AbGradCon 2018

1
00:00:00,260 --> 00:00:13,160
[Music]

2
00:00:20,370 --> 00:00:16,950
hi thank you so much for having me today

3
00:00:22,200 --> 00:00:20,380
so first off I just wanted to talk very

4
00:00:24,450 --> 00:00:22,210
briefly about why methane is so

5
00:00:28,050 --> 00:00:24,460
important for my research so if we look

6
00:00:30,749 --> 00:00:28,060
at methane on earth about 90% of Earth's

7
00:00:33,150 --> 00:00:30,759
methane is generated or has biological

8
00:00:34,770 --> 00:00:33,160
origin prophecies and so I would argue

9
00:00:37,020 --> 00:00:34,780
that the presence of methane in any

10
00:00:39,570 --> 00:00:37,030
terrestrial atmosphere warrants careful

11
00:00:41,820 --> 00:00:39,580
and thorough characterization and so if

12
00:00:44,070 --> 00:00:41,830
we look at methane on Mars my finger

13
00:00:45,990 --> 00:00:44,080

surfs have just discovered a little over

14
00:00:48,000 --> 00:00:46,000
a decade ago via both ground-based

15
00:00:50,250 --> 00:00:48,010
measurements and orbital measurements

16
00:00:52,350 --> 00:00:50,260
and both of the results sort of show

17
00:00:54,990 --> 00:00:52,360
that methane is varying over very large

18
00:00:58,680 --> 00:00:55,000
spatial regions and varying seasonally

19
00:01:01,080 --> 00:00:58,690
over time but this discovery was very

20
00:01:03,180 --> 00:01:01,090
controversial because theoretical and

21
00:01:05,460 --> 00:01:03,190
model predictions showed something very

22
00:01:07,200 --> 00:01:05,470
different so on through theoretical

23
00:01:10,770 --> 00:01:07,210
prediction the main mechanism for

24
00:01:12,179 --> 00:01:10,780
destruction process in the Martian

25
00:01:14,910 --> 00:01:12,189
atmosphere and upper Martian atmosphere

26
00:01:18,330 --> 00:01:14,920
is through fatalis so sunlight comes in

27
00:01:20,849 --> 00:01:18,340
associate the methane into ch3 and h and

28
00:01:23,789 --> 00:01:20,859
that gives you a methylene lifetime of

29
00:01:25,770 --> 00:01:23,799
around 300 years so theoretical model

30
00:01:27,749 --> 00:01:25,780
predictions we're sort of showing that

31
00:01:29,160 --> 00:01:27,759
methane should be Wommack species in the

32
00:01:31,980 --> 00:01:29,170
atmosphere and shouldn't really be

33
00:01:34,770 --> 00:01:31,990
varying over a spatial or seasonal

34
00:01:36,419 --> 00:01:34,780
timescales but that's not all because

35
00:01:38,910 --> 00:01:36,429
the methane in life time is so short

36
00:01:40,980 --> 00:01:38,920
compared to the age of the planet that's

37
00:01:43,499 --> 00:01:40,990
also indicated that there must be some

38
00:01:45,300 --> 00:01:43,509

present-day source of methane and that

39
00:01:47,370 --> 00:01:45,310
prompted scientists to ask the question

40
00:01:49,830 --> 00:01:47,380
well if methane is being produced today

41
00:01:51,989 --> 00:01:49,840
where is it coming from and there are

42
00:01:53,730 --> 00:01:51,999
several hypotheses in the literature

43
00:01:57,419 --> 00:01:53,740
that go over potential sources for

44
00:02:00,690 --> 00:01:57,429
methane like volcanism serpentinization

45
00:02:04,050 --> 00:02:00,700
subsurface process exogenous sources

46
00:02:06,569 --> 00:02:04,060
like meteorite impacts and cometary and

47
00:02:11,210 --> 00:02:06,579
dust impacts and of course one of the

48
00:02:14,520 --> 00:02:11,220
favorites biology and so fast-forward to

49
00:02:16,220 --> 00:02:14,530
2012 when curiosity was first launched

50
00:02:18,229 --> 00:02:16,230
since its

51
00:02:20,960 --> 00:02:18,239
landing on Mars it's actually been

52
00:02:24,229 --> 00:02:20,970
