> 00:28:52,880
20 or so years

766
00:28:56,470 --> 00:28:54,559
the final animation i'd like to talk

767
00:28:58,549 --> 00:28:56,480
about is in figure 11

768
00:29:01,029 --> 00:28:58,559
and as some of you may already be aware

769
00:29:03,190 --> 00:29:01,039
there is talk of a very large el nino

770
00:29:05,909 --> 00:29:03,200
occurring throughout this winter and

771
00:29:08,310 --> 00:29:05,919
having a big impact on rainfall

772
00:29:10,549 --> 00:29:08,320
particularly here in california

773
00:29:12,230 --> 00:29:10,559
this animation shows a comparison of the

774
00:29:14,950 --> 00:29:12,240
1997

775
00:29:17,990 --> 00:29:14,960
uh el nino which was the last really

776
00:29:20,230 --> 00:29:18,000
large el nino to bring changes to the

777
00:29:22,789 --> 00:29:20,240
entire weather and patter climate

778
00:29:25,350 --> 00:29:22,799
patterns all the way across the planet

779
00:29:28,870 --> 00:29:25,360
um if we compare this year's el nino to

780
00:29:31,430 --> 00:29:28,880
the monster el nino of 1997 we see that

781
00:29:33,269 --> 00:29:31,440
in some ways this el nino has already

782
00:29:36,070 --> 00:29:33,279
exceeded it in size

783
00:29:38,630 --> 00:29:36,080
however the next few months in really

784
00:29:41,110 --> 00:29:38,640
the next month or two we will begin to

785
00:29:43,350 --> 00:29:41,120
know whether this el nino will persist

786
00:29:45,830 --> 00:29:43,360
through the winter certainly there's an

787
00:29:48,710 --> 00:29:45,840
el nino and it's pretty big but we'll

788
00:29:51,510 --> 00:29:48,720

have a big impact on rainfall the next

789
00:29:54,070 --> 00:29:51,520
month or two we'll really decide that

790
00:29:55,510 --> 00:29:54,080
so with that i think i'll stop and pass

791
00:29:57,750 --> 00:29:55,520
the uh

792
00:29:59,350 --> 00:29:57,760
pass this back over to steve for

793
00:30:02,389 --> 00:29:59,360
questions

794
00:30:05,269 --> 00:30:02,399
okay thanks josh um just a note before

795
00:30:07,350 --> 00:30:05,279
we go to questions uh we now have tom

796
00:30:09,350 --> 00:30:07,360
wagner with us he's our cryosphere

797
00:30:11,190 --> 00:30:09,360
program scientist here at nasa

798
00:30:12,149 --> 00:30:11,200
headquarters and he'll take any

799
00:30:14,310 --> 00:30:12,159
questions

800
00:30:17,110 --> 00:30:14,320
anyone has about the nasa's about nasa's

801
00:30:19,510 --> 00:30:17,120
sea level rise program as mike pride had

802
00:30:22,230 --> 00:30:19,520
to leave us for another appointment just

803
00:30:24,149 --> 00:30:22,240
a reminder to ask a question via social

804
00:30:27,190 --> 00:30:24,159
media on twitter

805
00:30:28,870 --> 00:30:27,200
use the hashtag ask nasa

806
00:30:30,230 --> 00:30:28,880
and for the media

807
00:30:31,909 --> 00:30:30,240
on the call

808
00:30:34,549 --> 00:30:31,919
to ask a question and put yourself in

809
00:30:36,549 --> 00:30:34,559
the queue just on your phone

810
00:30:38,870 --> 00:30:36,559
type star one

811
00:30:42,470 --> 00:30:38,880
we'll start with a few questions that

812
00:30:45,510 --> 00:30:42,480
we've received already via social media

813
00:30:47,830 --> 00:30:45,520

the first is if seas continues to rise

814
00:30:49,990 --> 00:30:47,840
flooding low land areas what will happen

815
00:30:53,750 --> 00:30:50,000
to the world's freshwater rivers and

816
00:30:53,760 --> 00:31:00,950
who could take that question

817
00:31:05,830 --> 00:31:02,389
steve is that something you could

818
00:31:05,840 --> 00:31:09,669
yeah i uh

819
00:31:14,149 --> 00:31:12,470
you know it's it's uh there's no

820
00:31:16,630 --> 00:31:14,159
it's be difficult to talk about the

821
00:31:18,870 --> 00:31:16,640
direct effects but certainly as i

822
00:31:21,990 --> 00:31:18,880
mentioned earlier in my slides

823
00:31:24,070 --> 00:31:22,000
you know sea level is intimately tied to

824
00:31:26,389 --> 00:31:24,080
the hydrologic cycle which is the rivers

825
00:31:27,590 --> 00:31:26,399
and streams on the continents

826
00:31:30,870 --> 00:31:27,600
and so

827
00:31:33,269 --> 00:31:30,880
as we change the the global water cycle

828
00:31:35,669 --> 00:31:33,279
that will definitely have an effect on

829
00:31:37,269 --> 00:31:35,679
the water on the continents and

830
00:31:39,509 --> 00:31:37,279
and thus those rivers and streams

831
00:31:41,269 --> 00:31:39,519
eventually

832
00:31:42,870 --> 00:31:41,279
hey this is tom wagner from nasa i just

833
00:31:44,789 --> 00:31:42,880
wanted to add a little bit that as sea

834
00:31:47,190 --> 00:31:44,799
levels rise you also get salt water

835
00:31:49,669 --> 00:31:47,200
intrusion to local aquifers so it pushes

836
00:31:51,909 --> 00:31:49,679
back fresh water from coastal areas and

837
00:31:54,630 --> 00:31:51,919
the range of the estuary also changes

838
00:31:56,470 --> 00:31:54,640

quite a bit so there are some impacts to

839
00:31:58,389 --> 00:31:56,480
local waterways particularly in coastal

840
00:32:00,789 --> 00:31:58,399
areas and also fresh water resources

841
00:32:02,630 --> 00:32:00,799
that are in the ground

842
00:32:04,389 --> 00:32:02,640
okay thank you

843
00:32:06,549 --> 00:32:04,399
one other question from social media

844
00:32:08,149 --> 00:32:06,559
before we go to the journalists on the

845
00:32:09,430 --> 00:32:08,159
phone line

846
00:32:11,909 --> 00:32:09,440
what are the biggest

847
00:32:14,070 --> 00:32:11,919
specific technological gaps that you

848
00:32:16,389 --> 00:32:14,080
have now in studying this problem is it

849
00:32:19,029 --> 00:32:16,399
the matter of better sensors

850
00:32:25,029 --> 00:32:19,039
modeling or tools to inform local

851
00:32:29,990 --> 00:32:27,909
eric would you like to take that one

852
00:32:31,990 --> 00:32:30,000
yeah i can say a few words on that i

853
00:32:34,789 --> 00:32:32,000
think the biggest technological

854
00:32:36,630 --> 00:32:34,799
challenge for in particular studying

855
00:32:39,590 --> 00:32:36,640
the evolutions of ice sheets and how

856
00:32:41,750 --> 00:32:39,600
fast they may decay into the ocean

857
00:32:45,350 --> 00:32:41,760
is that a lot of these changes are

858
00:32:48,230 --> 00:32:45,360
taking place from below the surface

859
00:32:49,509 --> 00:32:48,240
which is much more difficult to

860
00:32:51,669 --> 00:32:49,519
