
ORACLES
OBSERVATIONS OF CLOUDS ABOVE AEROSOLS AND THEIR INTERACTIONS

1
00:00:02,100 --> 00:00:03,710
Welcome to Earth Expeditions

2
00:00:03,710 --> 00:00:06,260
our time to tell you about all these fantastic

3
00:00:06,260 --> 00:00:07,260
Hey Tom!

4
00:00:07,260 --> 00:00:08,640
What do you think?

5
00:00:08,640 --> 00:00:09,660
I like it!

6
00:00:09,660 --> 00:00:10,541
I'm ready to

7
00:00:10,541 --> 00:00:11,945
go to the Great Barrier Reef.

8
00:00:11,950 --> 00:00:13,750
Me too I got my snorkel!

9
00:00:13,750 --> 00:00:15,970
Guys we're not going to the Great Barrier Reef.

10
00:00:16,040 --> 00:00:18,030
You said we're going in the ocean this week!

11
00:00:18,180 --> 00:00:21,680
I said we need more emotion

12
00:00:21,680 --> 00:00:23,310
I thought you said grab your wetsuit we're gonna go study coral reefs

13
00:00:23,310 --> 00:00:24,670

in the Great Barrier Reef in Australia.

14
00:00:24,670 --> 00:00:26,660
Alright I guess we're stuck here again.

15
00:00:26,660 --> 00:00:29,610
Yeah! We're back in the studio.

16
00:00:29,610 --> 00:00:31,699
We'lll still tell you that all the really cool

17
00:00:32,699 --> 00:00:33,699
research that's happening in the Great

18
00:00:33,699 --> 00:00:35,159
Barrier Reef, southern Africa and

19
00:00:35,159 --> 00:00:37,449
Greenland through our technology like

20
00:00:37,449 --> 00:00:40,739
video cameras.

21
00:00:40,739 --> 00:00:43,019
Welcome to Earth Expeditions

22
00:00:43,019 --> 00:01:02,699
[MUSIC]

23
00:01:03,100 --> 00:01:06,189
At NASA we know our world is changing

24
00:01:06,189 --> 00:01:08,220
and we're on it in the field up in the

25
00:01:08,220 --> 00:01:10,190
sky in the ocean and on-the-ground

26
00:01:10,190 --> 00:01:12,230
basically all around. From the Great

27
00:01:12,230 --> 00:01:14,060
Barrier Reef to the clouds above Africa

28
00:01:14,060 --> 00:01:16,170
to the receding glaciers of Greenland.

29
00:01:16,170 --> 00:01:17,502
NASA Earth scientists are collecting the

30
00:01:17,502 --> 00:01:19,729
data to help us understand how the world

31
00:01:19,729 --> 00:01:21,369
is an interconnected system and how we

32
00:01:21,369 --> 00:01:24,831
can improve our lives.

33
00:01:24,840 --> 00:01:26,840
produces almost a third of the world's

34
00:01:26,840 --> 00:01:28,700
vegetative burning would send smoke

35
00:01:28,700 --> 00:01:30,780
particles up into the atmosphere where

36
00:01:30,780 --> 00:01:32,890
they eventually mix with stratocumulus

37
00:01:32,890 --> 00:01:35,670
clouds over southeastern Atlantic Ocean

38
00:01:35,670 --> 00:01:37,950

our team observations of clouds above

39
00:01:37,950 --> 00:01:40,020
aerosols and their interactions or

40
00:01:40,020 --> 00:01:42,299
ORACLES as we call them is checking out

41
00:01:42,299 --> 00:01:45,079
clouds above Africa with some pretty amazing aircraft.

42
00:01:45,160 --> 00:01:48,200
My name is Jens Redemann I'm the principal investigator

43
00:01:48,399 --> 00:01:51,080
for the ORACLES project and I work for

44
00:01:51,080 --> 00:01:53,030
the NASA Ames Research Center in Moffett

45
00:01:53,030 --> 00:01:55,140
Field California the ORACLES mission

46
00:01:55,140 --> 00:01:59,039
is a five-year project in which we're

47
00:01:59,039 --> 00:02:01,579
going to fly two research aircraft in 2016

48
00:02:01,580 --> 00:02:05,240
and one research aircraft in 2017 and 18

49
00:02:05,420 --> 00:02:08,720
- each from Namibia to study the

50
00:02:09,390 --> 00:02:11,290
interaction of biomass burning emissions

51
00:02:11,290 --> 00:02:13,750
and low-level clouds over the southeast

52
00:02:13,750 --> 00:02:15,740
Atlantic. There's a long list of reasons

53
00:02:15,740 --> 00:02:18,160
why we're working here in Namibia.