taking methane measurements through the

53
00:02:26,509 --> 00:02:24,239
TLS Sam instrument and so on this plot

54
00:02:28,699 --> 00:02:26,519
basically what we have on the x-axis is

55
00:02:30,500 --> 00:02:28,709
time LS is just a way to denote the

56
00:02:33,289 --> 00:02:30,510
Martian seasons and then on the y-axis

57
00:02:35,780 --> 00:02:33,299
we have the methane concentration and so

58
00:02:37,940 --> 00:02:35,790
over time curiosity has been taking

59
00:02:40,400 --> 00:02:37,950
methane measurements at the surface at

60
00:02:44,600 --> 00:02:40,410
Gale Crater and what my group was really

61
00:02:46,850 --> 00:02:44,610
interested in is the highest methane

62
00:02:48,289 --> 00:02:46,860
concentration that was reported by

63
00:02:52,610 --> 00:02:48,299

curiosity

64
00:02:54,589 --> 00:02:52,620
so basically methane sort of rapidly

65
00:02:57,920 --> 00:02:54,599
increases to the highest methane metric

66
00:03:00,559 --> 00:02:57,930
methane concentration and then 47 Sol's

67
00:03:03,050 --> 00:03:00,569
later they see the methane right back

68
00:03:05,000 --> 00:03:03,060
down almost at zero concentration which

69
00:03:07,280 --> 00:03:05,010
is sort of like varying at a background

70
00:03:09,890 --> 00:03:07,290
level of 0.7 parts per billion per

71
00:03:12,440 --> 00:03:09,900
volume and so our group wanted to see if

72
00:03:14,839 --> 00:03:12,450
we could reconcile and recreate this

73
00:03:17,360 --> 00:03:14,849
behavior build up and then rapid

74
00:03:19,490 --> 00:03:17,370
decrease with our 1d photochemical model

75
00:03:21,289 --> 00:03:19,500
at most and it was actually mentioned in

76
00:03:23,569 --> 00:03:21,299
the talk in the previous section by

77
00:03:25,909 --> 00:03:23,579
Andrew where we have a 1d photochemical

78
00:03:28,400 --> 00:03:25,919
model that it's climate and has

79
00:03:31,759 --> 00:03:28,410
photochemistry his was using the coupled

80
00:03:33,650 --> 00:03:31,769
model and mine is solely using the photo

81
00:03:36,170 --> 00:03:33,660
chemistry side and if you want to know

82
00:03:38,180 --> 00:03:36,180
more about Atmos you can see the poster

83
00:03:39,500 --> 00:03:38,190
by our assessment airlock muda who's

84
00:03:43,159 --> 00:03:39,510
going to be in the first poster session

85
00:03:45,140 --> 00:03:43,169
today but basically what happens in the

86
00:03:47,390 --> 00:03:45,150
bottle we start at a starting point

87
00:03:49,580 --> 00:03:47,400
concentration which will henceforth be

88
00:03:52,190 --> 00:03:49,590

on the ch4 background that's where we're

89
00:03:54,440 --> 00:03:52,200
going to start and then we know what the

90
00:03:56,180 --> 00:03:54,450
highest methane measurement was and in

91
00:03:57,379 --> 00:03:56,190
the model what we want to try to do is

92
00:03:59,839 --> 00:03:57,389
we want to try to start from the

93
00:04:02,180 --> 00:03:59,849
background concentration build up the

94
00:04:04,309 --> 00:04:02,190
methane concentration to the highest

95
00:04:06,589 --> 00:04:04,319
observed measurement using the

96
00:04:08,990 --> 00:04:06,599
atmospheric processes and photochemistry

97
00:04:11,119 --> 00:04:09,000
that we know about Mars and then start

98
00:04:13,280 --> 00:04:11,129
at the highest methane measurement run

99
00:04:14,780 --> 00:04:13,290
the model again and see if we can break

100
00:04:17,390 --> 00:04:14,790
down the methane to background

101
00:04:20,240 --> 00:04:17,400
concentrations in time scales consistent

102
00:04:22,219 --> 00:04:20,250
with the Curiosity rover and we also

103
00:04:23,570 --> 00:04:22,229
