WEBVTT

1 00:00:08.560 --> 00:00:11.430 <v ->Is recorded, and the recording</v>

2 00:00:11.430 --> 00:00:13.180 will be published later online

3 00:00:13.180 --> 00:00:15.540 on our Yale Center on Climate Change website.

4 00:00:15.540 --> 00:00:19.470 And during the seminar, if you have any questions,

5 00:00:19.470 --> 00:00:24.060 please feel free to type in your questions in the chat box.

6 00:00:24.060 --> 00:00:26.933 So without further ado, Pablo, welcome.

7 00:00:28.030 --> 00:00:28.863 <v ->Thank you Kai,</v>

8 00:00:28.863 --> 00:00:30.940 and thank you for the audience for being here.

9 00:00:30.940 --> 00:00:34.240 Thank you for the invitation for me, it's an honor

10 00:00:34.240 --> 00:00:36.370 to be sharing the information

11 00:00:36.370 --> 00:00:38.943 that we have from different research projects,

12 00:00:40.170 --> 00:00:43.517 and sharing with people outside of Puerto Rico.

13 00:00:43.517 --> 00:00:46.060 Please let me know when you can see

14 00:00:46.060 --> 00:00:49.410 my screen as not duplicated.

15 00:00:49.410 --> 00:00:50.910 Can you see it well?

16 00:00:50.910 --> 00:00:52.390 <v ->Yes.</v> <v ->Okay, perfect.</v>

17 00:00:52.390 --> 00:00:53.223 Thank you, Kai.

18 00:00:53.223 --> 00:00:58.223 Let me move this out of here, and also let me minimize this.

19 00:00:58.340 --> 00:00:59.959 So again, thank you for the invitation.

20 00:00:59.959 --> 00:01:02.110 I'm Pablo Mendez-Lazaro, I'm an Associate Professor

21 00:01:02.110 --> 00:01:05.190 at the University of Puerto Rico Medical Science Campus.

22 00:01:05.190 --> 00:01:06.980 I've been working at their

23 00:01:06.980 --> 00:01:09.960 environmental health department for 13 years.

24 00:01:09.960 --> 00:01:12.900 I'm a geographer by background,

25 00:01:12.900 --> 00:01:15.950 but then I switched right there,

26 00:01:15.950 --> 00:01:18.670 interdisciplinary research and graduate school

27 00:01:18.670 --> 00:01:20.447 on Marine science and (indistinct)

28 00:01:20.447 --> 00:01:21.870 and climate change.

29 00:01:21.870 --> 00:01:23.590 So therefore probably

30 00:01:25.043 --> 00:01:27.580 I can have a little bit of flexibility

31 00:01:27.580 --> 00:01:30.313 when changing from one topic to another.

32 00:01:31.350 --> 00:01:32.183 In this case,

33 00:01:32.183 --> 00:01:34.250 I'm gonna be talking about atmospheric conditions

34 00:01:34.250 --> 00:01:39.100 that are impacting or affecting public health

35 00:01:39.100 --> 00:01:42.620 and what kind of research we're doing in Puerto Rico,

36 00:01:42.620 --> 00:01:44.473 mainly with Saharan dust.

37 00:01:46.260 --> 00:01:48.830 Basically we do have two research projects

38 00:01:48.830 --> 00:01:52.300 that are funded by NASA, NASA ROSES,

39 00:01:52.300 --> 00:01:55.513 which is also their health and air quality program.

40 00:01:57.030 --> 00:01:58.800 The first one is a research project

41 00:01:58.800 --> 00:02:01.250 that we submitted back in 2017.

42 00:02:01.250 --> 00:02:05.580 We have been working with three different working groups

43 00:02:05.580 --> 00:02:10.580 and mainly we proposed to use the early warning system

44 00:02:10.630 --> 00:02:11.980 to develop early warning system

45 00:02:11.980 --> 00:02:15.180 using satellites information around bay stations,

46 00:02:15.180 --> 00:02:17.600 and also to quantify the impacts mainly

47 00:02:17.600 --> 00:02:19.650 on respiratory diseases on Puerto Rico.

48 00:02:19.650 --> 00:02:21.590 I'm gonna be speaking about a little bit,

49 00:02:21.590 --> 00:02:22.520 what is Saharan dust?

50 00:02:22.520 --> 00:02:24.010 Most of you probably are aware

51 00:02:24.010 --> 00:02:26.670 of the Godzilla dust event that occurred in 2020,

52 00:02:26.670 --> 00:02:28.520 but for those of you that are not aware,

53 00:02:28.520 --> 00:02:29.943 I'm gonna be explaining a little bit,

54 00:02:29.943 --> 00:02:31.640 what is Saharan dust,

55 00:02:31.640 --> 00:02:33.980 and this is an analysis in Puerto Rico.

56 00:02:33.980 --> 00:02:34.813 So to do that,

57 00:02:34.813 --> 00:02:36.537 we proposed three different working groups,

58 00:02:36.537 --> 00:02:39.770 and for ones which was the responsible of working

59 00:02:39.770 --> 00:02:43.490 on analyzing the intrinsic relationship into the dust

60 00:02:43.490 --> 00:02:44.493 and public health,

61 00:02:45.990 --> 00:02:48.340 using different methods and approach.

62 00:02:48.340 --> 00:02:51.140 Qualitative analysis but also quantitative analysis

63 00:02:51.140 --> 00:02:53.080 using secondary databases.

64 00:02:53.080 --> 00:02:54.707 The second one, the second working group

65 00:02:54.707 --> 00:02:57.710 was the one responsible of analyzing,

66 00:02:57.710 --> 00:03:00.000 we call it atmospheric forcing and air quality.

67 00:03:00.000 --> 00:03:01.650 And these ones were the one responsible

68 00:03:01.650 --> 00:03:03.928 of analyzing and doing the characterization

69 00:03:03.928 --> 00:03:06.090 of the dust using ground based stations,

70 00:03:06.090 --> 00:03:08.683 but also diesel particular matter.

71 00:03:08.683 --> 00:03:11.980 And you will ask, "Okay, so why diesel particular matter?"

72 00:03:11.980 --> 00:03:13.490 Because in our case we believe that,

73 00:03:13.490 --> 00:03:16.180 not in our case, I think that all of us agree,

74 00:03:16.180 --> 00:03:18.370 I'm preaching to the choir in this case but

75 00:03:18.370 --> 00:03:21.500 natural sources of air pollution are interacting

76 00:03:21.500 --> 00:03:24.203 with anthropogenic sources of air pollution.

77 00:03:24.203 --> 00:03:26.720 And one of the main sources of air pollution in Puerto Rico

78 00:03:26.720 --> 00:03:29.880 could be considered diesel particular matter,

79 00:03:29.880 --> 00:03:31.190 the anthropogenic sources, right?

80 00:03:31.190 --> 00:03:34.200 And one of the main natural sources of air pollution

81 00:03:34.200 --> 00:03:35.280 are the dust that are coming

82 00:03:35.280 --> 00:03:37.230 from the other side of the Atlantic.

83 00:03:37.230 --> 00:03:39.080 So we were wondering as well,

84 00:03:39.080 --> 00:03:43.270 what could happen if both of these aerosols

85 00:03:43.270 --> 00:03:47.430 and pollutants get together

86 00:03:47.430 --> 00:03:49.900 and how the conditions in the air quality

87 00:03:49.900 --> 00:03:54.420 can get deteriorated because of the simultaneous events.

88 00:03:54.420 --> 00:03:55.530 And the third working group

89 00:03:55.530 --> 00:03:57.510 is the one that we call decision, support tool,

90 00:03:57.510 --> 00:03:59.270 computation, and visualization.

91 00:03:59.270 --> 00:04:00.183 And this one is the working group

92 00:04:00.183 --> 00:04:02.600 that is responsible of developing

93 00:04:02.600 --> 00:04:05.480 the early warning system in collaboration

94 00:04:05.480 --> 00:04:07.490 with the National Weather Service,

95 00:04:07.490 --> 00:04:10.330 the office in San Juan and the Department of Health.

96 00:04:10.330 --> 00:04:12.882 So we call it like a, it's like a co-design,

97 00:04:12.882 --> 00:04:16.670 it's a human design center approach

98 00:04:16.670 --> 00:04:19.970 where we are working directly with any users,

99 00:04:19.970 --> 00:04:24.800 to see how can we help them to improve decision making

100 00:04:24.800 --> 00:04:26.040 for these kind of hazards.

101 00:04:26.040 --> 00:04:27.840 And how to protect the population

102 00:04:27.840 --> 00:04:30.540 when this threat is arriving to the Caribbean.

103 00:04:30.540 --> 00:04:33.490 Mainly as again, we started with Puerto Rico,

104 00:04:33.490 --> 00:04:35.670 but this kind of tool could be scalable

105 00:04:35.670 --> 00:04:36.990 to the rest of the Caribbean,

106 00:04:36.990 --> 00:04:39.230 because what we're using are satellite information

107 00:04:39.230 --> 00:04:41.980 and this information is available for the whole region.

108 00:04:45.000 --> 00:04:50.000 So to do that, I first built a team,

109 00:04:50.014 --> 00:04:51.863 a multidisciplinary team, this is who we are.

110 00:04:51.863 --> 00:04:55.143 A multidisciplinary team of epidemiologists,

111 00:04:57.310 --> 00:04:59.780 dermatologists, people from remote sensing,

112 00:04:59.780 --> 00:05:02.540 chemistry, atmospheric science and climatology.

113 00:05:02.540 --> 00:05:04.600 All of us working together

114 00:05:04.600 --> 00:05:06.510 to do this kind of research

115 00:05:06.510 --> 00:05:08.350 and developing early warning system

116 00:05:08.350 --> 00:05:09.887 for the Caribbean region.

117 00:05:09.887 --> 00:05:12.320 And what is this Saharan dust?

118 00:05:12.320 --> 00:05:16.060 So in the case of the Caribbean and the Sahara,

119 00:05:16.060 --> 00:05:18.630 this is our aerosols and mineral dust

120 00:05:18.630 --> 00:05:20.883 that are coming mainly from the Saharan desert.

121 00:05:20.883 --> 00:05:23.370 The Sahara desert is one of the biggest desert worldwide,

122 00:05:23.370 --> 00:05:26.860 and it can provide over 20 billions of tons

123 00:05:26.860 --> 00:05:28.430 that can reach into the Americas.

124 00:05:28.430 --> 00:05:29.500 When I'm saying the Americas,

125 00:05:29.500 --> 00:05:31.240 not only to the Caribbean region,

126 00:05:31.240 --> 00:05:34.030 because it depends on what season of the year.

127 00:05:34.030 --> 00:05:35.670 South America can be impacted

128 00:05:35.670 --> 00:05:37.367 by this dust coming from Africa,

129 00:05:37.367 --> 00:05:40.173 but also North America and the Caribbean region.

130 00:05:41.840 --> 00:05:43.890 In the Caribbean,

131 00:05:43.890 --> 00:05:45.910 these events are associated with increase

132 00:05:45.910 --> 00:05:48.250 on excessive risk of emergency room visits

133 00:05:48.250 --> 00:05:51.190 and hospitalizations related to respiratory diseases.

134 00:05:51.190 --> 00:05:54.630 This has been observed in Granada, Guadalupe, Martinique

135 00:05:55.560 --> 00:05:57.343 and in Puerto Rico as well.

136 00:05:58.680 --> 00:06:01.080 Well, we were working with this

137 00:06:01.080 --> 00:06:04.763 natural source of air pollution affecting public health.

138 00:06:06.217 --> 00:06:10.770 All of a sudden it appears, the coronavirus, SARS-CoV-2.

139 00:06:10.770 --> 00:06:13.220 So, which is the responsible of the COVID 19 pandemic

140 00:06:13.220 --> 00:06:14.880 that we're suffering.

141 00:06:14.880 --> 00:06:17.370 The first cases of COVID 19 in Puerto Rico

142 00:06:17.370 --> 00:06:19.860 were registered in March 2020.

143 00:06:19.860 --> 00:06:21.377 So very early after the pandemic,

144 00:06:21.377 --> 00:06:23.763 and I think that the first cases in Europe

145 00:06:23.763 --> 00:06:26.525 were registered in December, 2019,

146 00:06:26.525 --> 00:06:29.130 and then it took only a couple of months

147 00:06:29.130 --> 00:06:31.140 for the virus to get to the Caribbean region.

148 00:06:31.140 --> 00:06:36.017 And when that happened, we were able to wonder ourself,

149 00:06:36.017 --> 00:06:38.440 "Okay, so we have been working with Saharan dust,

150 00:06:38.440 --> 00:06:41.280 and this dust is associated with hospitalization

151 00:06:41.280 --> 00:06:44.000 and emergency room visit due to respiratory diseases.

