
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:12,230 --> 00:00:09,370
[Applause]

3
00:00:16,010 --> 00:00:12,240
good afternoon everyone and thanks again

4
00:00:19,999 --> 00:00:16,020
for staying all the time to Friday

5
00:00:24,830 --> 00:00:20,009
afternoon so what I'm gonna talk this

6
00:00:28,810 --> 00:00:24,840
afternoon is about applying brine

7
00:00:33,260 --> 00:00:28,820
stability models to the existence and of

8
00:00:35,110 --> 00:00:33,270
special regions on mass so and I'm very

9
00:00:38,930 --> 00:00:35,120
happy that Herrmann did such a great

10
00:00:40,970 --> 00:00:38,940
introduction about brand stability and

11
00:00:45,140 --> 00:00:40,980
modeling and phase diagrams therefore I

12
00:00:47,690 --> 00:00:45,150
don't have to do it so very quickly a

13
00:00:50,500 --> 00:00:47,700

little bit of background about special

14
00:00:55,060 --> 00:00:50,510
regions which we are defined in that

15
00:00:58,460 --> 00:00:55,070
report and paper on astrobiology as

16
00:01:01,460 --> 00:00:58,470
regions where potential forward

17
00:01:04,160 --> 00:01:01,470
contamination could happen in the case

18
00:01:07,069 --> 00:01:04,170
we would have a crash of wrong landing

19
00:01:11,539 --> 00:01:07,079
on improperly decontaminated spacecraft

20
00:01:13,730 --> 00:01:11,549
so it was defined by basically the

21
00:01:17,389 --> 00:01:13,740
intercept which corresponded to three

22
00:01:19,160 --> 00:01:17,399
research groups between the chemistry

23
00:01:21,050 --> 00:01:19,170
and thermodynamics about liquid

24
00:01:24,919 --> 00:01:21,060
stability information on the surface of

25
00:01:27,289 --> 00:01:24,929
mass the biology side with the

26
00:01:30,469 --> 00:01:27,299
temperature and relative humidity /

27
00:01:33,830 --> 00:01:30,479
water activity requirements for life as

28
00:01:35,929 --> 00:01:33,840
we know it and potential so that was

29
00:01:39,230 --> 00:01:35,939
more the biologists and some of you

30
00:01:41,899 --> 00:01:39,240
might be in the room today and the

31
00:01:45,709 --> 00:01:41,909
geomorphology is then people doing

32
00:01:49,370 --> 00:01:45,719
mapping about the potential sources of

33
00:01:51,769 --> 00:01:49,380
what at the surface of mass so in that

34
00:01:54,139 --> 00:01:51,779
talk because we've probably already

35
00:01:55,399 --> 00:01:54,149
heard a lot about that one also it seems

36
00:02:00,319 --> 00:01:55,409
to me that still a lot of uncertainty

37
00:02:04,489 --> 00:02:00,329
there I'm gonna focus mostly on that

38
00:02:06,649 --> 00:02:04,499

side so for example and of course we can

39
00:02:09,260 --> 00:02:06,659
easily imagine it was very hard to

40
00:02:12,530 --> 00:02:09,270
compile all those results into a single

41
00:02:14,449 --> 00:02:12,540
map so that's also I'm focusing on that

42
00:02:20,149 --> 00:02:14,459
on that side because not being really

43
00:02:22,430 --> 00:02:20,159
well explored so far and let's okay so

44
00:02:26,090 --> 00:02:22,440
here is an example of one of those maps

45
00:02:28,520 --> 00:02:26,100
one's about depth of potential water ice

46
00:02:31,040 --> 00:02:28,530
at the surface of mass and how it would

47
00:02:33,940 --> 00:02:31,050
be eventually accessible so you would go

48
00:02:37,990 --> 00:02:33,950
from very shallow or subset of

49
00:02:40,880 --> 00:02:38,000
subsurface ice in the polar latitude to

50
00:02:43,940 --> 00:02:40,890
disconnected shallow ice within a few

51
00:02:46,310 --> 00:02:43,950
meters deep to almost no ice closer to

52
00:02:48,230 --> 00:02:46,320
the equator so that's just an example of

53