similarly wanted to try this with the

104
00:04:25,670 --> 00:04:23,580
lowest methane measurement where we

105
00:04:27,830 --> 00:04:25,680
start at the lowest we build it up to

106
00:04:29,300 --> 00:04:27,840
the background concentration and then we

107
00:04:29,870 --> 00:04:29,310
start at the background and break it

108
00:04:32,180 --> 00:04:29,880
back to

109
00:04:34,100 --> 00:04:32,190
you the lowest methane concentration but

110
00:04:36,200 --> 00:04:34,110
before we can do that we need to know

111
00:04:38,750 --> 00:04:36,210
what flux is we need to use in order to

112
00:04:42,110 --> 00:04:38,760
sustain these concentrations at long

113
00:04:43,670 --> 00:04:42,120

timescales and so on the x-axis here we

114
00:04:45,430 --> 00:04:43,680
have flux which is basically just the

115
00:04:48,050 --> 00:04:45,440
rate at which the species is being

116
00:04:50,210 --> 00:04:48,060
released into the atmosphere and the

117
00:04:51,500 --> 00:04:50,220
y-axis we have the concentration and

118
00:04:54,860 --> 00:04:51,510
these are all the fluxes that I

119
00:04:57,710 --> 00:04:54,870
calculated that would produce particular

120
00:04:59,270 --> 00:04:57,720
methane concentrations so any flux above

121
00:05:01,610 --> 00:04:59,280
the black line could produce the

122
00:05:02,660 --> 00:05:01,620
background concentration fluxes above

123
00:05:04,370 --> 00:05:02,670
the purple line or the lowest

124
00:05:07,730 --> 00:05:04,380
measurement and then this particular

125
00:05:09,410 --> 00:05:07,740
flux above the red line can sustain the

126
00:05:10,810 --> 00:05:09,420
highest methane measurement at long

127
00:05:16,970 --> 00:05:10,820
steady-state

128
00:05:19,520 --> 00:05:16,980
timescales so then when we were trying

129
00:05:21,260 --> 00:05:19,530
to do this calculation what we wanted to

130
00:05:24,230 --> 00:05:21,270
do is we wanted to use time dependent

131
00:05:25,550 --> 00:05:24,240
calculations basically stop the model at

132
00:05:27,650 --> 00:05:25,560
time scales consistent with the

133
00:05:29,930 --> 00:05:27,660
Curiosity rover to see what would happen

134
00:05:31,820 --> 00:05:29,940
and see how the methane concentration

135
00:05:33,050 --> 00:05:31,830
would change and what we found was that

136
00:05:35,420 --> 00:05:33,060
if we start at the background

137
00:05:36,670 --> 00:05:35,430
concentration and we run the model with

138
00:05:38,960 --> 00:05:36,680

that flux that I showed you previously

139
00:05:41,660 --> 00:05:38,970
we can build up the methane to the

140
00:05:43,280 --> 00:05:41,670
highest methane concentration within the

141
00:05:46,280 --> 00:05:43,290
time scales that are consistent with the

142
00:05:48,320 --> 00:05:46,290
Curiosity rover but if we start at the

143
00:05:49,880 --> 00:05:48,330
highest concentration and we try to

144
00:05:52,220 --> 00:05:49,890
break down the methane on those same

145
00:05:54,290 --> 00:05:52,230
time scales we find me concentration

146
00:05:57,410 --> 00:05:54,300
sort of levels off and Peters off and

147
00:06:01,820 --> 00:05:57,420
doesn't really reach the background for

148
00:06:04,850 --> 00:06:01,830
the lowest methane concentrations we did

149
00:06:06,230 --> 00:06:04,860
this experiment again build it up and we

150
00:06:08,270 --> 00:06:06,240
can find that we build it up to the

151
00:06:11,000 --> 00:06:08,280
background concentration well within

152
00:06:12,890 --> 00:06:11,010
those observational time scales and then

153
00:06:16,310 --> 00:06:12,900
we find that we can depict that

154
00:06:19,430 --> 00:06:16,320