to observe

861
00:32:54,389 --> 00:32:51,679
from satellites than than surface

862
00:32:56,630 --> 00:32:54,399
processes we're interested in

863
00:32:58,310 --> 00:32:56,640

warm water at depth which we cannot

864
00:33:01,350 --> 00:32:58,320
sense easily from the surface we're

865
00:33:03,190 --> 00:33:01,360
interested in the troughs uh the passage

866
00:33:06,310 --> 00:33:03,200
for warm water to research glaciers

867
00:33:08,950 --> 00:33:06,320
which we cannot easily observe uh

868
00:33:11,110 --> 00:33:08,960
from from from the surface and also some

869
00:33:13,350 --> 00:33:11,120
of the processes are taking place at the

870
00:33:15,430 --> 00:33:13,360
base of these ice sheets uh below

871
00:33:16,470 --> 00:33:15,440
kilometers of ice uh which are

872
00:33:18,870 --> 00:33:16,480
challenging

873
00:33:21,909 --> 00:33:18,880
another challenge that we're facing and

874
00:33:24,630 --> 00:33:21,919
mentioned earlier is that in order to

875
00:33:25,830 --> 00:33:24,640
produce more reliable projection

876
00:33:30,549 --> 00:33:25,840
the model

877
00:33:33,909 --> 00:33:30,559
of sophistication and they need to be

878
00:33:36,870 --> 00:33:33,919
run at much higher resolution than a lot

879
00:33:38,870 --> 00:33:36,880
of computers are able to do at present

880
00:33:40,470 --> 00:33:38,880
so we these are some of the challenges

881
00:33:42,870 --> 00:33:40,480
that we're facing

882
00:33:44,630 --> 00:33:42,880
i would just add to uh eric's answer

883
00:33:47,590 --> 00:33:44,640
that i think one of the challenges that

884
00:33:49,909 --> 00:33:47,600
we face is that uh we need more time

885
00:33:53,269 --> 00:33:49,919
as the ice sheets are just beginning

886
00:33:55,269 --> 00:33:53,279
their uh collapse and and

887
00:33:57,350 --> 00:33:55,279
to really decay

888
00:33:58,950 --> 00:33:57,360

we need some time to observe them and

889
00:34:00,789 --> 00:33:58,960
watch how this happens

890
00:34:03,350 --> 00:34:00,799
and that's part of the

891
00:34:05,190 --> 00:34:03,360
reasoning behind omg

892
00:34:07,590 --> 00:34:05,200
because we're going to be collecting a

893
00:34:09,270 --> 00:34:07,600
series of data over time and really

894
00:34:10,710 --> 00:34:09,280
we hope to see

895
00:34:12,389 --> 00:34:10,720
large changes in the ocean and

896
00:34:13,349 --> 00:34:12,399
corresponding changes in the ice that

897
00:34:15,909 --> 00:34:13,359
will give us

898
00:34:17,349 --> 00:34:15,919
a better idea of how these two things

899
00:34:19,030 --> 00:34:17,359
might be related

900
00:34:20,790 --> 00:34:19,040
i should also say that i forgot to

901
00:34:23,109 --> 00:34:20,800
mention during the primary call that you

902
00:34:24,710 --> 00:34:23,119
can learn more about omg at

903
00:34:29,669 --> 00:34:24,720
the following website

904
00:34:34,389 --> 00:34:31,909
and i'll uh echo josh's comment some

905
00:34:36,069 --> 00:34:34,399
more time that we you know we do need

906
00:34:37,750 --> 00:34:36,079
more time but we also need to continue

907
00:34:40,310 --> 00:34:37,760
the satellite measurements

908
00:34:42,629 --> 00:34:40,320
uh over that time so we have the clear

909
00:34:45,270 --> 00:34:42,639
picture that we need to understand how

910
00:34:47,510 --> 00:34:45,280
things are evolving

911
00:34:49,190 --> 00:34:47,520
okay thank you both our first question

912
00:34:52,550 --> 00:34:49,200
from the phone lines

913
00:34:55,270 --> 00:34:54,149

well thank you for taking my call can

914
00:34:59,589 --> 00:34:55,280
you hear me

915
00:35:02,230 --> 00:34:59,599
yes go ahead great thanks so much

916
00:35:04,230 --> 00:35:02,240
we as journalists we need to translate

917
00:35:05,829 --> 00:35:04,240
this into

918
00:35:07,750 --> 00:35:05,839
understandable information for our

919
00:35:09,910 --> 00:35:07,760
readers and i was just wondering if

920
00:35:12,310 --> 00:35:09,920
there's anything that you could say

921
00:35:13,910 --> 00:35:12,320
should be the the take away message from

922
00:35:15,829 --> 00:35:13,920
what you've learned from the satellite

923
00:35:16,790 --> 00:35:15,839
measurements over the past year in terms

924
00:35:20,470 --> 00:35:16,800
of

925
00:35:22,470 --> 00:35:20,480
uncertainty but what are we what are we

926
00:35:28,310 --> 00:35:22,480
really facing what are we looking at in

927
00:35:31,589 --> 00:35:30,390
well i think uh this is josh willis i

928
00:35:34,069 --> 00:35:31,599
think one of the things that we've

929
00:35:36,710 --> 00:35:34,079
learned is that uh the ice sheets are

930
00:35:38,710 --> 00:35:36,720
reacting even faster than we had

931
00:35:41,270 --> 00:35:38,720
previously suspected

932
00:35:43,270 --> 00:35:41,280
and that there's a large amount

933
00:35:45,430 --> 00:35:43,280
uh there's a large amount of uh ice

934
00:35:52,550 --> 00:35:45,440
there and the potential for sea level

935
00:35:57,589 --> 00:35:54,870
eric would you like to add to that

936
00:36:00,950 --> 00:35:57,599
yeah i would i would just add to

937
00:36:03,910 --> 00:36:00,960
to to this uh for your readers uh that

938
00:36:06,870 --> 00:36:03,920

uh i think on a personal level uh the

939
00:36:09,910 --> 00:36:06,880
data collected over the last few years

940
00:36:12,230 --> 00:36:09,920
uh make me more concerned about

941
00:36:14,790 --> 00:36:12,240
a bit of decay of ice sheets than than i

942
00:36:16,390 --> 00:36:14,800
was in the past so as as we go along i

943
00:36:20,230 --> 00:36:16,400
think we are a little bit more worried

944
00:36:25,109 --> 00:36:22,470
okay thank you our next question is from

945
00:36:28,310 --> 00:36:25,119
seth bornstein associated press go ahead

946
00:36:30,390 --> 00:36:28,320
seth okay uh yes thank you continue on

947
00:36:32,710 --> 00:36:30,400
that and i do have a follow-up maybe for

948
00:36:33,670 --> 00:36:32,720
eric or for any of you

949
00:36:35,109 --> 00:36:33,680
um

950
00:36:37,829 --> 00:36:35,119
you guys published an awful lot of

951
00:36:40,390 --> 00:36:37,839
interesting research last fall

952
00:36:42,230 --> 00:36:40,400
winter around agu i think it was i'm

953
00:36:44,710 --> 00:36:42,240
timing it's the wall

954
00:36:48,630 --> 00:36:44,720
and i'm trying to figure out what has

955
00:36:51,670 --> 00:36:48,640
changed from then to now

956