00:02:50,390 --> 00:02:48,240
the type of maps that was produced in

54
00:02:53,390 --> 00:02:50,400
that in that report try to understand

55
00:02:59,090 --> 00:02:53,400
where we should or should not land and

56
00:03:00,980 --> 00:02:59,100
be very careful about ok so we've

57
00:03:02,960 --> 00:03:00,990
already seen that one but it's a quick

58
00:03:06,230 --> 00:03:02,970
reminder so we have a few very few

59
00:03:07,970 --> 00:03:06,240
evidences of liquid water unmask and I'm

60
00:03:10,640 --> 00:03:07,980
not gonna go in detail but you have

61
00:03:13,640 --> 00:03:10,650
those droplets and the Phoenix lander

62
00:03:15,380 --> 00:03:13,650
stirred and the famous now ourselves

63
00:03:18,640 --> 00:03:15,390

also there's been a lot of discussion in

64
00:03:22,610 --> 00:03:18,650
recent years if they are actually

65
00:03:24,890 --> 00:03:22,620
related to liquid or not and there is a

66
00:03:26,330 --> 00:03:24,900
very for those of you might not be aware

67
00:03:28,190 --> 00:03:26,340
I have to mention it there is a

68
00:03:30,800 --> 00:03:28,200
significant literature now about the

69
00:03:33,250 --> 00:03:30,810
fact that could be entirely dry froze so

70
00:03:38,030 --> 00:03:33,260
it's very important to keep that in mind

71
00:03:41,300 --> 00:03:38,040
so here is what was ended up being

72
00:03:44,150 --> 00:03:41,310
defined as special region from the that

73
00:03:48,320 --> 00:03:44,160
I'm gonna focus on so a special region

74
00:03:51,080 --> 00:03:48,330
was defined as any temperature above 255

75
00:03:53,960 --> 00:03:51,090
Kelvin and water activity above point

76
00:03:56,509 --> 00:03:53,970
six and to be put some margin on it

77
00:04:00,199 --> 00:03:56,519
there was an extension to the uncertain

78
00:04:03,470 --> 00:04:00,209
regions which was temperature above 250

79
00:04:05,890 --> 00:04:03,480
and activity of water above 0.5 and that

80
00:04:08,330 --> 00:04:05,900
was based on the literature about

81
00:04:11,600 --> 00:04:08,340
extremophiles showing for example cell

82
00:04:16,670 --> 00:04:11,610
division at 258 may double metabolism

83
00:04:18,430 --> 00:04:16,680
down to 240 cell growth point 75 in a

84
00:04:22,330 --> 00:04:18,440
salt environment because I'm aware of

85
00:04:25,520 --> 00:04:22,340
the cell growth in that point six

86
00:04:29,840 --> 00:04:25,530
sucrose solution so the day we find a

87
00:04:31,670 --> 00:04:29,850
sucrose lake on math I wanna see that so

88
00:04:34,130 --> 00:04:31,680

anyway there is a large

89
00:04:36,110 --> 00:04:34,140
summary a very extensive summary of all

90
00:04:38,030 --> 00:04:36,120
that ETA ritual again in that people

91
00:04:43,219 --> 00:04:38,040
I'm not gonna go deeper but we took

92
00:04:46,790 --> 00:04:43,229
those boundaries in that study so then

93
00:04:49,129 --> 00:04:46,800
we try to understand what's the

94
00:04:51,379 --> 00:04:49,139
stability of liquid brines

95
00:04:53,719 --> 00:04:51,389
and mass so in our previous work we

96
00:04:56,710 --> 00:04:53,729
focused on what we do stabilize bright

97
00:05:00,980 --> 00:04:56,720
so there are three processes evaporation

98
00:05:06,890 --> 00:05:00,990
boiling and freezing so we took like two

99
00:05:09,260 --> 00:05:06,900
extreme cases the surface so and which

100
00:05:11,540 --> 00:05:09,270
is characterized by a potential maximum

101
00:05:13,760 --> 00:05:11,550
so that's the temperature profile in the

102
00:05:16,580 --> 00:05:13,770
subsurface and at the surface you can

103
00:05:18,890 --> 00:05:16,590
reach maximum temperature so you can

104
00:05:21,439 --> 00:05:18,900