destruction process as well but because

155
00:06:20,840 --> 00:06:19,440
our results were not necessarily what we

156
00:06:23,390 --> 00:06:20,850
wanted in terms of the destruction

157
00:06:25,520 --> 00:06:23,400
timescales for that methane we wanted to

158
00:06:27,410 --> 00:06:25,530
see if we can incorporate oxidant fluxes

159
00:06:29,270 --> 00:06:27,420
to help aid in the process of

160
00:06:30,680 --> 00:06:29,280
destruction and see if we could break

161
00:06:32,480 --> 00:06:30,690
down the methane and time scales

162
00:06:35,270 --> 00:06:32,490
consistent with what the Rover was

163
00:06:38,750 --> 00:06:35,280

actually seen and so just to show you

164
00:06:41,270 --> 00:06:38,760
again without the oxygen flux we got

165
00:06:44,300 --> 00:06:41,280
down through that 1.09 threshold in

166
00:06:46,880 --> 00:06:44,310
about 27 Martian

167
00:06:49,280 --> 00:06:46,890
but with the addition of an oxidant flux

168
00:06:51,350 --> 00:06:49,290
we found that in the time skills we

169
00:06:54,350 --> 00:06:51,360
still couldn't get below that 1.09

170
00:06:56,960 --> 00:06:54,360
threshold and the oxidant flux actually

171
00:07:01,190 --> 00:06:56,970
didn't really accelerate the process too

172
00:07:03,380 --> 00:07:01,200
much and so this led us to see well if

173
00:07:05,540 --> 00:07:03,390
we use steady-state calculations which

174
00:07:07,430 --> 00:07:05,550
is basically increasing the model time

175
00:07:10,550 --> 00:07:07,440
and letting the model go all the way to

176
00:07:12,590 --> 00:07:10,560
equilibrium time skills on the order of

177
00:07:14,900 --> 00:07:12,600
the age of the universe we wanted to see

178
00:07:17,210 --> 00:07:14,910
a can we break down the methane to that

179
00:07:19,460 --> 00:07:17,220
background concentration and if we can

180
00:07:21,530 --> 00:07:19,470
how long does it take and does the

181
00:07:23,360 --> 00:07:21,540
presence of an oxidant and to accelerate

182
00:07:25,460 --> 00:07:23,370
the process and so here are the results

183
00:07:28,100 --> 00:07:25,470
from those studies here where we have

184
00:07:30,650 --> 00:07:28,110
time now in Martian years studies and

185
00:07:33,860 --> 00:07:30,660
then we have the methane concentration

186
00:07:36,500 --> 00:07:33,870
on the y axis and so with the OClO flux

187
00:07:38,600 --> 00:07:36,510
off at the oxidant flux off we can see

188
00:07:41,150 --> 00:07:38,610

that we actually do reach and go below

189
00:07:43,430 --> 00:07:41,160
the background concentrations and then

190
00:07:46,160 --> 00:07:43,440
with the presence of an oxidant if we

191
00:07:48,050 --> 00:07:46,170
zoom into this portion here we actually

192
00:07:50,900 --> 00:07:48,060
see that the addition of the oxidant

193
00:07:52,880 --> 00:07:50,910
accelerates the process significantly so

194
00:07:54,050 --> 00:07:52,890
we're talking hundreds of Martian years

195
00:07:56,420 --> 00:07:54,060
to get down to the background

196
00:07:58,880 --> 00:07:56,430
concentration without the oxidant flux

197
00:08:00,380 --> 00:07:58,890
but once we incorporate the oxidant flux

198
00:08:03,080 --> 00:08:00,390
we're getting down to the background

199
00:08:05,120 --> 00:08:03,090
concentration in about 10 Martian years

200
00:08:07,580 --> 00:08:05,130
but that's still inconsistent with the

201
00:08:12,080 --> 00:08:07,590
Rover observations since it wasn't years

202
00:08:14,420 --> 00:08:12,090
it was 47 days but we wanted to see if

203
00:08:16,370 --> 00:08:14,430
our model results were consistent with

204
00:08:19,130 --> 00:08:16,380