00:36:55,109 --> 00:36:51,680
is there some new research is there

957
00:36:56,790 --> 00:36:55,119
something new new um estimations for sea

958
00:36:59,349 --> 00:36:56,800
level rise from the

959
00:37:01,349 --> 00:36:59,359
west antarctic ice sheet

960
00:37:02,230 --> 00:37:01,359
i i guess basically what i'm coming down

961
00:37:04,310 --> 00:37:02,240
to is

962
00:37:06,870 --> 00:37:04,320
everything you said to me seems the same

963
00:37:09,750 --> 00:37:06,880

things you said last fall winter

964
00:37:12,150 --> 00:37:09,760
um

965
00:37:14,069 --> 00:37:12,160
is there a reason you're doing this now

966
00:37:17,430 --> 00:37:14,079
and is there anything new that i haven't

967
00:37:18,710 --> 00:37:17,440
figured out here that i'm missing

968
00:37:20,310 --> 00:37:18,720
hey seth this is tom wagner from

969
00:37:23,109 --> 00:37:20,320
headquarters look

970
00:37:25,190 --> 00:37:23,119
the short answer is no the longer answer

971
00:37:27,190 --> 00:37:25,200
is number one this is the first time we

972
00:37:28,790 --> 00:37:27,200
put together that 20-year record on the

973
00:37:30,870 --> 00:37:28,800
actual sea level rise around the whole

974
00:37:32,870 --> 00:37:30,880
planet and we're showing the complexity

975
00:37:34,550 --> 00:37:32,880
of that the other thing is that in the

976
00:37:37,030 --> 00:37:34,560
recent months you've seen a couple of

977
00:37:39,349 --> 00:37:37,040
papers come out trying to do more

978
00:37:40,950 --> 00:37:39,359
detailed models of the ice sheets

979
00:37:43,109 --> 00:37:40,960
and the other thing that's happened is

980
00:37:44,870 --> 00:37:43,119
now nasa has this sea level change team

981
00:37:46,630 --> 00:37:44,880
which is committed to getting together

982
00:37:49,030 --> 00:37:46,640
all the interdisciplinary research to

983
00:37:50,630 --> 00:37:49,040
really improve it and so one of the

984
00:37:53,190 --> 00:37:50,640
reasons that i push for this is that you

985
00:37:55,349 --> 00:37:53,200
know if you look in the ipcc report you

986
00:37:57,109 --> 00:37:55,359
see really really wide error bars and

987
00:37:59,109 --> 00:37:57,119
what we're trying to do is kind of rip

988
00:38:00,950 --> 00:37:59,119

the hood off the research a little bit

989
00:38:02,790 --> 00:38:00,960
and let you guys see inside to the

990
00:38:05,349 --> 00:38:02,800
detailed work we're doing on this

991
00:38:07,750 --> 00:38:05,359
question across the board from actually

992
00:38:09,750 --> 00:38:07,760
radar altimetry of the surface of the

993
00:38:11,750 --> 00:38:09,760
ocean and how high it's getting through

994
00:38:14,150 --> 00:38:11,760
to going out and doing our new missions

995
00:38:16,230 --> 00:38:14,160
like omg which also just started right

996
00:38:17,750 --> 00:38:16,240
now and is just going in the field to go

997
00:38:19,829 --> 00:38:17,760
and measure what's going on at the ice

998
00:38:23,190 --> 00:38:19,839
ocean front right there

999
00:38:24,630 --> 00:38:23,200
okay okay and and then to follow up um

1000
00:38:25,910 --> 00:38:24,640
you guys talk an awful lot about ice

1001
00:38:28,069 --> 00:38:25,920
sheets and that's what you know the big

1002
00:38:30,470 --> 00:38:28,079
thing has been the last couple years

1003
00:38:31,670 --> 00:38:30,480
um but with omg you are looking at a

1004
00:38:32,950 --> 00:38:31,680
glacier

1005
00:38:35,829 --> 00:38:32,960
can you

1006
00:38:38,390 --> 00:38:35,839
expand a little bit on on trends with

1007
00:38:41,510 --> 00:38:38,400
glacier melt and sea level rise and

1008
00:38:45,510 --> 00:38:41,520
particularly if you don't mind

1009
00:38:47,109 --> 00:38:45,520
alaska glaciers and sea level rise

1010
00:38:49,430 --> 00:38:47,119
hey this is tom again i'll just take

1011
00:38:51,109 --> 00:38:49,440
this one so there's a fascinating paper

1012
00:38:52,870 --> 00:38:51,119
that actually just came out within the

1013
00:38:55,589 --> 00:38:52,880

last few weeks that looked at alaskan

1014
00:38:58,230 --> 00:38:55,599
glaciers and the curious thing is that

1015
00:39:00,470 --> 00:38:58,240
the alaskan glaciers we thought the

1016
00:39:01,910 --> 00:39:00,480
glaciers that at the ocean

1017
00:39:03,750 --> 00:39:01,920
looked like they were dumping all their

1018
00:39:05,589 --> 00:39:03,760
ice into the ocean the amazing thing is

1019
00:39:06,870 --> 00:39:05,599
that now that looks like that process

1020
00:39:08,710 --> 00:39:06,880
has stopped

1021
00:39:10,230 --> 00:39:08,720
and our future modeling for alaskan

1022
00:39:12,390 --> 00:39:10,240
glaciers is going to be based on the

1023
00:39:14,550 --> 00:39:12,400
surface mass balance how much they melt

1024
00:39:15,990 --> 00:39:14,560
because that looks to be a bigger factor

1025
00:39:18,150 --> 00:39:16,000
now

1026
00:39:20,150 --> 00:39:18,160
one of the ideas for that hot water from

1027
00:39:21,829 --> 00:39:20,160
the ocean might be causing ice sheet

1028
00:39:23,750 --> 00:39:21,839
instability actually came from the work

1029
00:39:25,430 --> 00:39:23,760
on alaskan glaciers but i want to throw

1030
00:39:26,790 --> 00:39:25,440
this question over to eric rino because

1031
00:39:29,829 --> 00:39:26,800
i have a feeling he'd like to talk about

1032
00:39:32,390 --> 00:39:29,839
this too uh no you made a very good

1033
00:39:34,310 --> 00:39:32,400
point tom i think when you look across

1034
00:39:36,230 --> 00:39:34,320
alaska greenland and antarctica you're

1035
00:39:38,310 --> 00:39:36,240
seeing a whole range of climate

1036
00:39:40,710 --> 00:39:38,320
variables we we're moving from the very

1037
00:39:43,589 --> 00:39:40,720
warm areas to the less warm to the very

1038
00:39:45,829 --> 00:39:43,599

cold and looking at alaska glaciers

1039
00:39:48,470 --> 00:39:45,839
tells us what greenland would look like

1040
00:39:49,910 --> 00:39:48,480
probably in a century or a few centuries

1041
00:39:51,589 --> 00:39:49,920
and what's happening in greenland is

1042
00:39:53,990 --> 00:39:51,599
relevant to what's going to happen to

1043
00:39:56,870 --> 00:39:54,000
antarctica in the future as well so

1044
00:39:59,190 --> 00:39:56,880
they're all connected pieces of research

1045
00:40:00,870 --> 00:39:59,200
it's true that in alaska we have now

1046
00:40:02,870 --> 00:40:00,880
fewer glaciers that reach the ocean