pretty much melt anywhere at the surface

105
00:05:25,010 --> 00:05:21,449
with two major of caveats number one

106
00:05:28,159 --> 00:05:25,020
you're going to significantly boil in

107
00:05:30,010 --> 00:05:28,169
the equatorial regions and evaporate

108
00:05:33,560 --> 00:05:30,020
pretty much everywhere else

109
00:05:35,270 --> 00:05:33,570
okay and with pretty fast evaporation

110
00:05:38,510 --> 00:05:35,280
rates in the order of several

111
00:05:41,180 --> 00:05:38,520
millimeters per year so considering that

112
00:05:45,230 --> 00:05:41,190
mass characterizing precipitable microns

113
00:05:49,370 --> 00:05:45,240

that would go away very quickly and in

114
00:05:52,820 --> 00:05:49,380
the subsurface where you have average

115
00:05:55,490 --> 00:05:52,830
temperature now you have two limits the

116
00:05:57,700 --> 00:05:55,500
northern the high latitudes would be

117
00:06:02,390 --> 00:05:57,710
permanently frozen and you could only

118
00:06:07,100 --> 00:06:02,400
melt in the more equatorial regions okay

119
00:06:09,200 --> 00:06:07,110
but that earlier model didn't take into

120
00:06:13,070 --> 00:06:09,210
account the amount of water vapor in the

121
00:06:15,920 --> 00:06:13,080
atmosphere and we know that from water

122
00:06:18,560 --> 00:06:15,930
vapor we can generate the liquid sense

123
00:06:21,890 --> 00:06:18,570
we can have water liquid brine sorry

124
00:06:25,390 --> 00:06:21,900
potentially stable at the surface so we

125
00:06:28,070 --> 00:06:25,400
used global circulation model that is

126
00:06:31,040 --> 00:06:28,080
summarized here and I'm not going to go

127
00:06:34,760 --> 00:06:31,050
too much in detail about that you can

128
00:06:37,670 --> 00:06:34,770
ask my quota for that but we try to

129
00:06:40,310 --> 00:06:37,680
simulate the temperature and reach

130
00:06:43,909 --> 00:06:40,320
humidity at the surface and characterize

131
00:06:47,029 --> 00:06:43,919
any time the temperature would be above

132
00:06:49,159 --> 00:06:47,039
the eutectic and relative humidity would

133
00:06:49,700 --> 00:06:49,169
be above the deliquescent relative

134
00:06:52,070 --> 00:06:49,710
humidity

135
00:06:56,140 --> 00:06:52,080
he had the same eutectic at the same

136
00:07:00,860 --> 00:06:56,150
time so here is what I show on that map

137
00:07:04,370 --> 00:07:00,870
so anywhere it's colored you pretty much

138
00:07:06,830 --> 00:07:04,380

Candida quiz okay and that's for calcium

139
00:07:09,860 --> 00:07:06,840
perchlorate we took the most extreme

140
00:07:11,930 --> 00:07:09,870
salt the one that everybody seems to

141
00:07:15,260 --> 00:07:11,940
like for good reason

142
00:07:18,440 --> 00:07:15,270
so anywhere it's Colorado you can delete

143
00:07:22,460 --> 00:07:18,450
quest must leave at very high latitude

144
00:07:25,580 --> 00:07:22,470
and that shows you the percent of the

145
00:07:27,980 --> 00:07:25,590
year at which liquid is stable so you

146
00:07:30,200 --> 00:07:27,990
can see that it never goes above three

147
00:07:32,980 --> 00:07:30,210
three and a half percent of the year

148
00:07:36,590 --> 00:07:32,990
which is extremely small so we are gonna

149
00:07:39,320 --> 00:07:36,600
it's gonna correspond to some hours in

150
00:07:41,900 --> 00:07:39,330
some favorable days at the right season

151
00:07:43,970 --> 00:07:41,910
so and it's almost never really

152
00:07:47,330 --> 00:07:43,980
continuous amounts of time it's very

153
00:07:51,290 --> 00:07:47,340
intermittent but you can you can request

154
00:07:53,590 --> 00:07:51,300
so one of the major reason for that

155