others in the literature and so we

205
00:08:21,440 --> 00:08:19,140
looked to a paper sugar at all 2012 that

206
00:08:23,900 --> 00:08:21,450
talked about methane concentrations be

207
00:08:26,480 --> 00:08:23,910
generated through exogenous sources

208
00:08:28,760 --> 00:08:26,490
basically the Martian meteorites and

209
00:08:30,980 --> 00:08:28,770
chondrites and then idps which are

210
00:08:33,680 --> 00:08:30,990
interplanetary dust particles they

211
00:08:35,480 --> 00:08:33,690
showed that that can produce 2.2 to 11

212
00:08:37,430 --> 00:08:35,490
per billion per volume and methane

213
00:08:39,800 --> 00:08:37,440

concentration and so that's actually

214
00:08:44,420 --> 00:08:39,810
consistent with our flux calculations

215
00:08:47,180 --> 00:08:44,430
and our results there but what we wanted

216
00:08:49,910 --> 00:08:47,190
to do following that procedure was we

217
00:08:52,090 --> 00:08:49,920
wanted to see well can we model the

218
00:08:54,200 --> 00:08:52,100
background fluctuations in the methane

219
00:08:55,820 --> 00:08:54,210
concentration over the course of the

220
00:08:57,250 --> 00:08:55,830
Martian year because in the literature

221
00:09:02,050 --> 00:08:57,260
there have been fewer

222
00:09:06,940 --> 00:09:02,060
theories that methane could be varying

223
00:09:08,890 --> 00:09:06,950
with the UV seasonal variations so our

224
00:09:11,050 --> 00:09:08,900
approach was to incorporate UV

225
00:09:14,230 --> 00:09:11,060
measurements from another instrument on

226
00:09:15,820 --> 00:09:14,240
the Curiosity rover wrens and then

227
00:09:17,350 --> 00:09:15,830
interpolate those measurements so that

228
00:09:19,420 --> 00:09:17,360
we have something for every day in the

229
00:09:22,210 --> 00:09:19,430
Martian year and then account for the

230
00:09:24,070 --> 00:09:22,220
effects of dust and step three is

231
00:09:26,140 --> 00:09:24,080
arguably one of the most important parts

232
00:09:29,470 --> 00:09:26,150
to this because the dust actually has a

233
00:09:32,020 --> 00:09:29,480
really big effect but we actually don't

234
00:09:34,300 --> 00:09:32,030
have dust particle physics and I won the

235
00:09:35,920 --> 00:09:34,310
photochemical model so I'll explain a

236
00:09:37,840 --> 00:09:35,930
little bit about how we account for the

237
00:09:40,330 --> 00:09:37,850
effects of dust so we have the ground

238
00:09:42,640 --> 00:09:40,340

and we have incoming sunlight basically

239
00:09:45,070 --> 00:09:42,650
what the dust does is it blocks some of

240
00:09:46,570 --> 00:09:45,080
that sunlight that hits the surface and

241
00:09:48,640 --> 00:09:46,580
so we wanted to sort of model that

242
00:09:49,840 --> 00:09:48,650
behavior decreasing the amount of

243
00:09:52,390 --> 00:09:49,850
sunlight because we know there's

244
00:09:55,050 --> 00:09:52,400
absorption due to dust and scattering

245
00:09:57,970 --> 00:09:55,060
due to dust and so we use the radiative

246
00:10:01,510 --> 00:09:57,980
standard radiative transfer equation to

247
00:10:03,550 --> 00:10:01,520
sort of figure out what is the flux

248
00:10:06,190 --> 00:10:03,560
that's actually hitting the surface so

249
00:10:09,790 --> 00:10:06,200
REMS actually measures tau and we know

250
00:10:11,920 --> 00:10:09,800
the original flux coming in as a model

251
00:10:13,960 --> 00:10:11,930
input and parameter so we can calculate

252
00:10:16,420 --> 00:10:13,970
the amount of sunlight that's actually

253
00:10:19,390 --> 00:10:16,430
hitting the surface and then account for

254
00:10:22,240 --> 00:10:19,400
the effects of dust in that way so by

255