1047
00:40:04,390 --> 00:40:02,880
because they melted away

1048
00:40:06,150 --> 00:40:04,400
in greenland

1049
00:40:07,910 --> 00:40:06,160
the vast majority of the glaciers

1050
00:40:10,310 --> 00:40:07,920
controlling the mass balance are

1051
00:40:12,790 --> 00:40:10,320
reaching the ocean and this is why prog

1052
00:40:15,750 --> 00:40:12,800
a program like omg is so critical to

1053
00:40:17,270 --> 00:40:15,760
make major advances in understanding

1054
00:40:20,630 --> 00:40:17,280
these processes

1055
00:40:22,150 --> 00:40:20,640
and this carries on also for antarctica

1056
00:40:24,230 --> 00:40:22,160
because a lot of the processes that are

1057
00:40:27,670 --> 00:40:24,240
taking place in greenland are also

1058
00:40:31,829 --> 00:40:27,680
relevant to antarctic glaciers

1059
00:40:39,510 --> 00:40:35,109
okay thank you our next question is from

1060
00:40:43,829 --> 00:40:42,150
go ahead irene hi thanks very much um i

1061
00:40:46,470 --> 00:40:43,839
have a couple of questions the first i

1062
00:40:48,470 --> 00:40:46,480
guess is kind of a real big picture

1063
00:40:50,150 --> 00:40:48,480

uh which is uh to anybody who'd like to

1064
00:40:53,030 --> 00:40:50,160
answer it um

1065
00:40:58,069 --> 00:40:53,040
what would you like people uh to do with

1066
00:41:01,750 --> 00:40:59,349
hey this is tom again from nasa

1067
00:41:03,750 --> 00:41:01,760
headquarters the most important thing is

1068
00:41:07,270 --> 00:41:03,760
this people need to understand that the

1069
00:41:09,829 --> 00:41:07,280
planet is not it's not changing it's

1070
00:41:11,750 --> 00:41:09,839
also changed and sea level is rising

1071
00:41:13,750 --> 00:41:11,760
right now and the most important thing

1072
00:41:15,750 --> 00:41:13,760
that i'd like people to do with this is

1073
00:41:17,990 --> 00:41:15,760
to understand that we have data now for

1074
00:41:19,829 --> 00:41:18,000
them to use in their planning and the

1075
00:41:22,069 --> 00:41:19,839
way that it goes is about risk tolerance

1076
00:41:24,069 --> 00:41:22,079
so for example if you're going to put in

1077
00:41:25,829 --> 00:41:24,079
major infrastructure like a water

1078
00:41:28,309 --> 00:41:25,839
treatment plant or a power plant in a

1079
00:41:30,710 --> 00:41:28,319
coastal zone things where you need they

1080
00:41:32,870 --> 00:41:30,720
cost society a lot of money to put in

1081
00:41:35,190 --> 00:41:32,880
and you have low tolerance for risk say

1082
00:41:37,190 --> 00:41:35,200
from flooding associated with a storm

1083
00:41:38,470 --> 00:41:37,200
surge or salt water intrusion or any of

1084
00:41:40,790 --> 00:41:38,480
those things

1085
00:41:42,550 --> 00:41:40,800
we have data that you can now use to

1086
00:41:44,550 --> 00:41:42,560
estimate what the impacts are going to

1087
00:41:46,470 --> 00:41:44,560
be in the next hundred years now the

1088
00:41:48,390 --> 00:41:46,480

error bars are still big but the point

1089
00:41:49,990 --> 00:41:48,400
of this conference today

1090
00:41:52,470 --> 00:41:50,000
is to tell you about all the work we're

1091
00:41:53,829 --> 00:41:52,480
doing to narrow that down and what i

1092
00:41:55,349 --> 00:41:53,839
would encourage people to do is to go

1093
00:41:57,270 --> 00:41:55,359
out and read about this as much as they

1094
00:41:59,109 --> 00:41:57,280
can there are resources from the

1095
00:42:00,829 --> 00:41:59,119
published papers we've talked about but

1096
00:42:03,349 --> 00:42:00,839
there are also places like

1097
00:42:05,030 --> 00:42:03,359
climate.data.gov um do any of the other

1098
00:42:06,790 --> 00:42:05,040
speakers want to add into what i've just

1099
00:42:08,950 --> 00:42:06,800
said

1100
00:42:10,390 --> 00:42:08,960
yeah this is josh i would i would just

1101
00:42:12,230 --> 00:42:10,400
add that

1102
00:42:14,309 --> 00:42:12,240
i think one of the main takeaways is

1103
00:42:15,589 --> 00:42:14,319
that people need to be prepared for sea

1104
00:42:17,190 --> 00:42:15,599
level rise

1105
00:42:19,109 --> 00:42:17,200
we're going to continue to have sea

1106
00:42:21,750 --> 00:42:19,119
level rise for

1107
00:42:23,910 --> 00:42:21,760
decades and probably centuries it's not

1108
00:42:25,270 --> 00:42:23,920
going to stop the question is how fast

1109
00:42:26,870 --> 00:42:25,280
is it going to be

1110
00:42:29,030 --> 00:42:26,880
and if you

1111
00:42:31,990 --> 00:42:29,040
live on a coastline or if you have some

1112
00:42:34,150 --> 00:42:32,000
economic dependence on a coastline

1113
00:42:36,630 --> 00:42:34,160

we have to be prepared for for rising

1114
00:42:38,470 --> 00:42:36,640
seas it's not a question of

1115
00:42:42,390 --> 00:42:38,480
when or it's not a question of how much

1116
00:42:46,710 --> 00:42:44,470
thanks very much and i have two kind of

1117
00:42:49,190 --> 00:42:46,720
housekeeping uh questions for you josh

1118
00:42:51,030 --> 00:42:49,200
um the first is um i might have just

1119
00:42:53,109 --> 00:42:51,040
misheard you but when you said that uh

1120
00:42:55,430 --> 00:42:53,119
you were talking about the um falling

1121
00:42:57,750 --> 00:42:55,440
levels in the pacific over the past 22

1122
00:42:59,190 --> 00:42:57,760
years and then you said that

1123
00:43:00,630 --> 00:42:59,200
you know that could change and we could

1124
00:43:03,750 --> 00:43:00,640
be looking at

1125
00:43:05,670 --> 00:43:03,760
much faster sea level rise um on the u.s

1126
00:43:07,990 --> 00:43:05,680
i thought i heard you say east coast in

1127
00:43:10,150 --> 00:43:08,000
the next 20 years um did i mishear you

1128
00:43:11,990 --> 00:43:10,160
did did you mean sorry i may have i may

1129
00:43:14,069 --> 00:43:12,000
have misspoken but it should be the west

1130
00:43:16,470 --> 00:43:14,079
coast of course the east coast has

1131
00:43:18,150 --> 00:43:16,480
rising sea levels as well but they tend

1132
00:43:20,230 --> 00:43:18,160
to be much steadier

1133
00:43:23,109 --> 00:43:20,240
on the west coast on the coast of

1134
00:43:24,470 --> 00:43:23,119
california washington and oregon we've

1135
00:43:26,630 --> 00:43:24,480
certainly seen

1136
00:43:27,829 --> 00:43:26,640
almost no sea level and a slight sea

1137
00:43:29,910 --> 00:43:27,839
level drop

1138
00:43:31,750 --> 00:43:29,920