54
00:02:18,160 --> 00:02:20,240
The ER-2 aircraft that you see behind me

55
00:02:20,240 --> 00:02:23,640
actually requires a very long runway and

56
00:02:23,640 --> 00:02:25,420
a large hangar so that the instruments

57
00:02:25,420 --> 00:02:28,500
can be opened up and properly maintained

58
00:02:28,500 --> 00:02:30,020
after each one of their flights

59
00:02:30,020 --> 00:02:31,990
it's also the only access point to the

60
00:02:31,990 --> 00:02:34,030
southeast Atlantic really from which we

61
00:02:34,030 --> 00:02:36,500
can fly and reach far into the southeast

62
00:02:36,500 --> 00:02:38,960
Atlantic basin. So we're studying a very

63
00:02:38,960 --> 00:02:42,070

unique system the low-level cumulus

64
00:02:42,070 --> 00:02:44,370
clouds are not unique to the southeast

65
00:02:44,370 --> 00:02:47,830
Atlantic but the fact that they're

66
00:02:47,830 --> 00:02:49,360
coexisting with biomass burning

67
00:02:49,360 --> 00:02:51,610
emissions at altitude is very unique to

68
00:02:51,610 --> 00:02:53,740
the southeast Atlantic and gives us the

69
00:02:53,740 --> 00:02:59,840
opportunity to study the interactions of
aerosol particles with these clouds.

70
00:02:59,840 --> 00:03:03,310
And these interactions actually are some

71
00:03:03,310 --> 00:03:05,210
of the largest remaining uncertainties

72
00:03:05,210 --> 00:03:08,650
in how humans effect climate.

73
00:03:08,650 --> 00:03:10,790
We think that the data is useful in two ways first off

74
00:03:10,790 --> 00:03:12,510
there really no observations of these

75
00:03:12,510 --> 00:03:14,240
aerosol particles in the southeast

76
00:03:14,240 --> 00:03:16,230
Atlantic because they usually over late

77
00:03:16,230 --> 00:03:18,540
he's very bright clouds and the

78
00:03:18,540 --> 00:03:20,660
satellite information that we gather

79
00:03:20,660 --> 00:03:22,460
don't quite give us all the details that

80
00:03:22,460 --> 00:03:26,290
we need in order to study their effects.

81
00:03:26,290 --> 00:03:28,180
The other thing is that these effects

82
00:03:28,180 --> 00:03:29,820
and interactions between aerosol

83
00:03:29,820 --> 00:03:31,560
particles and cloud particles really go

84
00:03:31,560 --> 00:03:33,770
on globally and climate modelers

85
00:03:33,770 --> 00:03:35,240
struggle mightily with with

86
00:03:35,240 --> 00:03:37,290
parameterizing them and putting them

87
00:03:37,290 --> 00:03:39,600
into their global climate models so

88

00:03:39,600 --> 00:03:43,460
implicitly we hope to have an impact on

89
00:03:43,460 --> 00:03:44,470
on the predictions of future

90
00:03:44,470 --> 00:03:47,090
anthropogenic impact on climate the

91
00:03:47,090 --> 00:03:50,000
Namibia has been most welcoming we

92
00:03:50,000 --> 00:03:52,440
have been welcomed with open arms

93
00:03:52,440 --> 00:03:54,330
the infrastructure is terrific the

94
00:03:54,330 --> 00:03:57,470
airport has been recently renovated and

95
00:03:57,470 --> 00:04:00,210
gives us a perfect infrastructure really

96
00:04:00,210 --> 00:04:01,210
but it's really good

97
00:04:01,210 --> 00:04:03,290
the welcoming by by the University and

98
00:04:03,290 --> 00:04:05,340
and research types in the country that

99
00:04:05,340 --> 00:04:08,660
has has has made this little bit special.