00:10:25,180 --> 00:10:22,250
incorporating the REMS measurements so

256
00:10:27,580 --> 00:10:25,190
we have Martian days on the x-axis and

257
00:10:31,030 --> 00:10:27,590
then we have the concentration and what

258
00:10:33,370 --> 00:10:31,040
the REMS instrument was measuring on the

259
00:10:35,800 --> 00:10:33,380
other y axis and then we have the some

260
00:10:39,670 --> 00:10:35,810
of the Sam data here for reference when

261
00:10:41,980 --> 00:10:39,680
I incorporated flux of methane that was

262
00:10:45,420 --> 00:10:41,990
staying constant throughout the year we

263
00:10:49,000 --> 00:10:45,430

found that the changes in the methane

264
00:10:52,360 --> 00:10:49,010
were being produced via changes in the

265
00:10:55,060 --> 00:10:52,370
REMS and the UV so we were showing that

266
00:10:59,710 --> 00:10:55,070
there are seasonal variations in methane

267
00:11:01,810 --> 00:10:59,720
due to the unique flux but we found that

268
00:11:03,340 --> 00:11:01,820
we're only really correctly predicting

269
00:11:05,710 --> 00:11:03,350
one of the Sam measurements and we're

270
00:11:08,460 --> 00:11:05,720
sort of off shooting and over predicting

271
00:11:11,100 --> 00:11:08,470
the other two so by incorporating

272
00:11:13,500 --> 00:11:11,110
a second flux and doing the calculation

273
00:11:15,900 --> 00:11:13,510
over again keeping that methane counts

274
00:11:18,680 --> 00:11:15,910
that methane flux constant or seeing

275
00:11:21,180 --> 00:11:18,690
that we can basically predict correctly

276
00:11:23,220 --> 00:11:21,190
the same measurements but on an

277
00:11:26,100 --> 00:11:23,230
individual basis and it takes some range

278
00:11:28,910 --> 00:11:26,110
of fluxes in order to characterize this

279
00:11:31,980 --> 00:11:28,920
behavior and so just to summarize

280
00:11:34,500 --> 00:11:31,990
basically for the steady-state runs we

281
00:11:35,880 --> 00:11:34,510
are determining the fluxes needed in

282
00:11:40,320 --> 00:11:35,890
order to sustain the methane

283
00:11:42,540 --> 00:11:40,330
concentrations and our model fluxes and

284
00:11:44,760 --> 00:11:42,550
calculations are consistent with papers

285
00:11:47,490 --> 00:11:44,770
in the literature like sugar at all 2012

286
00:11:49,800 --> 00:11:47,500
and for the time dependent calculations

287
00:11:51,390 --> 00:11:49,810
are basically showing that it's easy to

288
00:11:53,970 --> 00:11:51,400

build up the methane and time scales

289
00:11:57,630 --> 00:11:53,980
consistent with the Curiosity rover but

290
00:12:00,090 --> 00:11:57,640
much harder to break them down on those

291
00:12:01,640 --> 00:12:00,100
same observational timescales and this

292
00:12:05,760 --> 00:12:01,650
is true even with the addition of

293
00:12:08,070 --> 00:12:05,770
oxidant fluxes and then we found if we

294
00:12:10,520 --> 00:12:08,080
use the steady-state runs then we find

295
00:12:13,560 --> 00:12:10,530
that we can get down to the background

296
00:12:15,630 --> 00:12:13,570
concentration and the process is much

297
00:12:17,460 --> 00:12:15,640
faster and the destruction process is

298
00:12:22,170 --> 00:12:17,470
much faster with the incorporation of

299
00:12:24,720 --> 00:12:22,180
the oxidant and then for the

300
00:12:27,650 --> 00:12:24,730
steady-state calculations for the

301
00:12:30,450 --> 00:12:27,660
Martian year we find that we can depict

302
00:12:33,900 --> 00:12:30,460
variations in the background methane

303
00:12:36,540 --> 00:12:33,910
concentration and the time dependent

304
00:12:38,610 --> 00:12:36,550
effects were ignored for this but we can

305