but this is a temporary thing we're

1139
00:43:34,630 --> 00:43:31,760
we're going to see sea level rise on our

1140
00:43:36,150 --> 00:43:34,640
coast uh sometime in the next 20 years

1141
00:43:38,630 --> 00:43:36,160
we'll probably see

1142
00:43:40,390 --> 00:43:38,640
faster than average sea level rise so we

1143
00:43:42,069 --> 00:43:40,400
have to be prepared

1144
00:43:44,870 --> 00:43:42,079
thanks and then the other question is

1145
00:43:46,870 --> 00:43:44,880
just about um jason iii um considering

1146
00:43:49,030 --> 00:43:46,880
the importance of that mission are you

1147
00:43:51,670 --> 00:43:49,040
guys still um do you guys have any

1148
00:43:55,750 --> 00:43:51,680
problems being uh next in line when

1149
00:43:58,630 --> 00:43:55,760
spacex resumes flights well uh spacex

1150
00:44:00,790 --> 00:43:58,640
and nasa are working together to

1151
00:44:03,589 --> 00:44:00,800
understand the problem uh

1152
00:44:05,030 --> 00:44:03,599
that caused the anomaly uh on the the

1153
00:44:07,349 --> 00:44:05,040
previous launch

1154
00:44:09,829 --> 00:44:07,359
and when everyone's happy then we'll set

1155
00:44:12,390 --> 00:44:09,839
a new launch date and

1156
00:44:14,069 --> 00:44:12,400
i i don't have any real new news on that

1157
00:44:15,589 --> 00:44:14,079
i accept to say that everyone's working

1158
00:44:17,109 --> 00:44:15,599
really hard and

1159
00:44:19,910 --> 00:44:17,119
looking forward to

1160
00:44:23,030 --> 00:44:19,920
launching as soon as we can

1161
00:44:25,829 --> 00:44:23,040
as safely as we can

1162
00:44:28,390 --> 00:44:25,839
okay thank you next question is from

1163
00:44:29,190 --> 00:44:28,400

eric nyler at discovery news go ahead

1164
00:44:32,150 --> 00:44:29,200
eric

1165
00:44:34,790 --> 00:44:32,160
hi uh good afternoon everybody um just

1166
00:44:36,870 --> 00:44:34,800
wanted to to get a little context and

1167
00:44:40,309 --> 00:44:36,880
significance of the

1168
00:44:42,230 --> 00:44:40,319
uh recent data from greenland on this 12

1169
00:44:44,790 --> 00:44:42,240
square kilometer

1170
00:44:46,470 --> 00:44:44,800
uh hunk of glacier that

1171
00:44:48,710 --> 00:44:46,480
cracked up

1172
00:44:50,630 --> 00:44:48,720
does this happen every summer is this

1173
00:44:54,230 --> 00:44:50,640
gonna you know

1174
00:44:56,069 --> 00:44:54,240
uh re-freeze this this winter i mean is

1175
00:44:58,309 --> 00:44:56,079
you know what does this mean when we can

1176
00:45:01,190 --> 00:44:58,319
run pictures of it but i need to know

1177
00:45:04,870 --> 00:45:01,200
how big a deal it is and um and and some

1178
00:45:07,430 --> 00:45:04,880
analysis of it

1179
00:45:08,710 --> 00:45:07,440
i i can i can take that uh this is eric

1180
00:45:10,950 --> 00:45:08,720
um

1181
00:45:13,589 --> 00:45:10,960
i think this is a continuing and

1182
00:45:16,470 --> 00:45:13,599
evolving story on jakob seven is very

1183
00:45:19,510 --> 00:45:16,480
the the largest ice stream in green it's

1184
00:45:21,670 --> 00:45:19,520
a major feature in greenland uh the

1185
00:45:23,829 --> 00:45:21,680
retreat started in 2002 it's still

1186
00:45:26,069 --> 00:45:23,839
ongoing and some of the calving events

1187
00:45:28,230 --> 00:45:26,079
that we've seen this this summer which

1188
00:45:29,829 --> 00:45:28,240

are spectacular because they're very big

1189
00:45:31,190 --> 00:45:29,839
and they make the ice front retreat

1190
00:45:33,030 --> 00:45:31,200
farther inland

1191
00:45:36,790 --> 00:45:33,040
they were preceded by similar big

1192
00:45:39,750 --> 00:45:36,800
carving events in 2011 2010

1193
00:45:41,910 --> 00:45:39,760
they are examples of what we are likely

1194
00:45:43,750 --> 00:45:41,920
to see more and more along the coast of

1195
00:45:45,030 --> 00:45:43,760
greenland as the glaciers retreat

1196
00:45:47,349 --> 00:45:45,040
fathering land

1197
00:45:50,470 --> 00:45:47,359
and we are moving into a set of

1198
00:45:52,790 --> 00:45:50,480
processes where we have uh very tall

1199
00:45:54,470 --> 00:45:52,800
carving cliffs that are unstable and

1200
00:45:56,790 --> 00:45:54,480
start fracturing

1201
00:45:58,470 --> 00:45:56,800
and break up into icebergs and

1202
00:45:59,910 --> 00:45:58,480
the ice front of the glacier starts

1203
00:46:02,150 --> 00:45:59,920
retreating in land

1204
00:46:04,069 --> 00:46:02,160
and as a result the glacier has more

1205
00:46:05,510 --> 00:46:04,079
reasons to continue to speed up and

1206
00:46:07,750 --> 00:46:05,520
retreat

1207
00:46:10,630 --> 00:46:07,760
some of this evolution we've we've never

1208
00:46:13,430 --> 00:46:10,640
seen something like this on that scale

1209
00:46:16,069 --> 00:46:13,440
before so what's happening in jakobson

1210
00:46:18,630 --> 00:46:16,079
is extremely important and relevant

1211
00:46:20,309 --> 00:46:18,640
to other pieces of greenland

1212
00:46:23,510 --> 00:46:20,319
and and personally

1213
00:46:25,190 --> 00:46:23,520

i am i am in awe and seeing how fast the

1214
00:46:27,510 --> 00:46:25,200
ice fought the calving fault of these

1215
00:46:28,950 --> 00:46:27,520
glaciers is retweeting england year by

1216
00:46:30,710 --> 00:46:28,960
year

1217
00:46:34,309 --> 00:46:30,720
this big piece of ice that uh

1218
00:46:36,550 --> 00:46:34,319
disappeared a few weeks ago is is not

1219
00:46:38,710 --> 00:46:36,560
going to be replaced easily by some

1220
00:46:40,950 --> 00:46:38,720
re-advance over the winter

1221
00:46:42,950 --> 00:46:40,960
we're seeing a continuous retreat of

1222
00:46:44,950 --> 00:46:42,960
this size front is of course modulated

1223
00:46:46,550 --> 00:46:44,960
by seasonal variations

1224
00:46:48,390 --> 00:46:46,560
so you have some oscillations around the

1225
00:46:50,150 --> 00:46:48,400
mean position but the ice front is

1226
00:46:52,230 --> 00:46:50,160
clearly retreating

1227
00:46:56,230 --> 00:46:52,240
on a steady rate inland into these

1228
00:47:00,550 --> 00:46:59,030
okay thank you our next question is from

1229
00:47:01,829 --> 00:47:00,560
jerry hume

1230
00:47:03,349 --> 00:47:01,839
go ahead jerry

1231
00:47:05,349 --> 00:47:03,359
hi yes uh

1232
00:47:06,790 --> 00:47:05,359
i'm with news 13 here in orlando so

1233
00:47:08,870 --> 00:47:06,800
florida was mentioned at the beginning

1234
00:47:10,550 --> 00:47:08,880