00:07:55,970 --> 00:07:53,600
behavior is what a man showed is that

156
00:07:59,590 --> 00:07:55,980
anti-correlation between creative

157
00:08:03,440 --> 00:07:59,600
humidity and temperature when it's warm

158
00:08:06,140 --> 00:08:03,450
it's very dry and when it's you need

159
00:08:08,390 --> 00:08:06,150
it's extremely cold so it's you have to

160
00:08:11,120 --> 00:08:08,400
have the few points where you have the

161
00:08:16,450 --> 00:08:11,130
right balance to be able to dedicate but

162
00:08:19,400 --> 00:08:16,460
it's possible now so here is a

163
00:08:23,540 --> 00:08:19,410

temperature of a swiss water activity

164
00:08:25,760 --> 00:08:23,550
ice line summarizing all the salt and i

165
00:08:27,290 --> 00:08:25,770
showed you here the boundaries we found

166
00:08:31,220 --> 00:08:27,300
because we mapped that from multiple

167
00:08:33,860 --> 00:08:31,230
salts and basically anything below

168
00:08:36,590 --> 00:08:33,870
calcium chloride so calcium cod would be

169
00:08:39,440 --> 00:08:36,600
to 20 Kelvin point six relative humidity

170
00:08:42,530 --> 00:08:39,450
or water activity below that you can

171
00:08:47,540 --> 00:08:42,540
potentially daily quest unmask anything

172
00:08:50,300 --> 00:08:47,550
above will not the request so now that

173
00:08:52,850 --> 00:08:50,310
we have those parameters we try to look

174
00:08:56,300 --> 00:08:52,860
a bit more in terms of habitability so

175
00:09:00,170 --> 00:08:56,310
yeah I'm sorry for it so my most

176
00:09:02,800 --> 00:09:00,180
complicated side so that one shows when

177
00:09:05,440 --> 00:09:02,810
we have in those daily questing regions

178
00:09:07,720 --> 00:09:05,450
but can be the maximum water activity

179
00:09:12,250 --> 00:09:07,730
and you can see that we can get water

180
00:09:14,769 --> 00:09:12,260
activities up to one sounds good but the

181
00:09:18,220 --> 00:09:14,779
temperatures are extremely cold okay

182
00:09:20,079 --> 00:09:18,230
they are around 200 Kelvin and the other

183
00:09:22,900 --> 00:09:20,089
side we did the exact opposite we looked

184
00:09:25,300 --> 00:09:22,910
at what the maximum solution temperature

185
00:09:30,550 --> 00:09:25,310
and you can see that it stays fairly

186
00:09:34,030 --> 00:09:30,560
cold around 210 maybe up to 215 Kelvin

187
00:09:36,730 --> 00:09:34,040
and in the meantime the maximum water

188
00:09:40,990 --> 00:09:36,740

activity at those temperature is going

189
00:09:44,410 --> 00:09:41,000
to be around 0.4 0.7 so it's gonna

190
00:09:46,720 --> 00:09:44,420
remain also really small so that allows

191
00:09:49,420 --> 00:09:46,730
us to bracket the habitability

192
00:09:52,210 --> 00:09:49,430
conditions to speech the potential

193
00:09:55,329 --> 00:09:52,220
special regions in those any the

194
00:09:57,760 --> 00:09:55,339
requesting areas and basically that's

195
00:10:01,810 --> 00:09:57,770
what we get when we try to plot those

196
00:10:03,880 --> 00:10:01,820
and sustain condition nothing so that's

197
00:10:05,140 --> 00:10:03,890
just I know it sounded obvious from the

198
00:10:07,630 --> 00:10:05,150
previous slide but that's just to

199
00:10:10,360 --> 00:10:07,640
confirm it visually you can never get

200
00:10:14,140 --> 00:10:10,370
the uncertain regions and let alone

201
00:10:17,550 --> 00:10:14,150
special regions so now I have to mention

202
00:10:21,280 --> 00:10:17,560
that there are a couple of small

203
00:10:23,530 --> 00:10:21,290
cavities to to mention number one you

204
00:10:26,470 --> 00:10:23,540
can admit a stable liquid and that was

205
00:10:29,520 --> 00:10:26,480