152 00:06:44.000 --> 00:06:46.180 So what could happen to this patient

153 00:06:46.180 --> 00:06:48.100 or what could happen in the Caribbean,

154 00:06:48.100 --> 00:06:51.170 if we are facing two hazards?"

155 00:06:51.170 --> 00:06:52.770 Both are different hazards,

156 00:06:52.770 --> 00:06:56.320 but both of them are affecting the same system,

157 00:06:56.320 --> 00:06:58.280 the same respiratory disease system.

158 00:06:58.280 --> 00:07:01.430 One is air pollution, natural sources of air pollution,

159 00:07:01.430 --> 00:07:02.860 and the other one is a virus.

160 00:07:02.860 --> 00:07:05.010 But again, both of them are interacting,

161 00:07:05.010 --> 00:07:06.423 affecting the same system.

162 00:07:07.950 --> 00:07:10.117 So why we're doing this?

163 00:07:10.117 --> 00:07:11.980 And why we are also including

164 00:07:11.980 --> 00:07:14.720 some other environmental factors, okay?

165 00:07:14.720 --> 00:07:16.860 So air pollution is being

166 00:07:16.860 --> 00:07:19.140 as considered like the silent killer.

167 00:07:19.140 --> 00:07:20.580 And it's not only

168 00:07:20.580 --> 00:07:23.020 the anthropogenic sources of air pollution,

169 00:07:23.020 --> 00:07:25.640 but there's many other natural resources of air pollution

170 00:07:25.640 --> 00:07:28.330 that can exacerbate our health, right?

171 00:07:28.330 --> 00:07:31.730 And it's been acknowledge by the World Health Organization,

172 00:07:31.730 --> 00:07:33.210 but also by the CDC

173 00:07:33.210 --> 00:07:37.900 and some others important agencies worldwide.

174 00:07:37.900 --> 00:07:42.060 And some other factors that we are considering for example,

175 00:07:42.060 --> 00:07:44.960 I'm just gonna be talking about very slightly

176 00:07:44.960 --> 00:07:47.950 about the other one that is another climate hazard

177 00:07:47.950 --> 00:07:51.700 that could be considered a silent killer is extreme heat.

178 00:07:51.700 --> 00:07:53.850 And accordingly to the CDC for example,

179 00:07:53.850 --> 00:07:55.720 extreme heat, at least in the United States,

180 00:07:55.720 --> 00:07:59.550 it can be considered the number one weather related death.

181 00:07:59.550 --> 00:08:03.360 So is the one number one responsible for death

182 00:08:03.360 --> 00:08:06.480 when we're talking about climate and extreme weather events.

183 00:08:06.480 --> 00:08:08.883 So in terms of public health and mortality,

184 00:08:08.883 --> 00:08:11.920 when we're talking about air pollution and extreme heat,

185 00:08:11.920 --> 00:08:15.960 both of them are ranking first or second.

186 00:08:15.960 --> 00:08:17.460 It depends how do you look at.

187 00:08:18.517 --> 00:08:21.570 Both of them are considered number one

188 00:08:21.570 --> 00:08:24.293 in terms of impacting and affecting public health.

189 00:08:25.140 --> 00:08:25.973 In the left side,

190 00:08:25.973 --> 00:08:27.700 what I'm showing is the weather fatalities

191 00:08:27.700 --> 00:08:29.400 that occur in the United States

192 00:08:29.400 --> 00:08:32.127 in the 48 continental states.

193 00:08:32.127 --> 00:08:33.983 And as you can see for example,

194 00:08:33.983 --> 00:08:36.600 when we're talking about weather fatalities,

195 00:08:36.600 --> 00:08:38.778 they are not associated with hurricanes

196 00:08:38.778 --> 00:08:40.490 they are not associated with floods.

197 00:08:40.490 --> 00:08:42.850 Most of them again are associated

198 00:08:42.850 --> 00:08:46.000 with heat and extreme heat, right?

199 00:08:46.000 --> 00:08:48.450 So these are two very important component

200 00:08:48.450 --> 00:08:50.700 because you will see that,

201 00:08:50.700 --> 00:08:51.890 right after our result

202 00:08:52.822 --> 00:08:54.710 what we're seeing as preliminary results

203 00:08:54.710 --> 00:08:57.670 is that actually both of them are interacting

204 00:08:57.670 --> 00:09:00.090 with the pandemic and are exacerbating

205 00:09:01.250 --> 00:09:02.820 the conditions in the patients

206 00:09:02.820 --> 00:09:04.793 that are struggling with the virus.

207 00:09:06.580 --> 00:09:08.130 So as I mentioned, this is something

208 00:09:08.130 --> 00:09:09.300 that I think that all of us,

209 00:09:09.300 --> 00:09:11.974 if you're coming from the Yale School of Public Health

210 00:09:11.974 --> 00:09:14.680 and front of environmental health, most of you are aware.

211 00:09:14.680 --> 00:09:17.018 So there are multiple sources of air pollution

212 00:09:17.018 --> 00:09:18.860 and we have two first categories.

213 00:09:18.860 --> 00:09:23.130 The first one is the anthropogenic sources of air pollution,

214 00:09:23.130 --> 00:09:28.130 which are from transportation for example, airplanes,

215 00:09:28.160 --> 00:09:31.420 ships, trucks, vehicles, whatever,

216 00:09:31.420 --> 00:09:33.190 some others are from the industries.

217 00:09:33.190 --> 00:09:35.640 But also we have natural sources of air pollution,

218 00:09:35.640 --> 00:09:38.710 and this is where we are doing emphasis in our research.

219 00:09:38.710 --> 00:09:41.267 And the natural sources of air pollution

220 00:09:41.267 --> 00:09:42.650 and those one that

221 00:09:44.010 --> 00:09:46.150 the source of the pollution,

222 00:09:46.150 --> 00:09:49.230 it can be thousand of kilometers away

223 00:09:49.230 --> 00:09:52.190 from the places that are getting affected.

224 00:09:52.190 --> 00:09:53.220 And in our case for example,

225 00:09:53.220 --> 00:09:55.407 we're talking about natural sources of air pollution

226 00:09:55.407 --> 00:09:58.570 the are five to 7,000 kilometers

227 00:09:58.570 --> 00:10:00.470 away from the Caribbean region.

228 00:10:00.470 --> 00:10:02.880 But actually they have the capacity

229 00:10:02.880 --> 00:10:05.170 to be transported by the trade winds

230 00:10:05.170 --> 00:10:07.370 in some specifics seasons.

231 00:10:07.370 --> 00:10:10.426 And to impact the region

232 00:10:10.426 --> 00:10:13.180 mainly in the Caribbean.

233 00:10:13.180 --> 00:10:16.060 The Saharan dust are mineral dust are not the only one,

234 00:10:16.060 --> 00:10:18.280 and not the only natural sources for pollution.

235 00:10:18.280 --> 00:10:20.550 We can see also some volcanic ashes,

236 00:10:20.550 --> 00:10:24.710 we can see sulfur also from volcanoes.

237 00:10:24.710 --> 00:10:27.650 And we have also mold and spores

238 00:10:27.650 --> 00:10:30.207 that can be provided by the vegetation

239 00:10:30.207 --> 00:10:32.520 in the tropical landscape for example,

240 00:10:32.520 --> 00:10:34.813 but there are multiple other sources of air pollution again,

241 00:10:34.813 --> 00:10:38.543 that are affecting or are interacting with pollution.

242 00:10:39.720 --> 00:10:40.710 What is the Saharan dust?

243 00:10:40.710 --> 00:10:45.130 So these are mineral dust particles that can fly literally

244 00:10:45.130 --> 00:10:47.970 and can be transported by the trade winds

245 00:10:47.970 --> 00:10:51.180 they're coming from, mainly from the Saharan desert.

246 00:10:51.180 --> 00:10:53.833 But also the Sahel desert is another source

247 00:10:53.833 --> 00:10:55.480 of this kind of dust,

248 00:10:55.480 --> 00:10:57.220 but we are using the Saharan dust.

249 00:10:57.220 --> 00:10:59.120 Right, because this is the main source

250 00:10:59.981 --> 00:11:02.440 of the particles that are getting to the Caribbean.

251 00:11:02.440 --> 00:11:04.330 And we're measuring this as aerosols

252 00:11:04.330 --> 00:11:06.030 and aerosol is basically,

253 00:11:06.030 --> 00:11:08.600 different small particles that could be liquid

254 00:11:08.600 --> 00:11:12.560 or solid that are suspended in the atmospheres.

255 00:11:12.560 --> 00:11:15.140 As I mentioned, it could be that of sea salts

256 00:11:15.140 --> 00:11:18.890 as well, volcanic ashes, smoke from fires, biomasses

257 00:11:18.890 --> 00:11:20.810 and factory pollution, right?

258 00:11:20.810 --> 00:11:22.190 Again, in our case,

259 00:11:22.190 --> 00:11:24.840 we are particularly interested in working

260 00:11:24.840 --> 00:11:26.570 with this particle that are coming

261 00:11:26.570 --> 00:11:29.280 from the other side of the Atlantic.

262 00:11:29.280 --> 00:11:31.480 This particle are very important because

263 00:11:31.480 --> 00:11:35.620 they provide nutrients to terrestrial ecosystem,

264 00:11:35.620 --> 00:11:39.180 but also to ocean ecosystem, so is very important.

265 00:11:39.180 --> 00:11:41.900 But when we're talking about public health,

266 00:11:41.900 --> 00:11:43.820 that's the negative component.

267 00:11:43.820 --> 00:11:47.750 Because in some cases, this particle,

268 00:11:47.750 --> 00:11:48.583 they're coarse, right?

269 00:11:48.583 --> 00:11:50.880 So in some cases they're big enough,

270 00:11:50.880 --> 00:11:52.910 but to fly from the other,

271 00:11:52.910 --> 00:11:55.950 to be suspended for a long period of time,

272 00:11:55.950 --> 00:11:58.120 and to cross all over the Atlantic

273 00:11:58.120 --> 00:11:59.960 suspended in the atmosphere,

274 00:11:59.960 --> 00:12:03.240 some of this particle are very small in size.

275 00:12:03.240 --> 00:12:06.810 And that's why it could be dangerous for public health,

276 00:12:06.810 --> 00:12:08.380 because some of them have the capacity

277 00:12:08.380 --> 00:12:11.840 to get inside of your system very deep.

278 00:12:11.840 --> 00:12:13.553 And in some cases, because we're talking about particles

279 00:12:13.553 --> 00:12:15.283 that are very small, right?

280 00:12:16.160 --> 00:12:17.820 This is another way on how to see it.

281 00:12:17.820 --> 00:12:20.720 We have the source, which is in the African continent,

282 00:12:20.720 --> 00:12:23.550 in the Northern side, from Sahara and the Sahel.

283 00:12:23.550 --> 00:12:27.470 And we need some specific condition for this sediment

284 00:12:27.470 --> 00:12:29.410 to get lift by the air,

285 00:12:29.410 --> 00:12:31.247 and to be transported by the trade winds,

286 00:12:31.247 --> 00:12:33.440 to the other side of the Atlantic.

287 00:12:33.440 --> 00:12:37.310 So we need to consider the wind speed, wind direction,

288 00:12:37.310 --> 00:12:41.790 and also the conditions that are causing the lift

289 00:12:41.790 --> 00:12:45.170 to occur in the Saharan desert, right?

290 00:12:45.170 --> 00:12:48.170 So when this, all this planets are aligned,

291 00:12:48.170 --> 00:12:51.220 that means that a dust cloud could be transported

292 00:12:51.220 --> 00:12:54.180 to the other side of the Atlantic, okay.

293 00:12:54.180 --> 00:12:55.610 The main season in the Caribbean

294 00:12:55.610 --> 00:12:58.710 of the African dust arriving to our region

295 00:12:58.710 --> 00:13:00.410 are mainly during the Summer, right?

296 00:13:00.410 --> 00:13:03.407 So it's also interacting with the hottest season

297 00:13:03.407 --> 00:13:05.120 in the Caribbean,

298 00:13:05.120 --> 00:13:09.760 and also it's interacting with the tropical storms.

299 00:13:09.760 --> 00:13:12.184 So you will see that

300 00:13:12.184 --> 00:13:16.200 the season start to increase the Saharan dust.

301 00:13:16.200 --> 00:13:18.460 These aerosols arriving to the Caribbean

302 00:13:18.460 --> 00:13:20.630 are increasing after May

303 00:13:20.630 --> 00:13:22.360 receiving a peak of the season

304 00:13:22.360 --> 00:13:23.580 during the months of June,

305 00:13:23.580 --> 00:13:25.940 and then starting to decrease again during July,

306 00:13:25.940 --> 00:13:27.340 August and September.