of the conference call i just was

1235
00:47:12,550 --> 00:47:10,560
wondering what this research means for

1236
00:47:14,950 --> 00:47:12,560
florida's coastline in the next century

1237
00:47:19,510 --> 00:47:14,960
and what should people do now

1238
00:47:26,150 --> 00:47:22,550

okay steve do you want to take that one

1239
00:47:27,510 --> 00:47:26,160
sure um you know so florida's is

1240
00:47:29,750 --> 00:47:27,520
probably one of the more vulnerable

1241
00:47:30,950 --> 00:47:29,760
areas in the country for sea level rises

1242
00:47:31,829 --> 00:47:30,960
as you know

1243
00:47:33,990 --> 00:47:31,839
and

1244
00:47:36,230 --> 00:47:34,000
you know right now we're we're saying

1245
00:47:37,990 --> 00:47:36,240
that you know we've committed to

1246
00:47:41,190 --> 00:47:38,000
probably more than three feet of sea

1247
00:47:42,950 --> 00:47:41,200
level rise um just based on uh the

1248
00:47:44,069 --> 00:47:42,960
warming we've had so far

1249
00:47:51,270 --> 00:47:44,079
so

1250
00:47:54,309 --> 00:47:51,280
the areas in florida because of the

1251
00:47:55,910 --> 00:47:54,319
limestone that it's built on so i think

1252
00:47:58,230 --> 00:47:55,920
this is uh

1253
00:48:00,230 --> 00:47:58,240
in a way this is a you know kind of a

1254
00:48:02,069 --> 00:48:00,240
a warning call for you guys down there

1255
00:48:03,670 --> 00:48:02,079
that that florida needs to start

1256
00:48:05,670 --> 00:48:03,680
thinking about how it's going to deal

1257
00:48:07,510 --> 00:48:05,680
with this sea level rise that's sure to

1258
00:48:09,510 --> 00:48:07,520
come

1259
00:48:12,390 --> 00:48:09,520
okay and my other question was how does

1260
00:48:20,710 --> 00:48:12,400
the combination of sea levels and

1261
00:48:25,510 --> 00:48:22,230
hey this is tom so one of the things

1262
00:48:27,670 --> 00:48:25,520
that happens is again as sea levels rise

1263
00:48:30,069 --> 00:48:27,680

the storm surge goes higher up on the

1264
00:48:31,670 --> 00:48:30,079
coast and causes more damage i kind of

1265
00:48:33,430 --> 00:48:31,680
will point out too that this is

1266
00:48:34,950 --> 00:48:33,440
significant enough that nasa kennedy

1267
00:48:36,630 --> 00:48:34,960
space center actually has an aggressive

1268
00:48:38,230 --> 00:48:36,640
program to deal with this

1269
00:48:40,230 --> 00:48:38,240
it's to the point where they've actually

1270
00:48:41,510 --> 00:48:40,240
created a map of the center to go and

1271
00:48:43,109 --> 00:48:41,520
figure out what areas they're going to

1272
00:48:44,069 --> 00:48:43,119
have to sacrifice and lose and what

1273
00:48:46,309 --> 00:48:44,079
areas they're going to be able to

1274
00:48:48,230 --> 00:48:46,319
continue to use so they can launch into

1275
00:48:50,390 --> 00:48:48,240
the next century and if you look up on

1276
00:48:51,990 --> 00:48:50,400
nasa's earth observatory site you can

1277
00:48:53,510 --> 00:48:52,000
actually see a story about this right

1278
00:48:55,349 --> 00:48:53,520
now

1279
00:48:57,349 --> 00:48:55,359
all right thank you

1280
00:49:01,109 --> 00:48:57,359
thank you our next question comes from

1281
00:49:02,710 --> 00:49:01,119
tim folger national geographic online

1282
00:49:04,069 --> 00:49:02,720
go ahead hi thank you

1283
00:49:05,670 --> 00:49:04,079
thank you um

1284
00:49:07,030 --> 00:49:05,680
is it known why antarctica's

1285
00:49:08,549 --> 00:49:07,040
contribution to

1286
00:49:11,030 --> 00:49:08,559
sea level rise has been less than

1287
00:49:12,630 --> 00:49:11,040
greenland's and one other possibly

1288
00:49:15,109 --> 00:49:12,640

related question

1289
00:49:16,710 --> 00:49:15,119
are we likely to see an acceleration of

1290
00:49:18,390 --> 00:49:16,720
ice loss

1291
00:49:20,390 --> 00:49:18,400
with less light being reflected back

1292
00:49:21,670 --> 00:49:20,400
into space and more light being absorbed

1293
00:49:27,430 --> 00:49:21,680
by the

1294
00:49:32,069 --> 00:49:30,230
eric would you like to address that one

1295
00:49:33,510 --> 00:49:32,079
uh i i'm not sure what caught the first

1296
00:49:34,950 --> 00:49:33,520
part of the question why is antarctica

1297
00:49:36,309 --> 00:49:34,960
contributing less than greenland was

1298
00:49:37,430 --> 00:49:36,319
that defense yes

1299
00:49:38,390 --> 00:49:37,440
yeah

1300
00:49:41,910 --> 00:49:38,400
all in

1301
00:49:45,190 --> 00:49:41,920
in greenland we have a response of

1302
00:49:46,790 --> 00:49:45,200
almost the entire ice sheet to

1303
00:49:48,549 --> 00:49:46,800
ongoing warming

1304
00:49:51,109 --> 00:49:48,559
in antarctica

1305
00:49:54,870 --> 00:49:51,119
we have leakage of ice only from a few

1306
00:49:56,710 --> 00:49:54,880
sectors italica is a very big place and

1307
00:49:59,030 --> 00:49:56,720
in fact i would turn it around and say

1308
00:50:02,470 --> 00:49:59,040
that with only these few sectors of

1309
00:50:04,549 --> 00:50:02,480
antarctica contributing right now

1310
00:50:06,390 --> 00:50:04,559
it's almost comparable to what's

1311
00:50:08,150 --> 00:50:06,400
happening to greenland and we know that

1312
00:50:10,390 --> 00:50:08,160
in the future if

1313
00:50:11,510 --> 00:50:10,400

more parts of antarctica react to

1314
00:50:13,030 --> 00:50:11,520
warming

1315
00:50:15,589 --> 00:50:13,040
the signal from antarctica will

1316
00:50:17,910 --> 00:50:15,599
obviously overwhelm what's happening uh

1317
00:50:19,270 --> 00:50:17,920
in greenland

1318
00:50:20,630 --> 00:50:19,280
the second part of the question could

1319
00:50:22,790 --> 00:50:20,640
you

1320
00:50:23,829 --> 00:50:22,800
yes the second part of the question was

1321
00:50:26,150 --> 00:50:23,839
are we

1322
00:50:27,430 --> 00:50:26,160
likely to see an acceleration of ice

1323
00:50:29,750 --> 00:50:27,440
loss

1324
00:50:32,549 --> 00:50:29,760
in the decades ahead we're not likely to

1325
00:50:35,829 --> 00:50:32,559
see it we are seeing it right now

1326
00:50:37,510 --> 00:50:35,839
in fact this this whole discussion is is

1327
00:50:39,109 --> 00:50:37,520
about sea level rise

1328
00:50:42,230 --> 00:50:39,119
rising now we're not talking about

1329
00:50:44,630 --> 00:50:42,240
futuristic scenarios sea level rise is

1330
00:50:46,390 --> 00:50:44,640
rising one foot per century and we're

1331
00:50:48,549 --> 00:50:46,400