like that very good talk from Andrew

206
00:10:35,260 --> 00:10:29,530
this morning showing the potential for

207
00:10:37,470 --> 00:10:35,270
metastable and super cooled liquid okay

208
00:10:42,910 --> 00:10:37,480
I'm almost done

209
00:10:44,590 --> 00:10:42,920
that's serious scary anyway so you can

210
00:10:46,750 --> 00:10:44,600
have like metastable liquid at much

211
00:10:48,820 --> 00:10:46,760
lower temperature especially when you go

212
00:10:50,920 --> 00:10:48,830
down in the realm of perchlorates you

213
00:10:53,320 --> 00:10:50,930

can very easy another of sourcing with

214
00:10:56,050 --> 00:10:53,330
those eutectics you can easily supercool

215
00:10:58,060 --> 00:10:56,060
them but you still end up with the same

216
00:10:59,980 --> 00:10:58,070
issue you never gonna get to the high

217
00:11:03,130 --> 00:10:59,990
temperature high relative humidity you

218
00:11:05,220 --> 00:11:03,140
need an a van you can also use complex

219
00:11:08,620 --> 00:11:05,230
brine so here is a binary mixture

220
00:11:11,140 --> 00:11:08,630
showing a lower relative humidity than

221
00:11:13,449 --> 00:11:11,150
for each individual salt and with that

222
00:11:16,450 --> 00:11:13,459
complex multiple salt you can even go to

223
00:11:19,810 --> 00:11:16,460
lower temperature

224
00:11:22,420 --> 00:11:19,820
below well below 200 Kelvin but again so

225
00:11:25,180 --> 00:11:22,430
that will extend the stability field of

226
00:11:28,600 --> 00:11:25,190
liquid bronze at the surface of mass at

227
00:11:33,790 --> 00:11:28,610
lower latitude but they will never cross

228
00:11:36,400 --> 00:11:33,800
the special regions requirements so here

229
00:11:37,900 --> 00:11:36,410
and the final one that I have to mention

230
00:11:40,320 --> 00:11:37,910
is that we use the global circulation

231
00:11:44,230 --> 00:11:40,330
models we cannot totally rule out

232
00:11:46,300 --> 00:11:44,240
potential very localized effects but

233
00:11:53,980 --> 00:11:46,310
that would be have to be modeled on a

234
00:11:56,740 --> 00:11:53,990
case by case space case by case and the

235
00:11:59,380 --> 00:11:56,750
two honey sauce in situ sauce we have a

236
00:12:00,220 --> 00:11:59,390
Phoenix and MSL and the steam show the

237
00:12:02,980 --> 00:12:00,230
same wizard

238
00:12:06,490 --> 00:12:02,990

one at the pole one at the equator we

239
00:12:08,740 --> 00:12:06,500
get the same result we cross the study

240
00:12:10,390 --> 00:12:08,750
Bay maybe the stability field of calcium

241
00:12:15,000 --> 00:12:10,400
perchlorate but we never cross the

242
00:12:16,840 --> 00:12:15,010
special regions so the my final

243
00:12:20,020 --> 00:12:16,850
conclusions that they request is

244
00:12:23,820 --> 00:12:20,030
perfectly possible unmask and only for

245
00:12:26,830 --> 00:12:23,830
the lowest eutectic salts like at least

246
00:12:29,710 --> 00:12:26,840
calcium chloride mostly calcium

247
00:12:33,550 --> 00:12:29,720
perchlorate and that special and

248
00:12:35,920 --> 00:12:33,560
uncertain regions probably do not exist

249
00:12:38,590 --> 00:12:35,930
and that contaminates forward

250
00:12:41,080 --> 00:12:38,600
contamination at least of mass should be

251
00:12:43,140 --> 00:12:41,090
extremely limited and that mass is

252
00:12:51,400 --> 00:12:43,150
particularly efficient that self called

253
00:13:00,400 --> 00:12:51,410
decontaminating thank you we have time

254
00:13:05,519 --> 00:13:03,760
Carole Stoker from NASA Ames your

255
00:13:11,320 --> 00:13:05,529
conclusion really is only relevant for

256
00:13:13,210 --> 00:13:11,330
modern conditions yes the temperatures