307 00:13:27.340 --> 00:13:28.990 And September is the peak season

308 00:13:28.990 --> 00:13:30.290 for the Caribbean region,

309 00:13:30.290 --> 00:13:34.020 for the hurricane Caribbean region, in our case.

310 00:13:34.020 --> 00:13:36.548 So the Saharan dust is also,

311 00:13:36.548 --> 00:13:39.827 and these aerosols are interacting also with the atmosphere,

312 00:13:39.827 --> 00:13:42.290 which is important because this is dry air.

313 00:13:42.290 --> 00:13:43.360 And in some cases,

314 00:13:43.360 --> 00:13:45.470 this Sahara dust also is associated

315 00:13:45.470 --> 00:13:49.680 with inhibition of the formation of tropical storms

316 00:13:49.680 --> 00:13:51.310 and powerful hurricanes.

317 00:13:51.310 --> 00:13:55.680 We still need to analyze better that kind of information,

318 00:13:55.680 --> 00:13:59.050 but the scientists are still wondering

319 00:13:59.050 --> 00:14:02.690 how these interactions could be positive, in some cases

320 00:14:02.690 --> 00:14:06.010 for hurricane formation in the Caribbean.

321 00:14:06.010 --> 00:14:07.918 These aerosol are also associated

322 00:14:07.918 --> 00:14:10.100 with an increase in PM2.5, as I mentioned.

323 00:14:10.100 --> 00:14:15.020 Some of them are big, bigger than PM10, for example,

324 00:14:15.020 --> 00:14:19.200 but some others could be as small as 2.5 or even smaller.

325 00:14:19.200 --> 00:14:21.340 And that's why they have the capacity to float

326 00:14:21.340 --> 00:14:23.160 and to be suspended in the atmosphere

327 00:14:23.160 --> 00:14:24.860 for thousand of kilometers, right?

328 00:14:25.790 --> 00:14:29.010 So when these dust clouds arrive to our region,

329 00:14:29.010 --> 00:14:34.010 it's also increasing the concentration of PM2.5

330 00:14:34.590 --> 00:14:35.810 during this season

331 00:14:35.810 --> 00:14:38.263 and it's associated with the peak events, right?

332 00:14:39.101 --> 00:14:41.640 And as you can see, I'm just citing here

333 00:14:41.640 --> 00:14:44.640 that the dust, it positively associated

334 00:14:44.640 --> 00:14:46.770 with cardiovascular and respiratory conditions

335 00:14:46.770 --> 00:14:48.700 in the Caribbean and in this case

336 00:14:48.700 --> 00:14:50.820 is related to Puerto Rico,

337 00:14:50.820 --> 00:14:54.410 but also is associated with asthma, hospitalization

338 00:14:54.410 --> 00:14:56.900 and emergency room visits in children's,

339 00:14:56.900 --> 00:14:58.830 which we are talking about kids

340 00:14:58.830 --> 00:15:01.823 in Trinidad and Tobago, Guadalupe and Granada.

341 00:15:03.420 --> 00:15:07.520 So one of the channels that we're using

342 00:15:07.520 --> 00:15:09.380 to identify these aerosols

343 00:15:09.380 --> 00:15:10.707 is the aerosol optical depth.

344 00:15:10.707 --> 00:15:13.410 The aerosol optical depth is by scattering,

345 00:15:13.410 --> 00:15:15.060 the light scattering that we're receiving

346 00:15:15.060 --> 00:15:17.630 using satellite remote sensing

347 00:15:17.630 --> 00:15:20.290 and information from different sensors

348 00:15:20.290 --> 00:15:22.060 that I'm gonna be speaking about.

349 00:15:22.060 --> 00:15:25.300 And so this is the, they have no maximum units.

350 00:15:25.300 --> 00:15:28.030 They can go from zero up to two until now,

351 00:15:28.030 --> 00:15:29.683 after we saw with Godzilla.

352 00:15:30.920 --> 00:15:34.420 So zero means that there are no visible particles

353 00:15:34.420 --> 00:15:38.180 in the atmosphere that could be identified

354 00:15:38.180 --> 00:15:40.570 using these sensors.

355 00:15:40.570 --> 00:15:43.050 And the higher the numbers,

356 00:15:43.050 --> 00:15:46.900 it means that a lot of particles are in the atmosphere

357 00:15:46.900 --> 00:15:49.670 are being identified using the satellites

358 00:15:49.670 --> 00:15:53.045 that are floating in the atmosphere, okay?

359 00:15:53.045 --> 00:15:55.100 In terms of the data that we're using,

360 00:15:55.100 --> 00:15:58.260 as I mentioned, we're using different sources of data.

361 00:15:58.260 --> 00:15:59.093 So we're using VIIRS,

362 00:15:59.093 --> 00:16:02.513 which is visible infrared imaging radiometer suite,

363 00:16:03.367 --> 00:16:06.910 and coming out from that sensor we're using AOD.

364 00:16:06.910 --> 00:16:09.370 AOD again is aerosol optical depth.

365 00:16:09.370 --> 00:16:11.560 Then we have a Scatter Angstrom Exponent.

366 00:16:11.560 --> 00:16:14.560 You see this is an important variable,

367 00:16:14.560 --> 00:16:16.693 because it is associated,

368 00:16:17.628 --> 00:16:21.850 the lower the value with this, the Angstrom Exponent,

369 00:16:21.850 --> 00:16:23.640 it means that the particles

370 00:16:23.640 --> 00:16:26.760 are more associated to be dust, okay?

371 00:16:26.760 --> 00:16:29.180 So it's a proxy

372 00:16:29.180 --> 00:16:31.240 because when you're using satellite information,

373 00:16:31.240 --> 00:16:34.950 you are not seeing necessary the distinction between dust

374 00:16:34.950 --> 00:16:36.240 and some other particle

375 00:16:36.240 --> 00:16:38.490 that can be floating in the atmosphere,

376 00:16:38.490 --> 00:16:40.540 as I mentioned with ashes.

377 00:16:40.540 --> 00:16:43.967 But if you look at other kind of signal, for example,

378 00:16:43.967 --> 00:16:46.180 and in this case the Angstrom exponent,

379 00:16:46.180 --> 00:16:49.560 you can have a better idea of what kind of aerosol

380 00:16:49.560 --> 00:16:54.370 is floating in that dust, okay, in that cloud.

381 00:16:54.370 --> 00:16:56.810 So we are using Angstrom exponent

382 00:16:56.810 --> 00:16:58.633 but also mass concentration.

383 00:16:59.660 --> 00:17:01.540 To understand and to see the better,

384 00:17:01.540 --> 00:17:05.070 how this atmospheric variables

385 00:17:05.070 --> 00:17:07.740 are interacting with other environmental factors

386 00:17:07.740 --> 00:17:09.550 nearby the Caribbean region,

387 00:17:09.550 --> 00:17:13.580 we're also using sea surface temperature

388 00:17:13.580 --> 00:17:15.800 to see how it can influence,

389 00:17:15.800 --> 00:17:18.760 if it have cooling effects over the ocean,

390 00:17:18.760 --> 00:17:21.870 or if it has a warming effect over the ocean.

391 00:17:21.870 --> 00:17:23.660 And it's three case,

392 00:17:23.660 --> 00:17:27.483 it depends on how it's occurring this dust cloud,

393 00:17:29.230 --> 00:17:32.800 the day, the concentration and the amount of dust

394 00:17:32.800 --> 00:17:34.494 that can be present.

395 00:17:34.494 --> 00:17:39.494 We're also using MODIS and UTCI, which is from Sentinel.

396 00:17:39.940 --> 00:17:43.170 This is a Universal Thermal Climate Index.

397 00:17:43.170 --> 00:17:44.980 To see again, the interaction

398 00:17:44.980 --> 00:17:47.830 with the occurrence of the Saharan dust

399 00:17:47.830 --> 00:17:52.450 in the Caribbean and the temperatures in our region.

400 00:17:52.450 --> 00:17:53.283 To do that,

401 00:17:53.283 --> 00:17:58.140 we started analyzing daily values since 2012, until 2020.

402 00:17:59.751 --> 00:18:03.750 You have all of the current databases.

403 00:18:03.750 --> 00:18:06.200 There are different satellites

404 00:18:06.200 --> 00:18:08.010 coming from NASA for example,

405 00:18:08.010 --> 00:18:10.680 some of the are geostationary data,

406 00:18:10.680 --> 00:18:12.960 and some others are orbital data.

407 00:18:12.960 --> 00:18:15.820 And where we say geostationary data for example,

408 00:18:15.820 --> 00:18:17.540 to use geostationary data,

409 00:18:17.540 --> 00:18:20.810 it means that it is a satellite or a signal

410 00:18:20.810 --> 00:18:24.403 that is providing you information very frequently,

411 00:18:25.470 --> 00:18:29.870 from the same part of the earth constantly, right?

412 00:18:29.870 --> 00:18:32.030 So like, as it can be with GOES-R, for example,

413 00:18:32.030 --> 00:18:36.190 we're also using GOES-R to develop the early warning system.

414 00:18:36.190 --> 00:18:38.510 But if you want to understand the trajectory

415 00:18:39.550 --> 00:18:41.880 of this system for example,

416 00:18:41.880 --> 00:18:44.050 so then we're using, for example, VIIRS,

417 00:18:44.050 --> 00:18:47.180 because VIIRS is a polar orbit and is a satellite

418 00:18:47.180 --> 00:18:49.260 that is turning around the earth

419 00:18:49.260 --> 00:18:51.670 and is providing you information

420 00:18:51.670 --> 00:18:53.720 about what is happening with this aerosols

421 00:18:53.720 --> 00:18:57.690 and the atmospheric conditions in other places of the world.

422 00:18:57.690 --> 00:18:59.520 So you can understand what is happening

423 00:18:59.520 --> 00:19:02.000 with the source of the dust

424 00:19:02.000 --> 00:19:04.360 that are probably coming to your region

425 00:19:04.360 --> 00:19:05.830 in the next couple of days.

426 00:19:05.830 --> 00:19:09.660 So we're using two different formats of information.

427 00:19:09.660 --> 00:19:11.540 One is geostationary data

428 00:19:11.540 --> 00:19:13.400 that are coming from GOES-R mainly,

429 00:19:13.400 --> 00:19:14.940 and the other ones that are coming from VIIRS

430 00:19:14.940 --> 00:19:18.140 that are orbital information.

431 00:19:18.140 --> 00:19:19.970 The orbital information has a limitation,

432 00:19:19.970 --> 00:19:22.540 because for example, in our case, Puerto is very small.

433 00:19:22.540 --> 00:19:26.100 So it means that the VIIRS is only providing data,

434 00:19:26.100 --> 00:19:27.853 very accurate data for the region,

435 00:19:28.760 --> 00:19:31.513 every couple of days, for example.

436 00:19:31.513 --> 00:19:36.280 It's not necessarily, it like between five to seven days,

437 00:19:36.280 --> 00:19:39.850 the interval or the frequency when you can have

438 00:19:39.850 --> 00:19:42.910 information for aerosols in the Caribbean.

439 00:19:42.910 --> 00:19:44.910 But if you're using GOES-R for example,

440 00:19:44.910 --> 00:19:49.320 GOES-R is providing you aerosol information constantly.

441 00:19:49.320 --> 00:19:51.220 Well, most of the time there are still,

442 00:19:51.220 --> 00:19:52.290 there are other limitations,

443 00:19:52.290 --> 00:19:54.400 but I'm not gonna be speaking about that.

444 00:19:54.400 --> 00:19:55.420 There are other limitation

445 00:19:55.420 --> 00:19:57.840 about this geostationary satellite,

446 00:19:57.840 --> 00:19:59.330 but it could be providing you

447 00:20:00.270 --> 00:20:01.880 very frequent information

448 00:20:01.880 --> 00:20:04.453 about the aerosol optical depth in the region.

449 00:20:05.290 --> 00:20:08.370 So with all this aerosol we have in place

450 00:20:08.370 --> 00:20:10.360 the first experimental decision support tool,

451 00:20:10.360 --> 00:20:12.020 this is how we're calling it

452 00:20:12.020 --> 00:20:14.820 in collaboration with the Puerto Rico Department of Health

453 00:20:14.820 --> 00:20:18.040 and different 19 organizations, health clinics,

454 00:20:18.040 --> 00:20:20.300 and the National Weather Service.

455 00:20:20.300 --> 00:20:25.260 It's been posted in the webpage of CARICOOS,

456 00:20:25.260 --> 00:20:28.020 CARICOOS is the Caribbean Coastal Ocean

457 00:20:28.020 --> 00:20:29.450 Observing System.