100
00:04:08,660 --> 00:04:10,590
We're very excited to be here pulling

101
00:04:10,590 --> 00:04:12,450
off a research effort halfway around the

102
00:04:12,450 --> 00:04:15,840
world is always difficult and we haven't

103
00:04:15,840 --> 00:04:18,209
been able to do it with a lot of support

104
00:04:18,209 --> 00:04:20,959
from the Namibian government entities and

105
00:04:20,959 --> 00:04:22,720
a lot of local researchers and and

106
00:04:22,720 --> 00:04:25,250
support and we couldn't be more excited

107
00:04:25,250 --> 00:04:26,490
to be here.

108
00:04:26,490 --> 00:04:28,480
[MUSIC STING]

109
00:04:28,490 --> 00:04:30,160
The ORACLES mission is going after one of the most important

110
00:04:30,160 --> 00:04:31,620
questions and understanding the Earth's

111
00:04:31,620 --> 00:04:33,630
climate system which is how to stuff we

112
00:04:33,630 --> 00:04:35,890
burn effect how clouds form.

113

00:04:35,890 --> 00:04:37,070
Yeah and it's

114
00:04:37,070 --> 00:04:39,130
really cool because in these like

115
00:04:39,130 --> 00:04:40,990
intricate missions you have so many team

116
00:04:40,990 --> 00:04:42,340
members who put in so much effort to

117
00:04:42,340 --> 00:04:43,340
make it happen

118
00:04:43,340 --> 00:04:44,540
yeah like most people think oh it's just

119
00:04:44,540 --> 00:04:45,970
a bunch of scientists right but you've

120
00:04:45,970 --> 00:04:47,440
got everything for mechanics that

121
00:04:47,440 --> 00:04:49,000
keeping the plane flying to the

122
00:04:49,000 --> 00:04:50,320
technicians tweak and all the

123
00:04:50,320 --> 00:04:51,320
instruments

124
00:04:51,320 --> 00:04:52,690
although even through the people who are

125
00:04:52,690 --> 00:04:54,160
doing things like getting the data

126
00:04:54,160 --> 00:04:55,880
together and putting it up on the web

127
00:04:55,880 --> 00:04:57,340
yeah and then you also have science

128
00:04:57,340 --> 00:04:59,040
writers like me and then you have your

129
00:04:59,040 --> 00:05:00,040
copy editors

130
00:05:00,040 --> 00:05:02,180
like you're saying your IT specialist is all

131
00:05:02,180 --> 00:05:03,750
this information we have to make it

132
00:05:03,750 --> 00:05:05,630
understandable for the public and then

133
00:05:05,630 --> 00:05:06,910
you also have the people have to take

134
00:05:06,910 --> 00:05:08,350
care of the people in the field with my

135
00:05:08,350 --> 00:05:10,210
accommodation, and the food, and the

136
00:05:10,210 --> 00:05:11,810
toilet paper and everything that they need.

137
00:05:11,810 --> 00:05:13,090
Yeah, it's a big team and you got to

138

00:05:13,090 --> 00:05:15,290
take care of it is and actually uh one

139
00:05:15,290 --> 00:05:17,450
of my favorite team members doesn't have
a pulse

140
00:05:17,450 --> 00:05:20,260
it's actually the coral missions G-IV.

141
00:05:20,290 --> 00:05:22,830
So let's go check in and fly like G-IV!

142
00:05:22,830 --> 00:06:16,800
[MUSIC\}

143
00:06:17,440 --> 00:06:19,180
Like we said before NASA Airborne

144
00:06:19,180 --> 00:06:20,680
Science is all over the world and we've

145
00:06:20,680 --> 00:06:23,210
got a mission continuing in the frozen
north

146
00:06:23,210 --> 00:06:24,260
checking out the melting glaciers of

147
00:06:24,260 --> 00:06:26,840
Greenland, flying out of Keflavik Iceland.

148
00:06:26,840 --> 00:06:28,160
Team OMG.