257
00:13:15,610 --> 00:13:13,220
in the northern plains and the ground

258
00:13:17,769 --> 00:13:15,620
ice in the northern plains is very

259
00:13:19,900 --> 00:13:17,779
different at high obliquity and even

260
00:13:22,030 --> 00:13:19,910
somewhat different at the opposite phase

261
00:13:24,579 --> 00:13:22,040
of perihelion mm-hmm so have you

262
00:13:26,050 --> 00:13:24,589
considered that not yet but yeah that's

263
00:13:28,630 --> 00:13:26,060

something we wanna medela

264
00:13:30,670 --> 00:13:28,640
high ubiquity in particular because it

265
00:13:32,320 --> 00:13:30,680
would generate much higher partial

266
00:13:34,630 --> 00:13:32,330
pressure of water in the atmosphere and

267
00:13:37,180 --> 00:13:34,640
a for higher relative humidity and a

268
00:13:39,130 --> 00:13:37,190
different temperature field at the

269
00:13:43,139 --> 00:13:39,140
surface that so data that would be very

270
00:13:51,310 --> 00:13:45,930
Herman Martinez University of Michigan

271
00:13:53,370 --> 00:13:51,320
how how did you model the relative

272
00:13:55,780 --> 00:13:53,380
humidity at the surface like using

273
00:13:59,500 --> 00:13:55,790
orbital measurements of the precipitable

274
00:14:03,040 --> 00:13:59,510
water content or how land and then if

275
00:14:04,930 --> 00:14:03,050
there was an odd sort of regolith in so

276
00:14:07,840 --> 00:14:04,940
could you give some details of the

277
00:14:13,620 --> 00:14:07,850
modeling to calculate relative humidity

278
00:14:17,190 --> 00:14:13,630
on the entire map if I remember well the

279
00:14:20,199 --> 00:14:17,200
global circulation model Odyssey is

280
00:14:22,810 --> 00:14:20,209
partial pressure of water a mixing ratio

281
00:14:24,699 --> 00:14:22,820
that is being converted then in reiative

282
00:14:29,050 --> 00:14:24,709
humidity using the temperature at the

283
00:14:30,670 --> 00:14:29,060
surface and I'm guessing my question is

284
00:14:32,769 --> 00:14:30,680
like I don't know it makes any

285
00:14:34,329 --> 00:14:32,779
difference whether the global model

286
00:14:36,930 --> 00:14:34,339
considers you know like an interactive

287
00:14:39,280 --> 00:14:36,940
regolith you know if it considers

288
00:14:41,260 --> 00:14:39,290

absorption desorption or if it's just

289
00:14:43,300 --> 00:14:41,270
like orbital measurements of the Colin

290
00:14:45,220 --> 00:14:43,310
abundance of water which which I'm

291
00:14:47,440 --> 00:14:45,230
guessing definitely like the GCM will

292
00:14:50,500 --> 00:14:47,450
will need that and then it is to built

293
00:14:52,510 --> 00:14:50,510
it or do you do you know there's an

294
00:14:54,340 --> 00:14:52,520
interactive regolith or if that do not

295
00:14:56,050 --> 00:14:54,350
any different now we don't consider yet

296
00:15:01,300 --> 00:14:56,060
an interactive Regulus because we

297
00:15:04,210 --> 00:15:01,310
haven't done subsurface water vapor I

298
00:15:06,819 --> 00:15:04,220
mean billowed we just considered the top

299
00:15:08,819 --> 00:15:06,829
not surface of the regolith so in that

300
00:15:10,780 --> 00:15:08,829
case that's option is not particularly

301
00:15:13,110 --> 00:15:10,790
significant it's just if you have like

302
00:15:14,850 --> 00:15:13,120
grains of perchlorate at the surface

303
00:15:17,239 --> 00:15:14,860
if you go deeper in the subsurface yes

304
00:15:22,590 --> 00:15:17,249
you have to take into account adsorption

305
00:15:25,739 --> 00:15:22,600
thank you very much hey Alex I like both

306
00:15:27,869 --> 00:15:25,749
NASA for it so I'm kind of new to the

307
00:15:30,269 --> 00:15:27,879