talking about the possibility of this

1332
00:50:50,549 --> 00:50:48,559
being three feet by century or even 30

1333
00:50:53,670 --> 00:50:50,559
feet per century if the ice sheets were

1334
00:50:56,710 --> 00:50:53,680
to decay in a very rapid mode

1335
00:50:58,630 --> 00:50:56,720
the acceleration we can see it with

1336
00:51:01,109 --> 00:50:58,640
the grace record we can see it with the

1337
00:51:02,950 --> 00:51:01,119
longer records combining the speed of

1338
00:51:03,829 --> 00:51:02,960

the glaciers with surface mass balance

1339
00:51:05,670 --> 00:51:03,839
model

1340
00:51:06,630 --> 00:51:05,680
the ice sheets are contributing

1341
00:51:09,109 --> 00:51:06,640
more

1342
00:51:11,270 --> 00:51:09,119
every year to sea level rise and we know

1343
00:51:13,190 --> 00:51:11,280
that this trend will only continue

1344
00:51:15,990 --> 00:51:13,200
there's no reason to expect that the ice

1345
00:51:17,990 --> 00:51:16,000
sheets will melt in the linear fashion

1346
00:51:20,710 --> 00:51:18,000
we know from physics that they will

1347
00:51:23,030 --> 00:51:20,720
react to warming in a long linear

1348
00:51:25,510 --> 00:51:23,040
fashion meaning the melting of ice

1349
00:51:27,990 --> 00:51:25,520
sheets will keep increasing faster and

1350
00:51:30,069 --> 00:51:28,000
faster with time and that's why some of

1351
00:51:31,990 --> 00:51:30,079
the measurements collected by nasa and

1352
00:51:35,109 --> 00:51:32,000
other agencies right now

1353
00:51:37,510 --> 00:51:35,119
are an important red flag on what's

1354
00:51:39,270 --> 00:51:37,520
about to come which is going to be much

1355
00:51:42,390 --> 00:51:39,280
larger than what we've been witnessing

1356
00:51:44,150 --> 00:51:42,400
in the past 20 30 years

1357
00:51:45,430 --> 00:51:44,160
hey just to add together this is tom

1358
00:51:47,109 --> 00:51:45,440
your question i know you were also

1359
00:51:49,270 --> 00:51:47,119
interested in the loss of sea ice and

1360
00:51:50,630 --> 00:51:49,280
the change of albedo that is one of the

1361
00:51:52,150 --> 00:51:50,640
things that we work on in the arctic

1362
00:51:53,670 --> 00:51:52,160
ocean is there is warming that gets

1363
00:51:55,430 --> 00:51:53,680

associated with that it's kind of a

1364
00:51:56,870 --> 00:51:55,440
complicated problem though too because

1365
00:51:59,349 --> 00:51:56,880
when you don't have ice on the surface

1366
00:52:00,549 --> 00:51:59,359
you can let more heat out of the ocean

1367
00:52:02,150 --> 00:52:00,559
and that's kind of the cutting edge of

1368
00:52:04,470 --> 00:52:02,160
the research looking at the relation

1369
00:52:06,309 --> 00:52:04,480
between changes in sea ice cover changes

1370
00:52:08,069 --> 00:52:06,319
in ocean temperatures and then also

1371
00:52:11,349 --> 00:52:08,079
connecting that up to the changes in the

1372
00:52:13,430 --> 00:52:11,359
land-based ice that's around those

1373
00:52:15,990 --> 00:52:13,440
okay thanks our next question is from

1374
00:52:18,309 --> 00:52:16,000
jonathan amos bbc

1375
00:52:20,710 --> 00:52:18,319
go ahead hi steve thanks uh very much

1376
00:52:22,870 --> 00:52:20,720
for that a couple of questions uh if i

1377
00:52:23,670 --> 00:52:22,880
may first one can somebody explain to me

1378
00:52:32,790 --> 00:52:23,680
the

1379
00:52:34,710 --> 00:52:32,800
ocean mass is that is that a function of

1380
00:52:36,470 --> 00:52:34,720
thermal expansion what's the difference

1381
00:52:39,190 --> 00:52:36,480
between those two rates

1382
00:52:41,589 --> 00:52:39,200
yeah the two rates this is steve uh

1383
00:52:43,670 --> 00:52:41,599
so you know the sea level is really the

1384
00:52:45,990 --> 00:52:43,680
primary causes of the rise the total

1385
00:52:47,430 --> 00:52:46,000
rise is thermal expansion and then the

1386
00:52:49,990 --> 00:52:47,440
melting of ice whether it be from

1387
00:52:52,069 --> 00:52:50,000
glaciers or from the big ice sheets

1388
00:52:53,910 --> 00:52:52,079

and so the difference in those curves

1389
00:52:56,309 --> 00:52:53,920
there is is simply due to thermal

1390
00:52:58,950 --> 00:52:56,319
expansion mainly

1391
00:53:01,510 --> 00:52:58,960
right and my second question is uh is a

1392
00:53:03,589 --> 00:53:01,520
programmatic one and um i don't know if

1393
00:53:06,069 --> 00:53:03,599
it was a question more directed at mike

1394
00:53:07,190 --> 00:53:06,079
but um i know josh may be able to have a

1395
00:53:10,790 --> 00:53:07,200
go at

1396
00:53:13,670 --> 00:53:10,800
this in in europe uh jason is is being

1397
00:53:15,349 --> 00:53:13,680
re-badged sentinel has been

1398
00:53:17,510 --> 00:53:15,359
essentially wrapped into the the

1399
00:53:19,349 --> 00:53:17,520
copernicus program

1400
00:53:21,109 --> 00:53:19,359
here what does that mean for the

1401
00:53:22,069 --> 00:53:21,119
american partnership

1402
00:53:28,069 --> 00:53:22,079
in that

1403
00:53:32,390 --> 00:53:29,750
hi this is josh

1404
00:53:35,190 --> 00:53:32,400
we still certainly want to uh play a

1405
00:53:37,430 --> 00:53:35,200
role in uh the future of satellite

1406
00:53:40,309 --> 00:53:37,440
altimetry uh and i believe there are

1407
00:53:42,870 --> 00:53:40,319
still discussions uh underway about

1408
00:53:44,470 --> 00:53:42,880
exactly what that role will be

1409
00:53:46,470 --> 00:53:44,480
but uh

1410
00:53:48,790 --> 00:53:46,480
you know we still have a very strong and

1411
00:53:51,270 --> 00:53:48,800
vigorous science team which analyzes

1412
00:53:52,870 --> 00:53:51,280
satellite altimetry data which is funded

1413
00:53:55,589 --> 00:53:52,880

by nasa and

1414
00:53:58,710 --> 00:53:55,599
and the french space agency canes

1415
00:53:59,910 --> 00:53:58,720
and we expect to continue to fund a lot

1416
00:54:01,990 --> 00:53:59,920
of science

1417
00:54:04,549 --> 00:54:02,000
and also make contributions to this

1418
00:54:06,790 --> 00:54:04,559
mission uh but uh i think the details

1419
00:54:08,150 --> 00:54:06,800
are are still forthcoming on what

1420
00:54:10,230 --> 00:54:08,160
exactly the contribution the u.s

1421
00:54:12,230 --> 00:54:10,240
contribution will be for uh for the

1422
00:54:15,030 --> 00:54:12,240
jason cs mission

1423
00:54:16,950 --> 00:54:15,040
right okay thanks

1424
00:54:19,030 --> 00:54:16,960