149
00:06:28,400 --> 00:06:31,040
I'm Josh Willis, I'm a climate scientist at the Jet Propulsion

150

00:06:31,040 --> 00:06:32,990
Laboratory and right now i'm in

151
00:06:32,990 --> 00:06:35,400
Keflavík, Iceland in front of the

152
00:06:35,400 --> 00:06:38,810
Gulfstream Three, which we're using to conduct

153
00:06:38,810 --> 00:06:41,270
a survey for Oceans Melting Greenland.

154
00:06:41,270 --> 00:06:43,040
We have a series of points laid out where

155
00:06:43,040 --> 00:06:45,389
we would like to collect data and find

156
00:06:45,389 --> 00:06:47,580
large we fly over those points and drop

157
00:06:47,580 --> 00:06:49,020
when we're right above them

158
00:06:49,020 --> 00:06:51,340
however in some places where ice or

159
00:06:51,340 --> 00:06:54,360
clouds are a factor we relocate our

160
00:06:54,360 --> 00:06:56,260
points in order to find open water

161
00:06:56,260 --> 00:06:58,389
that's clear where we know we're not

162
00:06:58,389 --> 00:07:00,740
dropping on top of a ship or anything

163
00:07:00,740 --> 00:07:03,389
and we're able to drop through an area

164
00:07:03,389 --> 00:07:06,110
without sea ice. So in fact when we have

165
00:07:06,110 --> 00:07:08,639
to change quickly because there's sea

166
00:07:08,639 --> 00:07:12,060
ice conditions or clouds in our drop point.

167
00:07:12,060 --> 00:07:14,419
We look out the window and look for

168
00:07:14,419 --> 00:07:16,870
places where we see clear open water and

169
00:07:16,870 --> 00:07:19,240
clear skies just above it and we drop in

170
00:07:19,240 --> 00:07:21,990
those so the team is sometimes targeting

171
00:07:21,990 --> 00:07:25,290
in real time trying to find places that

172
00:07:25,290 --> 00:07:28,520
are close to our original plan drops but

173
00:07:28,520 --> 00:07:29,980
not quite there

174
00:07:29,980 --> 00:07:31,770
we've set up for different primary

175

00:07:31,770 --> 00:07:33,540
locations for collecting the

176
00:07:33,540 --> 00:07:36,740
observations for OMG because of the

177
00:07:36,740 --> 00:07:39,860
range of the aircraft and the way the

178
00:07:39,860 --> 00:07:42,070
survey plans spreads out the ocean

179
00:07:42,070 --> 00:07:44,080
measurements we really have to operate

180
00:07:44,080 --> 00:07:46,820
out of bases that are nearby and collect

181
00:07:46,820 --> 00:07:49,140
data that is not too long a trip for the

182
00:07:49,140 --> 00:07:51,650
plane if we spend a lot of fuel flying

183
00:07:51,650 --> 00:07:54,110
out and flying back then that means we

184
00:07:54,110 --> 00:07:56,449
have less fuel to actually drop the

185
00:07:56,449 --> 00:07:59,570
probes and collect data. So we've partition

186
00:07:59,570 --> 00:08:01,960
Greenland essentially into four pieces

187
00:08:01,960 --> 00:08:08,050
north and south and east and west

we began by surveying the southwest

188
00:08:08,050 --> 00:08:10,199
part of Greenland and we operated out of

189
00:08:10,199 --> 00:08:12,460
Kangerlussuaq walk we also dropped some

190
00:08:12,460 --> 00:08:15,860
probes on the way over when we flew from

191
00:08:15,860 --> 00:08:17,800
Bangor, Maine to Kangerlussuaq.

192
00:08:17,800 --> 00:08:21,700
So we flew from Bangor to Kanger.