stability diagrams of perchlorate you

308
00:15:31,920 --> 00:15:30,279
know I'm still learning you know so just

309
00:15:34,829 --> 00:15:31,930
a simple question right you know so

310
00:15:37,170 --> 00:15:34,839
let's take location Phoenix location

311
00:15:39,360 --> 00:15:37,180
right you have show subsurface ice there

312
00:15:41,460 --> 00:15:39,370
at listen you know I see permafrost

313
00:15:42,119 --> 00:15:41,470

right you know some three to five

314
00:15:44,749 --> 00:15:42,129
centimeters

315
00:15:48,929 --> 00:15:44,759
even in some locations mm-hmm right

316
00:15:50,939 --> 00:15:48,939
during Northern Hemisphere summer you

317
00:15:53,489 --> 00:15:50,949
know during specific month you know

318
00:15:55,439 --> 00:15:53,499
during very specific days temperature

319
00:15:58,829 --> 00:15:55,449
certainly raises about 250

320
00:16:02,059 --> 00:15:58,839
that's locations so you according to you

321
00:16:04,379 --> 00:16:02,069
does that mean during those hours you

322
00:16:05,639 --> 00:16:04,389
know during the second month of July

323
00:16:08,429 --> 00:16:05,649
whatever that you know the highest

324
00:16:10,170 --> 00:16:08,439
temperature where it is the water

325
00:16:14,910 --> 00:16:10,180
activity is going to be always below

326
00:16:18,239 --> 00:16:14,920
point six is that I mean there is gonna

327
00:16:24,059 --> 00:16:18,249
be some cases I mean if but let's be

328
00:16:27,809 --> 00:16:24,069
group how do you like and if so why that

329
00:16:30,150 --> 00:16:27,819
one you mean I'm not I don't know which

330
00:16:32,429 --> 00:16:30,160
one is subsurface it's all surface or no

331
00:16:34,259 --> 00:16:32,439
that's at the surface so if you have

332
00:16:36,660 --> 00:16:34,269
like three five centimeters you have to

333
00:16:38,819 --> 00:16:36,670
adjust those maps yes okay yeah because

334
00:16:41,489 --> 00:16:38,829
we have to integrate the evolution of

335
00:16:43,079 --> 00:16:41,499
temperature in the subsurface right but

336
00:16:46,259 --> 00:16:43,089
then you're gonna have a dampen of the

337
00:16:49,379 --> 00:16:46,269
maximum temperature right so the you

338
00:16:51,419 --> 00:16:49,389

have to realize that's three you can

339
00:16:53,429 --> 00:16:51,429
have plenty of cases where you're gonna

340
00:16:55,650 --> 00:16:53,439
go way above in temperature but that

341
00:16:58,379 --> 00:16:55,660
usually going humidity is going to drop

342
00:17:00,809 --> 00:16:58,389
down and if you go into subsurface your

343
00:17:02,059 --> 00:17:00,819
maximum available temperature is going

344
00:17:04,079 --> 00:17:02,069
to be lower

345
00:17:06,600 --> 00:17:04,089
yeah it just seems to me like you know

346
00:17:08,789 --> 00:17:06,610
you have like this compact icy

347
00:17:11,789 --> 00:17:08,799
subsurface and then you have loose on

348
00:17:15,149 --> 00:17:11,799
soil you know there are some you know

349
00:17:17,220 --> 00:17:15,159
storm comes in you expect you you all of

350
00:17:20,340 --> 00:17:17,230
a sudden exposing that icy permafrost I

351
00:17:22,199 --> 00:17:20,350
have troubles visualizing that you're

352
00:17:24,360 --> 00:17:22,209
not going to have Brian Branson there if

353
00:17:25,440 --> 00:17:24,370
you have perchlorate and if you have icy

354
00:17:27,480 --> 00:17:25,450
surface

355
00:17:30,570 --> 00:17:27,490
so that that's as I said you can always

356
00:17:32,810 --> 00:17:30,580
have very localized effect if I maybe

357
00:17:34,680 --> 00:17:32,820
when I think we should save this for

358
00:17:36,400 --> 00:17:34,690
discussion later and we need to go to