458 00:20:29.450 --> 00:20:32.240 And it's already a platform that is providing

459 00:20:32.240 --> 00:20:33.920 meteorological and climate information

460 00:20:33.920 --> 00:20:36.130 for Puerto Rico and the US Green Islands.

461 00:20:36.130 --> 00:20:36.963 So in this case,

462 00:20:36.963 --> 00:20:39.380 we're making leverage of that existing platform

463 00:20:39.380 --> 00:20:41.900 to provide to the audience

464 00:20:41.900 --> 00:20:45.240 the information that we're obtaining in this area.

465 00:20:45.240 --> 00:20:46.880 So we are retrieving data from

466 00:20:46.880 --> 00:20:49.460 four different regions in Puerto Rico.

467 00:20:49.460 --> 00:20:52.623 And this is the four tachometers that we have.

468 00:20:53.470 --> 00:20:55.750 We identified the level of risk

469 00:20:55.750 --> 00:20:57.870 based on the information that we obtain

470 00:20:57.870 --> 00:20:58.950 with the health clinics,

471 00:20:58.950 --> 00:21:03.260 with patients and with the secondary data that we analyzed.

472 00:21:03.260 --> 00:21:05.120 And based on that impact,

473 00:21:05.120 --> 00:21:07.940 we have the first warning system

474 00:21:07.940 --> 00:21:12.530 for level mild, extreme to very extreme conditions

475 00:21:12.530 --> 00:21:15.930 in term of air quality, and it depends on the color.

476 00:21:15.930 --> 00:21:18.510 And we have four different sites distributed

477 00:21:20.990 --> 00:21:23.810 in the most populated region of the island.

478 00:21:23.810 --> 00:21:26.430 To provide that information in real time

479 00:21:26.430 --> 00:21:31.430 and also we are developing the early warning system,

480 00:21:31.610 --> 00:21:34.200 meaning that it will be a forecast

481 00:21:34.200 --> 00:21:37.890 to give this information to the general public in advance

482 00:21:37.890 --> 00:21:41.040 for them to take precautious actions

483 00:21:41.040 --> 00:21:45.520 before this dust is arriving to the Caribbean.

484 00:21:45.520 --> 00:21:49.070 So this is our just example of how it looks like.

485 00:21:49.070 --> 00:21:51.280 The images are very raw, obviously,

486 00:21:51.280 --> 00:21:53.360 but as soon as you get into the webpage,

487 00:21:53.360 --> 00:21:54.990 you can use it in your app,

488 00:21:54.990 --> 00:21:56.720 and you can see the tachometers

489 00:21:56.720 --> 00:21:58.770 providing you in real time information

490 00:21:58.770 --> 00:22:02.910 about air quality associated with aerosols.

491 00:22:02.910 --> 00:22:04.850 This information had been used also

492 00:22:04.850 --> 00:22:08.910 to develop educational materials, and to do outreach

493 00:22:08.910 --> 00:22:11.660 with the National Weather Service in Puerto Rico,

494 00:22:11.660 --> 00:22:13.583 both in Spanish and English,

495 00:22:14.617 --> 00:22:17.223 and being used by the Department of Health.

496 00:22:18.170 --> 00:22:20.410 So now as we have like a prototype.

497 00:22:20.410 --> 00:22:23.860 As you can see here in October 3rd, 2021,

498 00:22:23.860 --> 00:22:26.640 we suffer one of the most recent dust cloud

499 00:22:26.640 --> 00:22:29.577 after the Godzilla dust event that occurred in 2020.

500 00:22:29.577 --> 00:22:32.370 And most of the agencies that were working with us

501 00:22:32.370 --> 00:22:34.940 and collaborating, they were using this information

502 00:22:36.424 --> 00:22:40.740 to make the population aware of their own healthy conditions

503 00:22:40.740 --> 00:22:44.200 that we were facing for sensitive group

504 00:22:44.200 --> 00:22:47.460 to take precautious measures.

505 00:22:47.460 --> 00:22:50.158 This is another example done on October seven,

506 00:22:50.158 --> 00:22:52.790 the agency were using our information

507 00:22:52.790 --> 00:22:54.890 to provide the best information as possible

508 00:22:54.890 --> 00:22:58.023 to the general audience and to sensitive groups.

509 00:23:01.054 --> 00:23:02.700 We did a couple of webinars

510 00:23:02.700 --> 00:23:05.790 impacting over 400,000 people in Puerto Rico.

511 00:23:05.790 --> 00:23:09.130 We did it with NASA, with the National Weather Service.

512 00:23:09.130 --> 00:23:11.349 We did it with the (indistinct),

513 00:23:11.349 --> 00:23:15.500 which is a, it's a science museum in Puerto Rico

514 00:23:15.500 --> 00:23:17.810 that are being responsible of

515 00:23:17.810 --> 00:23:21.100 providing a lot of education and webinars.

516 00:23:21.100 --> 00:23:23.723 So they did most of the outreach,

517 00:23:26.410 --> 00:23:30.650 and we did all of the science to the audience.

518 00:23:30.650 --> 00:23:34.020 So we have already now also

519 00:23:34.020 --> 00:23:37.836 an Air Quality Awareness Week in Puerto Rico,

520 00:23:37.836 --> 00:23:41.510 and it's happening all days, all year, sorry,

521 00:23:41.510 --> 00:23:44.010 and at the beginning of May.

522 00:23:44.010 --> 00:23:46.440 So during the month of May,

523 00:23:46.440 --> 00:23:49.590 we are giving webinars for the general audience

524 00:23:49.590 --> 00:23:51.200 in Spanish and English.

525 00:23:51.200 --> 00:23:53.540 Two different sessions for,

526 00:23:53.540 --> 00:23:55.400 to comply with Puerto Rico because,

527 00:23:55.400 --> 00:23:57.580 in Puerto Rico 98% of the population

528 00:23:57.580 --> 00:23:59.170 are Hispanic and Latino.

529 00:23:59.170 --> 00:24:03.040 And it's the main, is the principle language

530 00:24:03.040 --> 00:24:04.390 spoken here in Puerto Rico.

531 00:24:05.410 --> 00:24:08.683 Okay, so with that being said,

532 00:24:09.810 --> 00:24:11.830 something happened in between

533 00:24:11.830 --> 00:24:14.740 while we were developing the early warning system

534 00:24:14.740 --> 00:24:17.440 and when the first cases of COVID 19

535 00:24:17.440 --> 00:24:19.150 arrived to the Caribbean.

536 00:24:19.150 --> 00:24:20.900 So as I mentioned at the beginning,

537 00:24:22.230 --> 00:24:24.840 so the Saharan dust is associated

538 00:24:24.840 --> 00:24:27.330 with than accessories of emergency room visits,

539 00:24:27.330 --> 00:24:28.490 hospitalization,

540 00:24:28.490 --> 00:24:32.210 and in some cases, partially attributable to death.

541 00:24:32.210 --> 00:24:34.160 They partially attributable that doesn't mean

542 00:24:34.160 --> 00:24:36.640 that you are dying because of the Saharan dust,

543 00:24:36.640 --> 00:24:38.850 but with some other comorbidities

544 00:24:38.850 --> 00:24:40.660 and some other interactions,

545 00:24:40.660 --> 00:24:44.480 you might be suffering for exacerbations

546 00:24:44.480 --> 00:24:46.163 and you are most likely to die.

547 00:24:47.180 --> 00:24:49.200 So what we did is that,

548 00:24:49.200 --> 00:24:52.070 all of the sudden, the first cases of COVID 19

549 00:24:52.070 --> 00:24:55.460 getting into Puerto Rico in March 13th, 2020,

550 00:24:55.460 --> 00:25:00.120 and then NASA opened another call for proposal

551 00:25:00.120 --> 00:25:03.070 requesting to work with the COVID 19,

552 00:25:03.070 --> 00:25:04.550 it was a rapid assessment.

553 00:25:04.550 --> 00:25:08.370 So we wasn't expected an extreme event of dust

554 00:25:08.370 --> 00:25:11.250 as it happened during the Summer of 2020.

555 00:25:11.250 --> 00:25:14.480 But since we were already working

556 00:25:14.480 --> 00:25:17.863 with the Saharan dust previously for five years or more.

557 00:25:18.930 --> 00:25:20.770 We had this project, but we have been working

558 00:25:20.770 --> 00:25:23.310 with the Saharan dust for more years.

559 00:25:23.310 --> 00:25:27.120 So we were wondering what could happen if

560 00:25:27.120 --> 00:25:30.760 we have an extreme dust cloud event

561 00:25:30.760 --> 00:25:34.070 getting to the Caribbean, deteriorating the air quality,

562 00:25:34.070 --> 00:25:38.070 and also having a lot of cases with COVID 19, right?

563 00:25:38.070 --> 00:25:40.450 So if already the Saharan dust

564 00:25:40.450 --> 00:25:42.330 is associated with an increase

565 00:25:42.330 --> 00:25:44.700 in the demand of healthcare facilities,

566 00:25:44.700 --> 00:25:47.860 what could happen is we were seeing the news

567 00:25:47.860 --> 00:25:49.220 in other places of the world

568 00:25:49.220 --> 00:25:50.610 where the hospitals were collapsing

569 00:25:50.610 --> 00:25:52.420 because they didn't have the capacity

570 00:25:52.420 --> 00:25:54.630 to provide the services to the patients, right?

571 00:25:54.630 --> 00:25:57.240 So we were wondering when we were submitting this proposal,

572 00:25:57.240 --> 00:25:59.200 what could happen if both of them

573 00:25:59.200 --> 00:26:02.703 are simultaneously occurring in the same time, right?

574 00:26:03.980 --> 00:26:06.330 So we submit the proposal,

575 00:26:06.330 --> 00:26:09.370 we obtained the grant and we quickly get

576 00:26:10.630 --> 00:26:13.050 working with the research.

577 00:26:13.050 --> 00:26:16.070 As I mentioned, when we submit the proposal,

578 00:26:16.070 --> 00:26:20.630 it was in April, 2020, just a couple of weeks

579 00:26:20.630 --> 00:26:22.610 after the first cases of COVID 19

580 00:26:22.610 --> 00:26:24.240 reported in Puerto Rico.

581 00:26:24.240 --> 00:26:26.250 By that time, we were not expecting

582 00:26:26.250 --> 00:26:29.020 to have Godzilla dust event.

583 00:26:29.020 --> 00:26:30.690 And for those of you that are not aware

584 00:26:30.690 --> 00:26:33.520 of what was Godzilla, Godzilla was a dust cloud

585 00:26:33.520 --> 00:26:35.480 that arrived to the Caribbean region.

586 00:26:35.480 --> 00:26:39.720 And we stayed under unhealthy conditions

587 00:26:39.720 --> 00:26:41.040 due to air quality

588 00:26:41.040 --> 00:26:44.270 for more than three days in the Caribbean region,

589 00:26:44.270 --> 00:26:47.240 so it was a little bit overwhelming. (laughs)

590 00:26:47.240 --> 00:26:48.470 So what we did is that

591 00:26:48.470 --> 00:26:52.080 we design a couple of instrument

592 00:26:52.080 --> 00:26:55.000 to work with physicians, with patients,

593 00:26:55.000 --> 00:26:56.880 and to better understandable vulnerabilities.

594 00:26:56.880 --> 00:26:59.030 We design a couple of qualitative instrument

595 00:26:59.030 --> 00:27:01.250 because we believe that working in public health,

596 00:27:01.250 --> 00:27:02.620 that the qualitative instrument

597 00:27:02.620 --> 00:27:04.710 could be richer in some cases,

598 00:27:04.710 --> 00:27:06.790 because they can provide you

599 00:27:06.790 --> 00:27:09.310 information about various vulnerability

600 00:27:09.310 --> 00:27:10.870 risk perception

601 00:27:10.870 --> 00:27:13.700 about how the people are working with this risk.

602 00:27:13.700 --> 00:27:15.490 This is risk perception as well, right?

603 00:27:15.490 --> 00:27:17.930 So we recruited more than...

604 00:27:17.930 --> 00:27:20.390 Sorry for those noises. (laughs)

605 00:27:20.390 --> 00:27:22.530 We recruited more than 55 physicians

606 00:27:22.530 --> 00:27:27.290 and over 100 patients to work with them.

607 00:27:27.290 --> 00:27:32.110 We also made a couple of memorandums of understanding

608 00:27:32.110 --> 00:27:34.210 and agreement with different clinics

609 00:27:34.210 --> 00:27:37.299 in order to receive medical records information,

610 00:27:37.299 --> 00:27:41.140 because not only understanding the number of cases

611 00:27:41.140 --> 00:27:43.900 that are getting into the hospital,

612 00:27:43.900 --> 00:27:48.260 but how these patients conditions

613 00:27:48.260 --> 00:27:51.270 could be exacerbated with the Saharan dust.