okay our next question is from amy green

1425
00:54:20,390 --> 00:54:19,040
at wmfe

1426
00:54:23,349 --> 00:54:20,400
go ahead amy

1427
00:54:24,870 --> 00:54:23,359
oh hi there um i am calling from orlando

1428
00:54:27,670 --> 00:54:24,880
i wondered if you could elaborate a

1429
00:54:29,190 --> 00:54:27,680
little bit more on florida's picture in

1430
00:54:30,309 --> 00:54:29,200
the future

1431
00:54:31,990 --> 00:54:30,319
you say

1432
00:54:34,549 --> 00:54:32,000
florida is one of the most vulnerable

1433
00:54:36,790 --> 00:54:34,559
places in the country for sea level rise

1434
00:54:39,670 --> 00:54:36,800
what are the forces that are combining

1435
00:54:41,430 --> 00:54:39,680
to create that unique

1436
00:54:43,910 --> 00:54:41,440
situation for florida certainly there

1437
00:54:46,710 --> 00:54:43,920
are other popular states like california

1438
00:54:48,790 --> 00:54:46,720

and texas with large coastlines alaska

1439
00:54:50,870 --> 00:54:48,800
of course is is

1440
00:54:52,870 --> 00:54:50,880
is very vulnerable what is unique about

1441
00:54:55,109 --> 00:54:52,880
florida's situation

1442
00:54:57,109 --> 00:54:55,119
uh this is steve uh it's very simple

1443
00:54:59,109 --> 00:54:57,119
just the the elevations of florida are

1444
00:54:59,990 --> 00:54:59,119
very low compared to those other places

1445
00:55:00,870 --> 00:55:00,000
so

1446
00:55:03,349 --> 00:55:00,880
um

1447
00:55:05,190 --> 00:55:03,359
so sea level rises the the amount of

1448
00:55:07,190 --> 00:55:05,200
land that will be

1449
00:55:09,270 --> 00:55:07,200
inundated is much bigger

1450
00:55:11,990 --> 00:55:09,280
than in a lot of other places around the

1451
00:55:15,510 --> 00:55:14,390
i would just uh add to that very quickly

1452
00:55:18,470 --> 00:55:15,520
that

1453
00:55:21,670 --> 00:55:18,480
florida also is a very the land on which

1454
00:55:24,470 --> 00:55:21,680
florida sits is uh very porous and so

1455
00:55:28,470 --> 00:55:24,480
sea level is or salt water is able to

1456
00:55:30,390 --> 00:55:28,480
intrude uh underneath uh and uh in in

1457
00:55:32,230 --> 00:55:30,400
toward the fresh water supply a little

1458
00:55:35,670 --> 00:55:32,240
more rapidly in florida because of the

1459
00:55:38,309 --> 00:55:35,680
the porous land

1460
00:55:42,309 --> 00:55:40,870
okay thank you i've got uh time for one

1461
00:55:45,750 --> 00:55:42,319
last question here it's from social

1462
00:55:47,990 --> 00:55:45,760
media um if all the land ice melted on

1463
00:55:51,030 --> 00:55:48,000

the planet how high would sea level rise

1464
00:55:54,150 --> 00:55:51,040
kind of a worst case scenario

1465
00:55:55,829 --> 00:55:54,160
is there a number for that eric

1466
00:55:58,549 --> 00:55:55,839
um

1467
00:56:03,910 --> 00:55:58,559
i think it's in the range of 60 meters

1468
00:56:07,589 --> 00:56:05,589
okay

1469
00:56:10,150 --> 00:56:07,599
thank you well that's all the uh

1470
00:56:12,390 --> 00:56:10,160
questions so we'll wrap it up a couple

1471
00:56:15,430 --> 00:56:12,400
of program notes and links for everybody

1472
00:56:16,870 --> 00:56:15,440
uh this friday at one o'clock eastern

1473
00:56:19,430 --> 00:56:16,880
goddard space flight center will be

1474
00:56:21,030 --> 00:56:19,440
hosting a live television program about

1475
00:56:23,589 --> 00:56:21,040
nasa's research

1476
00:56:24,470 --> 00:56:23,599
in and on the massive greenland ice

1477
00:56:26,390 --> 00:56:24,480
sheet

1478
00:56:28,549 --> 00:56:26,400
the event will feature scientists who

1479
00:56:30,630 --> 00:56:28,559
have been actively conducting field work

1480
00:56:32,470 --> 00:56:30,640
in greenland this summer with some

1481
00:56:34,230 --> 00:56:32,480
extensive video footage of the work

1482
00:56:36,309 --> 00:56:34,240
they've been performing

1483
00:56:40,470 --> 00:56:36,319
to watch that it'll be streamed online

1484
00:56:45,030 --> 00:56:42,549
nasa tv

1485
00:56:47,030 --> 00:56:45,040
also we've set up a website that will be

1486
00:56:49,510 --> 00:56:47,040
collecting all the materials we're

1487
00:56:51,670 --> 00:56:49,520
putting out about the rising seas this

1488
00:56:52,950 --> 00:56:51,680

week including uh materials from this

1489
00:56:56,470 --> 00:56:52,960
press briefing

1490
00:56:57,510 --> 00:56:56,480
that url is www.nasa.gov

1491
00:56:59,589 --> 00:56:57,520
slash

1492
00:57:02,390 --> 00:56:59,599
rising seas

1493
00:57:05,589 --> 00:57:02,400
and you can follow all the activities on

1494
00:57:07,190 --> 00:57:05,599
social media on two new social media

1495
00:57:09,589 --> 00:57:07,200
accounts from nasa

1496
00:57:12,390 --> 00:57:09,599
called nasa c level we have both a

1497
00:57:13,430 --> 00:57:12,400
twitter and a facebook account that just

1498
00:57:14,549 --> 00:57:13,440
went live

1499
00:57:17,430 --> 00:57:14,559
this week

1500
00:57:20,230 --> 00:57:17,440
and referring back to the

1501
00:57:21,829 --> 00:57:20,240
web page where graphics are for this

1502
00:57:24,390 --> 00:57:21,839
press briefing

1503
00:57:26,470 --> 00:57:24,400
during the call we added a link to the

1504
00:57:29,750 --> 00:57:26,480
top of that page if you want to look at

1505
00:57:30,870 --> 00:57:29,760
that page under for more information we

1506
00:57:32,630 --> 00:57:30,880
now have

1507
00:57:34,950 --> 00:57:32,640
a link

1508
00:57:37,750 --> 00:57:34,960
titled sea level rise

1509
00:57:39,510 --> 00:57:37,760
video resources a lot of downloadable

1510
00:57:41,589 --> 00:57:39,520
high definition

1511
00:57:44,549 --> 00:57:41,599
footage and clips there

1512
00:57:46,549 --> 00:57:44,559
from both data animations and some of

1513
00:57:49,270 --> 00:57:46,559

the activity that has been going on in

1514
00:57:50,630 --> 00:57:49,280
greenland and just to repeat that url so

1515
00:57:53,990 --> 00:57:50,640
everyone has it

1516
00:57:55,670 --> 00:57:54,000
it is go.nasa.gov

1517
00:57:59,190 --> 00:57:55,680
slash

1518
00:58:01,190 --> 00:57:59,200
rising seas briefing

1519
00:58:04,069 --> 00:58:01,200
so that comes to the end of our briefing

1520
00:58:05,589 --> 00:58:04,079
today thank you everybody for listening

1521
00:58:06,789 --> 00:58:05,599
have a good day

1522
00:58:08,390 --> 00:58:06,799
bye-bye

1523
00:58:10,390 --> 00:58:08,400
thank you for your participation in