193
00:08:22,580 --> 00:08:23,700
[DRUM RIMSHOT]

194
00:08:25,860 --> 00:08:28,830
So the Kangerlussuaq was a very

195
00:08:28,830 --> 00:08:30,520
interesting place but we were able to

196
00:08:30,520 --> 00:08:32,399
operate out of there for several days

197
00:08:32,399 --> 00:08:34,550
and really complete a large chunk of the

198
00:08:34,550 --> 00:08:37,149
southwest part of the survey dropping

199
00:08:37,149 --> 00:08:39,300
several dozen probes over the course of

200
00:08:39,300 --> 00:08:41,389
three or four days after picking up

201
00:08:41,389 --> 00:08:43,950
about probes from Thule we flew to

202
00:08:43,959 --> 00:08:46,850
Svalbard, Norway a small island off the

203
00:08:46,850 --> 00:08:49,389
northeast coast of Greenland from there

204
00:08:49,389 --> 00:08:51,209
we were able to complete the northeast

205
00:08:51,209 --> 00:08:53,079
part of the survey at least the parts

206
00:08:53,079 --> 00:08:55,149
that weren't covered with ice and then

207
00:08:55,149 --> 00:08:56,959
flying across the northern edge of

208
00:08:56,959 --> 00:08:58,850
Greenland and surveying along the

209
00:08:58,850 --> 00:09:00,910
northern coast of Greenland on our way

210
00:09:00,910 --> 00:09:04,689
back to Thule. We spent several days in

211
00:09:04,689 --> 00:09:06,649
Thule completing the northwest part of

212
00:09:06,649 --> 00:09:09,149

the survey before yesterday flying right

213
00:09:09,149 --> 00:09:11,629
across the Greenland ice sheet to

214
00:09:11,629 --> 00:09:14,519
Iceland and landing here in Keflavik.

215
00:09:14,519 --> 00:09:16,709
We've sent out a very ambitious plan

216
00:09:16,709 --> 00:09:20,689
here with the goal of dropping

217
00:09:20,689 --> 00:09:22,670
250 probes in about a month

218
00:09:22,670 --> 00:09:24,620
we're a little over halfway right now

219
00:09:24,620 --> 00:09:27,459
we've dropped we have a hundred left

220
00:09:27,459 --> 00:09:30,370
to go and about two weeks left to do it

221
00:09:30,370 --> 00:09:32,899
in so we're definitely beginning to feel

222
00:09:32,899 --> 00:09:36,389
the time crunch but i'm confident that

223
00:09:36,389 --> 00:09:38,699
we can have a really excellent survey

224
00:09:38,699 --> 00:09:42,869
with just a number of good weather days

225
00:09:42,869 --> 00:09:44,269
if we can get them.

226
00:09:44,269 --> 00:09:46,230
Hey Tom and Kasha I hope you enjoyed this

227
00:09:46,230 --> 00:09:48,850
little tour of Oceans Melting Greenland.

228
00:09:48,850 --> 00:09:51,940
I'm Josh Willis. OMG back to you guys

229
00:09:53,340 --> 00:09:55,480
Hey thanks Josh! Those guy's got to see

230
00:09:55,480 --> 00:09:57,420
some pretty amazing stuff huh?

231
00:09:57,420 --> 00:10:00,500
Yeah and it inspired us to come outside and it's not

232
00:10:00,500 --> 00:10:01,649
exactly Greenland but

233
00:10:01,649 --> 00:10:03,490
still pretty beautiful. Yeah but you know

234
00:10:03,490 --> 00:10:05,079
it's also a good example imagine come to

235
00:10:05,079 --> 00:10:06,999
a place like this with like a team of

236
00:10:06,999 --> 00:10:08,920
two dozen scientists and an airplane.

237
00:10:08,920 --> 00:10:10,839

I can't, and then you have all these things that

238
00:10:10,839 --> 00:10:12,769
you can't control like the weather or

239
00:10:12,769 --> 00:10:14,980
like your engine fails or something like.

240
00:10:14,980 --> 00:10:16,379
Yeah like science sometimes is just

241
00:10:16,379 --> 00:10:18,009
like an exercise and just keep trying

242
00:10:18,009 --> 00:10:20,409
keep fixing and keep moving on.

243
00:10:20,409 --> 00:10:20,930
Perseverance.

244
00:10:20,930 --> 00:10:22,339
Hey, well that's all for us today. We hope

245
00:10:22,339 --> 00:10:24,089
you enjoyed this episode of Earth Expeditions!

246
00:10:24,089 --> 00:10:25,749
And go outside and create