00:12:40,470 --> 00:12:38,620
explain any of the individual methane

306
00:12:42,000 --> 00:12:40,480
measurements as independent

307
00:12:44,700 --> 00:12:42,010
concentrations when we use the

308
00:12:47,130 --> 00:12:44,710
steady-state calculations and so with

309
00:12:52,540 --> 00:12:47,140
that I'll open it up to questions thank

310
00:13:08,269 --> 00:13:05,720
Thank You amber any questions do you

311
00:13:11,120 --> 00:13:08,279
have any hunch or what that unknown

312
00:13:14,930 --> 00:13:11,130
oxidant might be and maybe why we

313
00:13:17,420 --> 00:13:14,940

haven't detected it yet well so the

314
00:13:20,689 --> 00:13:17,430
oxidant flux that I incorporated is not

315
00:13:23,180 --> 00:13:20,699
necessarily unknown those fluxes were

316
00:13:25,250 --> 00:13:23,190
calculated from an atreya at all 2016

317
00:13:28,759 --> 00:13:25,260
paper that was looking at how can we

318
00:13:30,650 --> 00:13:28,769
produce pakora concentrations that have

319
00:13:34,160 --> 00:13:30,660
been seen by other Landers and Rovers

320
00:13:36,100 --> 00:13:34,170
missions and so we just used their OClO

321
00:13:39,019 --> 00:13:36,110
fluxes and their calculated fluxes

322
00:13:40,759 --> 00:13:39,029
incorporated them into the model to see

323
00:13:43,160 --> 00:13:40,769
if we can break down the methane

324
00:13:45,170 --> 00:13:43,170
concentration does that answer your

325
00:13:47,329 --> 00:13:45,180
question yeah sorry I'm just not an

326
00:13:49,670 --> 00:13:47,339
expert on this so no know how the

327
00:13:52,430 --> 00:13:49,680
perchlorate is getting into the

328
00:13:52,939 --> 00:13:52,440
atmosphere and oxidizing methane in the

329
00:13:55,100 --> 00:13:52,949
atmosphere

330
00:13:57,290 --> 00:13:55,110
I believe they found the caloric

331
00:13:58,579 --> 00:13:57,300
concentrations in different rock samples

332
00:14:00,500 --> 00:13:58,589
that they were taking and they were

333
00:14:03,350 --> 00:14:00,510
wondering how the court get there and

334
00:14:05,300 --> 00:14:03,360
trying to figure out what fluxes would

335
00:14:07,009 --> 00:14:05,310
be needed in order to produce those four

336
00:14:23,340 --> 00:14:07,019
core concentrations okay I got your

337
00:14:27,629 --> 00:14:25,920
it's a question so you were talking

338
00:14:29,160 --> 00:14:27,639

about the seasonal variations but it is

339
00:14:30,930 --> 00:14:29,170
only for one year that you're talking

340
00:14:33,269 --> 00:14:30,940
about or is it more than one you correct

341
00:14:34,860 --> 00:14:33,279
only one year that we were modeling is

342
00:14:36,389 --> 00:14:34,870
there a possibility to just check year

343
00:14:38,430 --> 00:14:36,399
by year if there is a party issue is

344
00:14:40,590 --> 00:14:38,440
that um that's a good point and we've

345
00:14:42,389 --> 00:14:40,600
actually been thinking about doing more

346
00:14:44,639 --> 00:14:42,399
of these studies with different parts of

347
00:14:47,280 --> 00:14:44,649
the Martian year but the problem is that

348
00:14:49,170 --> 00:14:47,290
with the Curiosity data I wanted to make

349
00:14:51,329 --> 00:14:49,180
sure that I was including some of the

350
00:14:52,710 --> 00:14:51,339
actual measurements so that we could

351
00:14:55,259 --> 00:14:52,720
have a comparison between what's

352
00:14:56,850 --> 00:14:55,269
observed versus what's predicted but I

353
00:14:59,189 --> 00:14:56,860
definitely do want to see whether or not

354
00:15:01,199 --> 00:14:59,199
it's going to vary over longer time

355
00:15:08,100 --> 00:15:01,209
scales and year to year time skills and