614 00:27:51.270 --> 00:27:53.950 And also we started to analyze

615 00:27:53.950 --> 00:27:56.620 the whole cost excess mortality,

616 00:27:56.620 --> 00:27:59.240 island wide, not only in some places,

617 00:27:59.240 --> 00:28:01.870 in interacting with the environmental factors.

618 00:28:01.870 --> 00:28:04.330 So this is like only a graphic showing

619 00:28:04.330 --> 00:28:07.640 when the first cases of COVID 19 arrive to Puerto Rico

620 00:28:07.640 --> 00:28:08.873 and to the Caribbean,

621 00:28:09.740 --> 00:28:14.740 and then how we suffered Godzilla dust event.

622 00:28:14.830 --> 00:28:17.790 The bigger the number in the right axis,

623 00:28:17.790 --> 00:28:20.540 as you can see are aerosol optical depth.

624 00:28:20.540 --> 00:28:23.770 It means that the most extreme values we observe

625 00:28:24.780 --> 00:28:28.180 for aerosols and these particles

626 00:28:28.180 --> 00:28:29.360 arriving to the Caribbean.

627 00:28:29.360 --> 00:28:32.450 It wast dust cloud huge enough

628 00:28:32.450 --> 00:28:36.630 that is almost covered all the Caribbean sea together,

629 00:28:36.630 --> 00:28:37.970 all of the lessers and fields,

630 00:28:37.970 --> 00:28:42.050 and also from Puerto Rico to Trinidad and Tobago.

631 00:28:42.050 --> 00:28:42.883 It was big enough,

632 00:28:42.883 --> 00:28:44.410 but also with a lot of concentration,

633 00:28:44.410 --> 00:28:46.860 higher values were observed during that time.

634 00:28:46.860 --> 00:28:48.420 In the central part of the graphic,

635 00:28:48.420 --> 00:28:50.420 what we're seeing here is that the black line

636 00:28:50.420 --> 00:28:54.630 are representing the years of 2020, the different month.

637 00:28:54.630 --> 00:28:55.640 And as you can see,

638 00:28:55.640 --> 00:28:59.060 it's marked a record for aerosol optical depth

639 00:28:59.060 --> 00:29:00.600 in our region.

640 00:29:00.600 --> 00:29:04.150 And again, Puerto Rico stayed for over three days

641 00:29:04.150 --> 00:29:05.930 with unhealthy sorry,

642 00:29:05.930 --> 00:29:09.560 with unhealthy conditions due to this Saharan dust PM2.5.

643 00:29:11.860 --> 00:29:12.693 And the bars,

644 00:29:12.693 --> 00:29:16.210 what we're seeing here are the number of cases

645 00:29:16.210 --> 00:29:21.210 that had been registered of COVID 19 and hospitalizations

646 00:29:22.550 --> 00:29:25.230 in some places of Puerto Rico, right?

647 00:29:25.230 --> 00:29:26.650 This is only a graphic,

648 00:29:26.650 --> 00:29:29.890 I'm not making any kind of assumption with the graphic.

649 00:29:29.890 --> 00:29:31.920 This is just to show you the patterns

650 00:29:31.920 --> 00:29:34.320 that were observed during that Summer.

651 00:29:34.320 --> 00:29:36.780 The lines are aerosol optical depth,

652 00:29:36.780 --> 00:29:39.053 the bars are hospital admissions.

653 00:29:40.450 --> 00:29:42.560 So in all places of Puerto Rico,

654 00:29:42.560 --> 00:29:44.960 as I mentioned in all our four tachometers,

655 00:29:44.960 --> 00:29:48.950 you can see the Godzilla dust event marking a record

656 00:29:48.950 --> 00:29:52.060 as never occurred in the last decades,

657 00:29:52.060 --> 00:29:54.240 or even prior to the decade.

658 00:29:54.240 --> 00:29:56.390 Satellite information, the one that we're using

659 00:29:56.390 --> 00:30:00.560 is only going back until 2012,

660 00:30:00.560 --> 00:30:03.410 but you using ground based station you can go as back as,

661 00:30:04.251 --> 00:30:07.720 as probably 20 to 30 years before from now.

662 00:30:07.720 --> 00:30:09.930 And it was also a record

663 00:30:09.930 --> 00:30:13.450 for this dust event in the Caribbean.

664 00:30:13.450 --> 00:30:15.330 These are only pictures for you

665 00:30:15.330 --> 00:30:18.770 that can see how the visibility decreases so much

666 00:30:18.770 --> 00:30:20.450 in some places of Puerto Rico.

667 00:30:20.450 --> 00:30:21.330 In the right side,

668 00:30:21.330 --> 00:30:23.170 we're are seeing the Southwest of Puerto Rico,

669 00:30:23.170 --> 00:30:24.450 this is Guánica bay.

670 00:30:24.450 --> 00:30:28.070 And on top of it, you can see the day before

671 00:30:28.070 --> 00:30:29.850 the arrival of the Godzilla dust event

672 00:30:29.850 --> 00:30:32.930 and then very early at 9:00 AM in the morning.

673 00:30:32.930 --> 00:30:36.310 So the visibility decrease up to three miles only

674 00:30:36.310 --> 00:30:37.590 in most of the island,

675 00:30:37.590 --> 00:30:42.450 when the visibility in Puerto Rico is mostly 20 to 21 miles.

676 00:30:42.450 --> 00:30:45.110 So you can imagine that the deterioration in air quality

677 00:30:45.110 --> 00:30:46.820 that had happened.

678 00:30:46.820 --> 00:30:51.820 So working with the physicians, most of them agree that

679 00:30:53.130 --> 00:30:55.610 there were the severity of the symptom

680 00:30:55.610 --> 00:30:57.400 of the patient of COVID 19

681 00:30:57.400 --> 00:30:59.380 could be most likely to be exacerbated

682 00:30:59.380 --> 00:31:00.870 because of the dust clouds.

683 00:31:00.870 --> 00:31:02.910 And when we were working with the patient,

684 00:31:02.910 --> 00:31:05.910 some of them were telling that they were more sensitive

685 00:31:05.910 --> 00:31:10.910 to these aerosols after being confirmed with COVID 19.

686 00:31:12.200 --> 00:31:15.883 So they were more sensitive after surviving the COVID-19

687 00:31:15.883 --> 00:31:19.650 than they used to be before having COVID 19.

688 00:31:19.650 --> 00:31:24.350 So in somehow it means that nowadays they're most sensitive.

689 00:31:24.350 --> 00:31:27.300 We also did another survey where we were lucky

690 00:31:27.300 --> 00:31:31.270 because we have 1500 participants that work with us

691 00:31:31.270 --> 00:31:33.090 provide a lot of information.

692 00:31:33.090 --> 00:31:35.750 Most of them were female, so we need to highlight that.

693 00:31:35.750 --> 00:31:39.833 So that's important to say, between 25 to 44 years old,

694 00:31:40.820 --> 00:31:42.340 but something very important is that,

695 00:31:42.340 --> 00:31:44.280 almost 65% of the population

696 00:31:44.280 --> 00:31:47.010 had at least one chronic conditions,

697 00:31:47.010 --> 00:31:50.380 and those individuals with at least one comorbidity

698 00:31:50.380 --> 00:31:54.810 are 14.37 more likely to need medical services

699 00:31:54.810 --> 00:31:59.810 when they are facing the Saharan dust in Puerto Rico.

700 00:32:00.600 --> 00:32:01.470 And this is what happened,

701 00:32:01.470 --> 00:32:03.570 for example, with the Godzilla dust event.

702 00:32:05.430 --> 00:32:06.790 Most of the people that participate,

703 00:32:06.790 --> 00:32:10.270 90% of them are indicating the Saharan dust is affecting

704 00:32:10.270 --> 00:32:13.710 both their family members, but also their own health status.

705 00:32:13.710 --> 00:32:15.900 So not only the participants,

706 00:32:15.900 --> 00:32:18.420 but also they consider that in their family members

707 00:32:18.420 --> 00:32:23.420 are also getting affected by this atmospheric conditions.

708 00:32:24.380 --> 00:32:25.590 Asthma is important

709 00:32:25.590 --> 00:32:26.850 because most of the respondent

710 00:32:26.850 --> 00:32:28.950 and the participants that participated saying that

711 00:32:28.950 --> 00:32:31.370 65% had only one chronic condition,

712 00:32:31.370 --> 00:32:33.663 but asthma was the most reported condition.

713 00:32:34.720 --> 00:32:38.330 Another important issue is that apparently

714 00:32:38.330 --> 00:32:43.330 these symptoms are mild to level to not that heavy

715 00:32:45.610 --> 00:32:49.450 or not that complicated because only 12%,

716 00:32:49.450 --> 00:32:52.880 only 12% of the 1500 that participated

717 00:32:52.880 --> 00:32:54.280 that were saying that

718 00:32:54.280 --> 00:32:57.390 the Saharan dust is affecting the health,

719 00:32:57.390 --> 00:32:59.810 of their family members and the own health,

720 00:32:59.810 --> 00:33:03.060 only 12% are seeking medical attention.

721 00:33:03.060 --> 00:33:06.990 So meaning that the impact on health of the Saharan dust

722 00:33:06.990 --> 00:33:10.490 is not necessarily need to be something that

723 00:33:10.490 --> 00:33:12.720 at least with this cases, right,

724 00:33:12.720 --> 00:33:17.250 that is gonna be saturating all of the hospital and clinics,

725 00:33:17.250 --> 00:33:21.520 but only 12% are gonna be visiting or are getting,

726 00:33:21.520 --> 00:33:23.280 their symptoms are so complicated,

727 00:33:23.280 --> 00:33:25.033 they need medical attention.

728 00:33:26.590 --> 00:33:29.400 To continue working with public health data,

729 00:33:29.400 --> 00:33:32.340 we are requesting the medical records

730 00:33:32.340 --> 00:33:34.010 in six different health clinics.

731 00:33:34.010 --> 00:33:38.430 So nowaday, we have 1200 medical records,

732 00:33:38.430 --> 00:33:41.500 the clinics provide this information in paper,

733 00:33:41.500 --> 00:33:43.530 so we are now doing the data entry.

734 00:33:43.530 --> 00:33:46.210 That's why we are requesting a no cost extension,

735 00:33:46.210 --> 00:33:48.773 to analyze this part of the project.

736 00:33:49.930 --> 00:33:52.629 And we requested all of the information

737 00:33:52.629 --> 00:33:57.629 from the first month once the COVID 19 get to Puerto Rico

738 00:33:57.730 --> 00:34:01.220 after one year after completely, right?

739 00:34:01.220 --> 00:34:02.100 Because when it was,

740 00:34:02.100 --> 00:34:05.720 when we were planning to end the analysis.

741 00:34:05.720 --> 00:34:06.670 We were not that lucky,

742 00:34:06.670 --> 00:34:07.790 it took us a lot of time

743 00:34:07.790 --> 00:34:10.200 because we were dealing with legal offices (laughs)

744 00:34:10.200 --> 00:34:12.600 and a lot of paperwork and memorandums of understanding.

745 00:34:12.600 --> 00:34:15.050 But finally, we have this information available.

746 00:34:15.050 --> 00:34:18.770 This is the only missing information that we still need

747 00:34:18.770 --> 00:34:21.120 to analyze, to better understand,

748 00:34:21.120 --> 00:34:23.140 how the patients that were admitted

749 00:34:23.140 --> 00:34:24.763 or visiting the hospitals,

750 00:34:25.927 --> 00:34:29.860 how their conditions were exacerbated by these symptoms.

751 00:34:29.860 --> 00:34:31.050 In terms of the databases,

752 00:34:31.050 --> 00:34:33.970 and I'm gonna be very quickly on this.

753 00:34:33.970 --> 00:34:34.950 Most of them are the one

754 00:34:34.950 --> 00:34:36.783 that are already mentioned at the beginning,

755 00:34:36.783 --> 00:34:40.263 what we were using, mortality, hospital admission,

756 00:34:40.263 --> 00:34:41.363 emergency room visits.

757 00:34:42.620 --> 00:34:44.150 Environmental factor source are

758 00:34:44.150 --> 00:34:46.800 heat index, universal thermal climate index

759 00:34:46.800 --> 00:34:48.543 and aerosols, okay?

760 00:34:49.700 --> 00:34:51.980 In terms of the hospital admission, this is another graphic.

761 00:34:51.980 --> 00:34:54.650 And again, I'm not making another,

762 00:34:54.650 --> 00:34:56.460 not assumption about this graphic,

763 00:34:56.460 --> 00:34:58.710 but what I would like to show is that

764 00:34:58.710 --> 00:35:00.940 as we can see at the very first beginning,

765 00:35:00.940 --> 00:35:03.660 we did suffer a couple of cases of COVID 19

766 00:35:03.660 --> 00:35:05.952 and hospitalization in the six clinics

767 00:35:05.952 --> 00:35:08.690 that are participating with us.

768 00:35:08.690 --> 00:35:11.210 And then because of the lockdown

769 00:35:11.210 --> 00:35:13.242 and the curfew,

770 00:35:13.242 --> 00:35:14.618 and all of the restrictions

771 00:35:14.618 --> 00:35:16.850 that the government did during that period,

772 00:35:16.850 --> 00:35:20.170 we were able to control all of the local transmissions

773 00:35:20.170 --> 00:35:21.057 and the infections,

774 00:35:21.057 --> 00:35:24.380 and we can see how it went very low.

775 00:35:24.380 --> 00:35:26.650 But then all of a sudden,

776 00:35:26.650 --> 00:35:29.930 together with the Godzilla dust event,

777 00:35:29.930 --> 00:35:34.350 we can see how COVID 19 cases started to increase.

778 00:35:34.350 --> 00:35:35.183 I'm not saying again,

779 00:35:35.183 --> 00:35:37.590 that this is because of the Godzilla dust event,

780 00:35:37.590 --> 00:35:38.863 but it happening very,

781 00:35:42.170 --> 00:35:43.990 it's timely associated if you want, (laughs)

782 00:35:43.990 --> 00:35:45.260 because both of them occur

783 00:35:45.260 --> 00:35:48.050 during the same time and same period, okay.

784 00:35:48.050 --> 00:35:51.860 So once the cases started to increase during the Summer,

785 00:35:51.860 --> 00:35:55.420 then during the Fall, during the hurricane season,

786 00:35:55.420 --> 00:35:56.540 it started to decrease,

787 00:35:56.540 --> 00:35:58.430 there was a lot of, couple of curfews

788 00:35:58.430 --> 00:36:00.220 and lockdown and government restrictions.

789 00:36:00.220 --> 00:36:02.817 And then during the Winter, which it was expected,

790 00:36:02.817 --> 00:36:06.390 the COVID 19 cases started to increase again

791 00:36:06.390 --> 00:36:08.610 and then restrictions, and we can see it here.

792 00:36:08.610 --> 00:36:10.543 And again, I'm not saying that the environmental factors

793 00:36:10.543 --> 00:36:12.460 are the only one that are associated

794 00:36:12.460 --> 00:36:14.810 with COVID 19 transmission and infections,

795 00:36:14.810 --> 00:36:16.830 we need to consider so many other

796 00:36:16.830 --> 00:36:18.900 social behaviorals and patterns

797 00:36:19.800 --> 00:36:23.870 that has been confirmed by the scientists

798 00:36:23.870 --> 00:36:25.110 that are also related

799 00:36:26.960 --> 00:36:29.093 with the spread of the COVID 19.

800 00:36:30.090 --> 00:36:31.390 I show already this graphic,

801 00:36:31.390 --> 00:36:33.100 but it's just to highlight again,

802 00:36:33.100 --> 00:36:35.710 that right after the cases,

803 00:36:35.710 --> 00:36:38.520 when the cases started to rise during the Summer,

804 00:36:38.520 --> 00:36:41.460 we were also facing the Godzilla dust event

805 00:36:41.460 --> 00:36:43.170 during the same period.

806 00:36:43.170 --> 00:36:46.320 Again, I'm not saying that

807 00:36:46.320 --> 00:36:48.785 it was because of the Saharan dust

808 00:36:48.785 --> 00:36:51.873 that the COVID 19 cases get so high, okay?

809 00:36:53.820 --> 00:36:56.490 In case of what we have on the hospital admissions,

810 00:36:56.490 --> 00:36:59.370 this is our very demographic profiles.

811 00:36:59.370 --> 00:37:00.660 And in terms of the mortality

812 00:37:00.660 --> 00:37:03.210 is what I think what is very important.

813 00:37:03.210 --> 00:37:05.880 So we do have a couple of,

814 00:37:05.880 --> 00:37:09.150 nine or more different environmental variables.

815 00:37:09.150 --> 00:37:12.690 We only are analyzing in this case, nine of them,

816 00:37:12.690 --> 00:37:14.420 the one that we think

817 00:37:14.420 --> 00:37:17.810 that could be impacting health in Puerto Rico,

818 00:37:17.810 --> 00:37:21.470 and we build 18 different environmental indices,

819 00:37:21.470 --> 00:37:25.973 most of them retrieve from the satellites data.

820 00:37:27.050 --> 00:37:31.700 Since some of them, and both of them are correlated

821 00:37:31.700 --> 00:37:33.620 because these are atmospheric conditions

822 00:37:33.620 --> 00:37:35.290 that have a lot of co-linearity,

823 00:37:35.290 --> 00:37:38.040 so we only kept a couple of them

824 00:37:39.940 --> 00:37:44.000 to have a better understanding on how these variables

825 00:37:44.000 --> 00:37:48.070 are associated with mortality in Puerto Rico.

826 00:37:48.070 --> 00:37:50.300 So we started analyzing,

827 00:37:50.300 --> 00:37:53.200 we requested daily mortality

828 00:37:53.200 --> 00:37:57.006 from the Department of Health in Puerto Rico.

829 00:37:57.006 --> 00:38:02.006 And as you can see here, this is mortality, total mortality,

830 00:38:03.020 --> 00:38:04.290 all causes.

831 00:38:04.290 --> 00:38:07.083 Non accidental mortality, let me clarify that.

832 00:38:07.083 --> 00:38:09.503 This is non accidental mortality,

833 00:38:10.370 --> 00:38:14.320 and we create this table for you to see it, for example.

834 00:38:14.320 --> 00:38:16.680 So since 2015 to 2020,

835 00:38:19.460 --> 00:38:21.860 in Puerto mortalities,

836 00:38:21.860 --> 00:38:25.820 used to be higher during the Autumn and during the Winter

837 00:38:25.820 --> 00:38:27.600 still don't know why,

838 00:38:27.600 --> 00:38:29.653 but this is the patterns that we observe.

839 00:38:30.958 --> 00:38:35.630 As you can see, for the last five years per season,

840 00:38:36.840 --> 00:38:38.920 the higher mortality occur

841 00:38:38.920 --> 00:38:41.570 in the aftermath of hurricane Maria,

842 00:38:41.570 --> 00:38:43.720 not necessarily during hurricane Maria.

843 00:38:43.720 --> 00:38:46.930 Again, not too many people died during land-fall,

844 00:38:46.930 --> 00:38:48.410 but many people died

845 00:38:48.410 --> 00:38:50.400 in the aftermath of hurricane Maria,

846 00:38:50.400 --> 00:38:52.023 weeks and two weeks ago.

847 00:38:53.120 --> 00:38:54.670 So after that,

848 00:38:54.670 --> 00:38:58.570 you can see another record that occurred in 2020,

849 00:38:58.570 --> 00:39:03.110 but surprisingly, it didn't occur in Fall or Winter,

850 00:39:03.110 --> 00:39:04.830 it occurred in Summer.

851 00:39:04.830 --> 00:39:06.780 So it means that it's associated also

852 00:39:06.780 --> 00:39:08.610 with the COVID 19 cases,

853 00:39:08.610 --> 00:39:11.217 again, not attributable 100%

854 00:39:13.700 --> 00:39:17.190 to the cases of COVID, but because of the pandemic,

855 00:39:17.190 --> 00:39:21.190 a lot of people were afraid to search for medical attention

856 00:39:21.190 --> 00:39:23.930 and a lot of other things that need to be considered

857 00:39:23.930 --> 00:39:26.940 making another record for mortality

858 00:39:26.940 --> 00:39:28.780 in Puerto Rico during the Summer.

859 00:39:28.780 --> 00:39:32.440 Which is weird because over the last five years,

860 00:39:32.440 --> 00:39:34.690 this is the only Summer

861 00:39:34.690 --> 00:39:37.684 that it marked a record on mortality,

862 00:39:37.684 --> 00:39:39.984 this is the first time that we're seeing this.

863 00:39:40.830 --> 00:39:44.787 And we're wondering also how much this dust cloud event

864 00:39:44.787 --> 00:39:49.253 should be exacerbating the conditions, okay?

865 00:39:50.130 --> 00:39:52.880 So when we started analyzing mortality,

866 00:39:52.880 --> 00:39:54.547 we first starting by saying,

867 00:39:54.547 --> 00:39:56.570 "Okay, so we have a seasonality

868 00:39:56.570 --> 00:39:59.120 for the Saharan dust arrival to the Caribbean."

869 00:39:59.120 --> 00:40:01.340 So we have Saharan days, for example,

870 00:40:01.340 --> 00:40:03.290 and we have non Saharan days.

871 00:40:03.290 --> 00:40:05.600 And those non Saharan days are those that are

872 00:40:05.600 --> 00:40:10.420 where we are not seeing aerosol optical depth.

873 00:40:10.420 --> 00:40:13.732 For example, the threshold that we use is 0.18,

874 00:40:13.732 --> 00:40:17.540 I'm not gonna go into the details. (laughs)

875 00:40:17.540 --> 00:40:19.520 And the other ones are the days

876 00:40:19.520 --> 00:40:24.520 where we can observe 0.18 or values above that

877 00:40:25.090 --> 00:40:26.957 for the aerosol optical depth.

878 00:40:26.957 --> 00:40:30.080 And we started to see that, for example, even though

879 00:40:32.630 --> 00:40:36.930 these aerosols are more associated to the Summer,

880 00:40:36.930 --> 00:40:40.260 but we can see a distinction also on mortality

881 00:40:40.260 --> 00:40:43.460 due to respiratory conditions without flu cases,

882 00:40:43.460 --> 00:40:45.470 because flu in Puerto Rico

883 00:40:45.470 --> 00:40:47.820 has a very marked seasonality as well,

884 00:40:47.820 --> 00:40:50.010 and it's more associated with Winter.

885 00:40:50.010 --> 00:40:52.980 So we took flu cases apart,

886 00:40:52.980 --> 00:40:56.000 and we take it out of the database and we only analyzed

887 00:40:56.000 --> 00:40:58.380 all of the other respiratory condition,

888 00:40:58.380 --> 00:41:01.713 and we started seeing some specific results.

889 00:41:03.670 --> 00:41:06.280 Analyzing it with COVID 19,

890 00:41:06.280 --> 00:41:10.600 we observed that actually during the Summer,

891 00:41:10.600 --> 00:41:15.600 the patients that had COVID 19 were more likely to die,

892 00:41:15.840 --> 00:41:20.150 when UTCI, UTCI is universal thermal climate index.

893 00:41:20.150 --> 00:41:23.060 This is another indicator to provide information

894 00:41:23.060 --> 00:41:26.860 about how is the sensitivity to heat, okay?

895 00:41:26.860 --> 00:41:28.010 So your thermal comfort

896 00:41:29.200 --> 00:41:32.390 in regard of temperatures, okay?

897 00:41:32.390 --> 00:41:36.460 So that is considering wind speed, wind direction,

898 00:41:36.460 --> 00:41:38.310 humidity, relative humility,

899 00:41:38.310 --> 00:41:41.552 and air surface temperature, obviously.

900 00:41:41.552 --> 00:41:42.970 But it's an indicator, it's an index,

901 00:41:42.970 --> 00:41:45.090 it's not an information that is being provided

902 00:41:45.090 --> 00:41:46.760 by the National Weather Service, for example,

903 00:41:46.760 --> 00:41:48.000 because what they're providing you

904 00:41:48.000 --> 00:41:53.000 is heat index or air surface temperature.

905 00:41:53.240 --> 00:41:57.760 But we are actually seeing and slightly increasing

906 00:41:57.760 --> 00:42:00.410 or slightly system higher, right?

907 00:42:00.410 --> 00:42:01.337 The mortality,

908 00:42:01.337 --> 00:42:03.690 and this is something that we observe during the Summer,

909 00:42:03.690 --> 00:42:05.540 which it makes a lot of sense, right?

910 00:42:06.470 --> 00:42:10.490 We also observe that COVID 19 patients

911 00:42:10.490 --> 00:42:15.490 are most likely to die when we do have also other allergens

912 00:42:16.320 --> 00:42:20.734 that are associated with molds and spores in Puerto Rico.

913 00:42:20.734 --> 00:42:23.340 So that's another natural sources of air pollution,

914 00:42:23.340 --> 00:42:24.570 as I mentioned.

915 00:42:24.570 --> 00:42:29.570 And also when we had starting adjusting

916 00:42:29.850 --> 00:42:33.200 all this analysis per age and per season,

917 00:42:33.200 --> 00:42:34.820 we are observing that actually

918 00:42:34.820 --> 00:42:36.750 the numbers are continuing to rise

919 00:42:36.750 --> 00:42:41.050 and are even higher for COVID 19 mortality,

920 00:42:41.050 --> 00:42:42.430 as we could be expected.

921 00:42:42.430 --> 00:42:43.840 And again, in this case,

922 00:42:43.840 --> 00:42:47.790 we are not considering the vaccine because we close

923 00:42:47.790 --> 00:42:51.960 prior to the vaccination period in Puerto Rico,

924 00:42:51.960 --> 00:42:55.100 so we close it until March 2021.

925 00:42:55.100 --> 00:42:56.700 Vaccine is another story,

926 00:42:56.700 --> 00:42:59.130 and vaccination is changing obviously

927 00:42:59.130 --> 00:43:01.407 it might change all of these results,

928 00:43:01.407 --> 00:43:05.640 and the technology from the medical component,

929 00:43:05.640 --> 00:43:07.270 because there are new treatments,

930 00:43:07.270 --> 00:43:10.000 there are innovations in medicines,

931 00:43:10.000 --> 00:43:11.710 and a lot of other things that are helping

932 00:43:11.710 --> 00:43:15.597 for the patient not to die because of the COVID-19.

933 00:43:17.750 --> 00:43:19.670 In terms of other respiratory diseases,

934 00:43:19.670 --> 00:43:22.160 we also observe that aerosol optical depth

935 00:43:22.160 --> 00:43:24.900 is also associated with the mortality

936 00:43:24.900 --> 00:43:29.490 of ischemic heart disease for Puerto Ricans.

937 00:43:29.490 --> 00:43:33.950 And also it is consistent even when you are adjusting this

938 00:43:33.950 --> 00:43:36.400 per year, per season, per age,

939 00:43:36.400 --> 00:43:39.000 and the different adjusting that can be done

940 00:43:39.000 --> 00:43:41.520 using the Poisson model assumption

941 00:43:41.520 --> 00:43:46.080 observations and the regulation analysis that we did.

942 00:43:46.080 --> 00:43:49.350 For further considerations I think that

943 00:43:49.350 --> 00:43:52.610 we are hunger to analyze the medical records

944 00:43:52.610 --> 00:43:54.980 because we are still doing the data entry.

945 00:43:54.980 --> 00:43:58.240 We still have only numbers as I show you

946 00:43:58.240 --> 00:44:02.350 in terms of increases in hospital admissions

947 00:44:02.350 --> 00:44:03.867 and emergency room visits.

948 00:44:03.867 --> 00:44:06.140 And so we were more able to analyze

949 00:44:06.140 --> 00:44:08.467 and to have a better results with mortality.

950 00:44:08.467 --> 00:44:11.170 But mortality is only that is of the eyebrows meaning that

951 00:44:11.170 --> 00:44:15.190 if you are able to identify that mortality

952 00:44:15.190 --> 00:44:18.690 is increasing because of some specific conditions

953 00:44:18.690 --> 00:44:23.220 you might expect that also you might expect to see

954 00:44:23.220 --> 00:44:25.420 a lot of people searching for medical attention,

955 00:44:25.420 --> 00:44:28.720 but are not that fragile to die, for example,

956 00:44:28.720 --> 00:44:30.530 and some others that are getting affected,

957 00:44:30.530 --> 00:44:32.750 but not even considering

958 00:44:32.750 --> 00:44:35.240 to search for medical attention, right?

959 00:44:35.240 --> 00:44:39.770 So these are important findings because for Puerto Rico,

960 00:44:39.770 --> 00:44:42.220 I think that we are not only developing

961 00:44:42.220 --> 00:44:44.610 the early warning system for a hazard

962 00:44:44.610 --> 00:44:47.950 that is deteriorating public health in the region,

963 00:44:47.950 --> 00:44:49.690 but also this is one of the first time

964 00:44:49.690 --> 00:44:52.800 that we can provide evidence that the Saharan dust

965 00:44:52.800 --> 00:44:55.550 is in somehow related with mortality.

966 00:44:55.550 --> 00:44:57.720 As well again, partially attributable.

967 00:44:57.720 --> 00:45:01.080 Something is a statistical analysis,

968 00:45:01.080 --> 00:45:04.650 and some other is that by doing the qualitative analysis,

969 00:45:04.650 --> 00:45:07.080 talking with the physician and with the experts,

970 00:45:07.080 --> 00:45:08.210 with the informants,

971 00:45:08.210 --> 00:45:10.930 we might be able to explain better

972 00:45:10.930 --> 00:45:14.890 how this hazard is deteriorating

973 00:45:14.890 --> 00:45:17.020 the health of their patients.

974 00:45:17.020 --> 00:45:20.010 We still have a lot of other questions

975 00:45:20.010 --> 00:45:23.050 that need to be answered in order to identify

976 00:45:23.050 --> 00:45:25.050 the vulnerable patients and population.

977 00:45:25.050 --> 00:45:26.570 I think that it's important

978 00:45:26.570 --> 00:45:29.350 that we are developing early warning system.

979 00:45:29.350 --> 00:45:31.610 You need to identify your target population,

980 00:45:31.610 --> 00:45:34.030 because this is how exactly,

981 00:45:34.030 --> 00:45:36.280 if you are talking about the population

982 00:45:36.280 --> 00:45:38.090 that are getting flooded or not.

983 00:45:38.090 --> 00:45:41.250 So you need to address your communication,

984 00:45:41.250 --> 00:45:44.470 your risk, your advisories

985 00:45:44.470 --> 00:45:48.350 to the more sensitive groups in order for them

986 00:45:48.350 --> 00:45:53.350 to take precautions before the arrival of this dust cloud.

987 00:45:54.900 --> 00:45:58.040 So we will continue working on this

988 00:45:58.040 --> 00:46:00.500 and we'll stop sharing my screen,

989 00:46:00.500 --> 00:46:03.963 and I'll be happy to answer whatever question you may have.

990 00:46:07.412 --> 00:46:10.080 <v ->Thank you so much for the wonderful presentation Pablo.</v>

991 00:46:10.080 --> 00:46:12.530 And just a reminder to the audience

992 00:46:12.530 --> 00:46:14.650 that if you have any questions,

993 00:46:14.650 --> 00:46:17.510 please do put them in the chat box.

994 00:46:17.510 --> 00:46:22.440 And well, for this seminar, we have 19 students attending,

995 00:46:22.440 --> 00:46:25.650 and we actually have already collected

996 00:46:25.650 --> 00:46:28.430 some of the questions from the students.

997 00:46:28.430 --> 00:46:30.370 So while the audience

998 00:46:30.370 --> 00:46:33.090 are putting their questions in the chat box,

999 00:46:33.090 --> 00:46:37.670 we are to start with two questions from students.

1000 00:46:37.670 --> 00:46:40.640 Actually, there are two types of questions

1001 00:46:40.640 --> 00:46:42.980 the students are mostly interested in.

1002 00:46:42.980 --> 00:46:46.800 The first one is actually, Pablo you show us how to

1003 00:46:46.800 --> 00:46:51.080 distangle the interactions between the dust and COVID

1004 00:46:51.080 --> 00:46:54.050 and the all the environmental factors.

1005 00:46:54.050 --> 00:46:57.240 So many students actually are wondering

1006 00:46:57.240 --> 00:47:00.340 how to control for confounding factors

1007 00:47:00.340 --> 00:47:02.500 like from human behavior.

1008 00:47:02.500 --> 00:47:05.130 Like people may spend more time in doors

1009 00:47:05.130 --> 00:47:06.350 during the Saharan dust.

1010 00:47:10.010 --> 00:47:11.960 <v ->That's a pretty good question.</v>

1011 00:47:11.960 --> 00:47:13.100 With the data that we have

1012 00:47:13.100 --> 00:47:16.730 from mortality and medical records,

1013 00:47:16.730 --> 00:47:17.990 it's a little bit complicated

1014 00:47:17.990 --> 00:47:21.270 to have that kind of information.

1015 00:47:21.270 --> 00:47:23.980 The only way that I will say that it will be useful

1016 00:47:23.980 --> 00:47:27.210 to receive more accurate information in that regard

1017 00:47:27.210 --> 00:47:28.693 will be by doing interviews.

1018 00:47:29.820 --> 00:47:34.640 One on one interviews with the patients, for example,

1019 00:47:34.640 --> 00:47:38.520 identifying or doing focus group directly with all of them.

1020 00:47:38.520 --> 00:47:40.230 That's another way on

1021 00:47:40.230 --> 00:47:43.290 how can you measure exposure, right?

1022 00:47:43.290 --> 00:47:44.123 Well not measure,

1023 00:47:44.123 --> 00:47:45.450 but at least having a proxy

1024 00:47:45.450 --> 00:47:48.640 on the exposure for Saharan dust.

1025 00:47:48.640 --> 00:47:49.930 So yes, it was complicated

1026 00:47:49.930 --> 00:47:52.390 because during this Godzilla dust event,

1027 00:47:52.390 --> 00:47:54.880 we were struggling with COVID 19.

1028 00:47:54.880 --> 00:47:57.130 One of the recommendations already in Puerto Rico,

1029 00:47:57.130 --> 00:47:59.570 and I think that is also in the United States as well happen

1030 00:47:59.570 --> 00:48:02.140 is that the agency were telling,

1031 00:48:02.140 --> 00:48:05.740 were suggesting the population to open the windows and doors

1032 00:48:05.740 --> 00:48:08.650 to let the clean air to get in. (laughs)

1033 00:48:08.650 --> 00:48:10.610 So, we'd receive a lot of memes

1034 00:48:10.610 --> 00:48:11.887 from people that were saying,

1035 00:48:11.887 --> 00:48:14.330 "Okay, so if I open the doors and the windows,

1036 00:48:14.330 --> 00:48:18.090 then my house will be full of sand. (laughs)

1037 00:48:18.090 --> 00:48:19.750 So what do I do?

1038 00:48:19.750 --> 00:48:21.287 I cannot open the windows.

1039 00:48:21.287 --> 00:48:24.020 I cannot open the doors

1040 00:48:24.020 --> 00:48:27.070 because I have an outdoor hazard,

1041 00:48:27.070 --> 00:48:29.130 but if I keep it closed,

1042 00:48:29.130 --> 00:48:32.337 then if someone bring the virus inside of my house,

1043 00:48:32.337 --> 00:48:35.390 I might probably get infected with the virus."

1044 00:48:35.390 --> 00:48:39.330 So yes, it was a little bit not funny,

1045 00:48:39.330 --> 00:48:42.059 but a lot of people took it that way.

1046 00:48:42.059 --> 00:48:44.380 And you can see a lot of memes that came out

1047 00:48:44.380 --> 00:48:45.453 during that season.

1048 00:48:47.010 --> 00:48:49.300 <v ->Thanks Pablo, yeah, this is very complicated.</v>

1049 00:48:49.300 --> 00:48:51.710 And when it gets to real policy recommendations,

1050 00:48:51.710 --> 00:48:56.210 I think a lot more research is needed.

1051 00:48:56.210 --> 00:48:58.958 I do see another question from Robert Dubrow,

1052 00:48:58.958 --> 00:49:01.351 Professor Robert Dubrow is the director,

1053 00:49:01.351 --> 00:49:03.780 faculty director of our center.

1054 00:49:03.780 --> 00:49:07.470 So he ask, "Is there evidence that climate change

1055 00:49:07.470 --> 00:49:10.670 is affecting Saharan dust in the Caribbean?

1056 00:49:10.670 --> 00:49:12.640 For example, is there anything known about

1057 00:49:12.640 --> 00:49:16.880 what caused the Godzilla dust event?"

1058 00:49:16.880 --> 00:49:19.510 And I also wanna mention that this question,

1059 00:49:19.510 --> 00:49:22.140 it combines with one of the students question

1060 00:49:22.140 --> 00:49:25.710 that wondering, not just dust,

1061 00:49:25.710 --> 00:49:29.547 but also other like hurricanes in Puerto Rico,

1062 00:49:29.547 --> 00:49:33.240 "Does climate change, you know, introduce some additional,

1063 00:49:33.240 --> 00:49:37.020 these extreme weather events and can they play a role

1064 00:49:37.020 --> 00:49:39.250 in the COVID prediction in Puerto Rico?"

1065 00:49:39.250 --> 00:49:43.270 So two separate questions, but kind of related, thank you.

1066 00:49:43.270 --> 00:49:45.240 <v ->Let me see, how can I address this?</v>

1067 00:49:45.240 --> 00:49:47.170 And thank you for both questions.

1068 00:49:47.170 --> 00:49:49.410 Let me mention something very quickly

1069 00:49:49.410 --> 00:49:51.430 related to the other one, to the first one.

1070 00:49:51.430 --> 00:49:53.070 By using masks,

1071 00:49:53.070 --> 00:49:55.536 one of the recommendations from the CDC,

1072 00:49:55.536 --> 00:50:00.536 we are unable to minimize the exposure to this dust,

1073 00:50:00.900 --> 00:50:02.340 right, to these aerosols.

1074 00:50:02.340 --> 00:50:03.173 So that's something very important,

1075 00:50:03.173 --> 00:50:05.090 and we need also to highlight,

1076 00:50:05.090 --> 00:50:06.520 because most of the people in Puerto Rico

1077 00:50:06.520 --> 00:50:08.940 are using mask outdoors, even outdoors, right,

1078 00:50:08.940 --> 00:50:10.370 so that's important.

1079 00:50:10.370 --> 00:50:12.350 Okay, so in terms of climate change,

1080 00:50:12.350 --> 00:50:16.270 yes, there is evidence that in some cases that

1081 00:50:16.270 --> 00:50:19.710 the Saharan desert is getting bigger.

1082 00:50:19.710 --> 00:50:23.640 So that means, that could mean, let me say it like that,

1083 00:50:23.640 --> 00:50:27.510 that most likely the source of mineral dust

1084 00:50:27.510 --> 00:50:31.770 could be increasing in terms of tons of sediments

1085 00:50:31.770 --> 00:50:34.220 that could be lifted by the air.

1086 00:50:34.220 --> 00:50:36.400 But we need some other kind of conditions

1087 00:50:36.400 --> 00:50:39.390 to make this dust to arrive to the Caribbean.

1088 00:50:39.390 --> 00:50:40.223 And for example,

1089 00:50:40.223 --> 00:50:42.460 wind directions and wind patterns, right?

1090 00:50:42.460 --> 00:50:44.650 So if you don't have the wind velocity

1091 00:50:44.650 --> 00:50:47.470 or the capacity to lift dust particles

1092 00:50:47.470 --> 00:50:49.230 to be transported, floating in the atmosphere

1093 00:50:49.230 --> 00:50:52.920 to the other side, it's another story.

1094 00:50:52.920 --> 00:50:56.380 But yes, the source is increasing in the Saharan desert.

1095 00:50:56.380 --> 00:50:59.220 So it's mean that it's getting dryer some places in Africa

1096 00:50:59.220 --> 00:51:01.610 and also to the Southern part of Europe.

1097 00:51:01.610 --> 00:51:03.840 So most likely, again,

1098 00:51:03.840 --> 00:51:07.363 providing more sources of mineral dust to the atmosphere.

1099 00:51:08.340 --> 00:51:11.370 If the trade winds continue to be the same,

1100 00:51:11.370 --> 00:51:15.400 we could say that probably it will increase

1101 00:51:15.400 --> 00:51:17.510 the amount of dust that we are receiving.

1102 00:51:17.510 --> 00:51:20.730 But until now, there is no evidence suggesting

1103 00:51:20.730 --> 00:51:23.880 that we are receiving most dust than ever.

1104 00:51:23.880 --> 00:51:26.600 We do receive a record

1105 00:51:26.600 --> 00:51:29.120 that it was marked by the Godzilla dust event,

1106 00:51:29.120 --> 00:51:33.288 but it's not marketing a trend, okay?

1107 00:51:33.288 --> 00:51:36.017 In terms of other sources of extreme event,

1108 00:51:36.017 --> 00:51:38.960 for example, yes, hurricane Maria

1109 00:51:38.960 --> 00:51:42.310 devastated millions and millions of trees and vegetation

1110 00:51:42.310 --> 00:51:44.410 and green infrastructure, right?

1111 00:51:44.410 --> 00:51:47.570 So right after hurricane Maria with a lot of humidity,

1112 00:51:47.570 --> 00:51:52.570 we marked another record for mold in Puerto Rico,

1113 00:51:53.190 --> 00:51:55.710 and mold is another natural source of air pollutions

1114 00:51:55.710 --> 00:51:57.170 other allergens, right.

1115 00:51:57.170 --> 00:51:58.110 And that was amazing.

1116 00:51:58.110 --> 00:52:01.110 So hurricane Maria switched a little bit

1117 00:52:01.110 --> 00:52:04.940 the pattern and the behaviors of these other allergens

1118 00:52:04.940 --> 00:52:07.597 that are associated with the vegetation.

1119 00:52:07.597 --> 00:52:10.620 And so meaning that these powerful extreme events,

1120 00:52:10.620 --> 00:52:13.090 have the capacity also to change

1121 00:52:13.090 --> 00:52:14.910 how these other allergens

1122 00:52:14.910 --> 00:52:17.163 are being distributed along the year.

1123 00:52:19.870 --> 00:52:20.870 <v ->Thanks Pablo, yeah.</v>

1124 00:52:20.870 --> 00:52:23.610 I just want to mention one of the things that

1125 00:52:25.220 --> 00:52:26.790 in terms of the dust,

1126 00:52:26.790 --> 00:52:29.650 there's also some researcher in from the European side,

1127 00:52:29.650 --> 00:52:31.490 say the Sahara dust

1128 00:52:31.490 --> 00:52:33.917 also larger in size than the PM2.5,

1129 00:52:33.917 --> 00:52:36.520 they do bring a lot of health effects

1130 00:52:36.520 --> 00:52:38.450 to the respiratory systems.

1131 00:52:38.450 --> 00:52:42.760 So I think in addition to the COVID work,

1132 00:52:42.760 --> 00:52:45.693 your Sahara dust work is also very interesting.

1133 00:52:46.850 --> 00:52:49.660 I do encourage audience, if you do have questions,

1134 00:52:49.660 --> 00:52:53.070 please feel free to put it in the chat box.

1135 00:52:53.070 --> 00:52:55.220 And if not then in the meantime,

1136 00:52:55.220 --> 00:52:58.020 I want to ask a final question from the students.

1137 00:52:58.020 --> 00:53:00.480 Actually, the students are very excited

1138 00:53:00.480 --> 00:53:04.400 about the public health early warning system

1139 00:53:04.400 --> 00:53:05.360 that you're creating.

1140 00:53:05.360 --> 00:53:06.810 And they're wondering, you know,

1141 00:53:06.810 --> 00:53:08.880 you study a lot about the interactions

1142 00:53:08.880 --> 00:53:13.200 of these seasonal pattern, the environment factors,

1143 00:53:13.200 --> 00:53:14.717 and they are wondering, like,

1144 00:53:14.717 --> 00:53:19.717 "When you actually put them into the policy recommendations,

1145 00:53:19.850 --> 00:53:22.233 what are the, you know,

1146 00:53:23.230 --> 00:53:25.230 experience or source you have

1147 00:53:25.230 --> 00:53:27.217 and how effective that could be?"

1148 00:53:28.260 --> 00:53:31.850 <v ->Well, I have two great experience in Puerto Rico,</v>

1149 00:53:31.850 --> 00:53:34.340 mainly with the Puerto Rico Department of Health,

1150 00:53:34.340 --> 00:53:36.380 because you have two different agencies

1151 00:53:36.380 --> 00:53:38.890 that are responsible of working with this, right?

1152 00:53:38.890 --> 00:53:40.240 The National Weather Service

1153 00:53:40.240 --> 00:53:42.720 is the agency responsible of monitoring the weather

1154 00:53:42.720 --> 00:53:44.140 and the atmospheric conditions,

1155 00:53:44.140 --> 00:53:47.320 but they're not responsible of issuing any kind of warning

1156 00:53:47.320 --> 00:53:49.190 to protect public health,

1157 00:53:49.190 --> 00:53:51.970 this is the responsibility of the Department of Health.

1158 00:53:51.970 --> 00:53:53.490 So you need that coordination,

1159 00:53:53.490 --> 00:53:57.150 one agency to monitor the weather

1160 00:53:57.150 --> 00:54:00.070 and to provide that warning for the population.

1161 00:54:00.070 --> 00:54:03.350 And the other one to tell the population what to do,

1162 00:54:03.350 --> 00:54:05.890 because this is a public health issue, right?

1163 00:54:05.890 --> 00:54:07.900 So I started working with them

1164 00:54:07.900 --> 00:54:09.650 since the very first beginning.

1165 00:54:09.650 --> 00:54:12.147 Both of them were very committed,

1166 00:54:12.147 --> 00:54:14.630 wanted to work with us very closely,

1167 00:54:14.630 --> 00:54:17.640 and so that's how we gained that trust.

1168 00:54:17.640 --> 00:54:20.600 So now all of us together, we're working on that.

1169 00:54:20.600 --> 00:54:22.800 So the recommendations are coming out

1170 00:54:22.800 --> 00:54:25.910 from meeting groups that we're having,

1171 00:54:25.910 --> 00:54:27.720 from all of our team,

1172 00:54:27.720 --> 00:54:28.870 epidemiologists, physicians

1173 00:54:28.870 --> 00:54:31.550 and climate atmospheric scientists,

1174 00:54:31.550 --> 00:54:33.360 working with the National Weather Service

1175 00:54:33.360 --> 00:54:34.750 and the Department of Health.

1176 00:54:34.750 --> 00:54:36.640 And all of them are listed,

1177 00:54:36.640 --> 00:54:41.640 so once the warnings are posted by the Department of Health,

1178 00:54:42.160 --> 00:54:45.690 then you will see the list that is the list of actions

1179 00:54:45.690 --> 00:54:49.250 that you need to do or to follow in the case,

1180 00:54:49.250 --> 00:54:52.083 if you are as part of the sensitive group.

1181 00:54:53.310 --> 00:54:56.030 <v ->Thanks Pablo, that's excellent point.</v>

1182 00:54:56.030 --> 00:54:58.940 I think we anchor your point that, you know,

1183 00:54:58.940 --> 00:55:01.990 to deal with the COVID pandemic also climate change,

1184 00:55:01.990 --> 00:55:05.608 we need a multi department and the collaborations

1185 00:55:05.608 --> 00:55:07.770 from researchers across

1186 00:55:07.770 --> 00:55:11.403 and also from different governmental agencies.

1187 00:55:12.500 --> 00:55:14.400 There's a follow up question from Rob,

1188 00:55:15.907 --> 00:55:18.450 "How far in advance can you predict

1189 00:55:18.450 --> 00:55:22.490 the levels of Saharan dust in the early warning systems?"

1190 00:55:22.490 --> 00:55:25.350 <v ->Well, now I suppose that we might,</v>

1191 00:55:25.350 --> 00:55:30.350 we might have up to 72 hours from now

1192 00:55:31.270 --> 00:55:33.530 and will be available somewhere

1193 00:55:33.530 --> 00:55:35.550 between this week and the other one.

1194 00:55:35.550 --> 00:55:38.120 But for now, if you go into the webpage,

1195 00:55:38.120 --> 00:55:41.740 what you will see is only the real time information.

1196 00:55:41.740 --> 00:55:46.740 We're still working on the early component (laughs)

1197 00:55:46.930 --> 00:55:49.830 to provide the information in advance.

1198 00:55:49.830 --> 00:55:52.940 So we have this year to continue working completely

1199 00:55:52.940 --> 00:55:54.280 on the forecasting.

1200 00:55:54.280 --> 00:55:56.070 Yeah, for 72 hours.

1201 00:55:56.070 --> 00:55:59.520 We will have it very soon this week or the next week.

1202 00:55:59.520 --> 00:56:02.150 And we will have one full year

1203 00:56:02.150 --> 00:56:04.210 to work it with the decision makers

1204 00:56:04.210 --> 00:56:07.210 and with the community on how to improve it.

1205 00:56:07.210 --> 00:56:09.080 To test it.

1206 00:56:09.080 --> 00:56:09.913 <v ->Yeah, thank you.</v>

1207 00:56:09.913 --> 00:56:10.746 Thank you, Pablo,

1208 00:56:10.746 --> 00:56:14.580 for the wonderful presentation and very engaged discussion.

1209 00:56:14.580 --> 00:56:16.360 And thank you all for joining us today.

1210 00:56:16.360 --> 00:56:18.860 I think let's give the final,

1211 00:56:18.860 --> 00:56:22.770 like applause to Pablo for the wonderful talk today,

1212 00:56:22.770 --> 00:56:24.583 and thank you everyone for coming.

1213 00:56:26.100 --> 00:56:27.730 <v ->Thank you for inviting me.</v>

1214 00:56:27.730 --> 00:56:29.430 Happy to be here.  <v ->Bye everyone.</v>

1215 00:56:32.810 --> 00:56:34.250 <v ->Thanks Pablo.</v>

1216 00:56:34.250 --> 00:56:36.103 <v ->Ciao Robert, good to see you.</v>