1
00:00:13,190 --> 00:00:10,629
day two of the geophysics marathon in

2
00:00:15,270 --> 00:00:13,200
san francisco scientists stream to and

3
00:00:17,670 --> 00:00:15,280
from hundreds of poster presentations

4
00:00:19,269 --> 00:00:17,680
and talks in the cavernous moscone

5
00:00:20,950 --> 00:00:19,279
convention center

6
00:00:22,950 --> 00:00:20,960
i caught up with another nasa new

7
00:00:25,349 --> 00:00:22,960
investigator whose research is near and

8
00:00:27,990 --> 00:00:25,359
dear to californians he showed me his

9
00:00:29,589 --> 00:00:28,000
talk here in moscone center south

10
00:00:31,910 --> 00:00:29,599
my name is gareth funning

11
00:00:34,069 --> 00:00:31,920
and i'm a assistant professor at the

12
00:00:36,229 --> 00:00:34,079
university of california riverside my

13
00:00:37,830 --> 00:00:36,239

main field of research is into the

14
00:00:40,790 --> 00:00:37,840
movements of faults either in

15
00:00:42,389 --> 00:00:40,800
earthquakes or slowly uh in a form of

16
00:00:44,470 --> 00:00:42,399
motion we call creep

17
00:00:46,389 --> 00:00:44,480
creep is a name we give to

18
00:00:50,150 --> 00:00:46,399
a behavior which

19
00:00:52,549 --> 00:00:50,160
has movement which is slow and steady um

20
00:00:54,950 --> 00:00:52,559
so we could talk about soil creek where

21
00:00:56,790 --> 00:00:54,960
slopes slowly move and things like that

22
00:00:58,389 --> 00:00:56,800
but in terms of faults

23
00:01:00,310 --> 00:00:58,399
we are talking about a movement of a

24
00:01:01,750 --> 00:01:00,320
fault which is slow and steady

25
00:01:03,110 --> 00:01:01,760
uh and in the absence of large

26
00:01:04,549 --> 00:01:03,120
earthquakes

27
00:01:06,230 --> 00:01:04,559
so normally what we expect to see on a

28
00:01:07,030 --> 00:01:06,240
fault is that

29
00:01:09,429 --> 00:01:07,040
um

30
00:01:11,670 --> 00:01:09,439
you have two plates moving or two blocks

31
00:01:13,750 --> 00:01:11,680
of the earth's crust moving with respect

32
00:01:15,109 --> 00:01:13,760
to each other on a fault

33
00:01:16,789 --> 00:01:15,119
and that fault

34
00:01:19,270 --> 00:01:16,799
most of the time is locked by friction

35
00:01:21,350 --> 00:01:19,280
as this movement is trying to occur so

36
00:01:23,270 --> 00:01:21,360
the stresses that that the two blocks in

37
00:01:24,149 --> 00:01:23,280
part on this on this fault

38
00:01:25,590 --> 00:01:24,159

um

39
00:01:28,550 --> 00:01:25,600
do not exceed the friction that's

40
00:01:31,990 --> 00:01:28,560
holding the fault together until

41
00:01:33,429 --> 00:01:32,000
suddenly it goes bang in one earthquake

42
00:01:35,749 --> 00:01:33,439
in the case of a creeping fault that

43
00:01:37,670 --> 00:01:35,759
doesn't happen whatever the frictional

44
00:01:40,630 --> 00:01:37,680
state of the fault is

45
00:01:41,670 --> 00:01:40,640
allows it to move very slowly without

46
00:01:43,749 --> 00:01:41,680
having

47
00:01:45,670 --> 00:01:43,759
any any large earthquake

48
00:01:46,710 --> 00:01:45,680
and that's really quite unusual

49
00:01:48,149 --> 00:01:46,720
most of the faults that have been

50
00:01:49,830 --> 00:01:48,159
observed in the world

51
00:01:52,230 --> 00:01:49,840
don't creep

52
00:01:55,270 --> 00:01:52,240
this is a project that is

53
00:01:57,990 --> 00:01:55,280
has been funded by nasa um as as the

54
00:01:59,670 --> 00:01:58,000
education outreach element of a of a new

55
00:02:01,190 --> 00:01:59,680
investigative grant

56
00:02:02,789 --> 00:02:01,200
and the ground is to study

57
00:02:04,789 --> 00:02:02,799
fault creep in the san francisco bay

58
00:02:06,550 --> 00:02:04,799
area northern california in general but

59
00:02:07,910 --> 00:02:06,560
the hayward fault is currently

60
00:02:09,669 --> 00:02:07,920
considered the most dangerous fault in

61
00:02:11,110 --> 00:02:09,679
the bay area consider in some way if we

62
00:02:13,030 --> 00:02:11,120
know where the fall is creeping we know

63
00:02:14,790 --> 00:02:13,040

where it's also not creeping and it's

64
00:02:16,630 --> 00:02:14,800
the areas that are not creeping the ones

65
00:02:19,030 --> 00:02:16,640
that will have earthquakes there's some

66
00:02:20,470 --> 00:02:19,040
examples of creek damage to various

67
00:02:22,150 --> 00:02:20,480
things in

68
00:02:24,550 --> 00:02:22,160
in the uh in northern california

69
00:02:26,630 --> 00:02:24,560
northern and central california

70
00:02:29,030 --> 00:02:26,640
this is where the the hayward fault goes

71
00:02:29,830 --> 00:02:29,040
through a wall so it actually broke

72
00:02:37,830 --> 00:02:29,840
that

73
00:02:39,430 --> 00:02:37,840
instructive so we can say

74
00:02:40,550 --> 00:02:39,440
diagonal cracks can only be caused by

75
00:02:41,750 --> 00:02:40,560
shearing

76
00:02:43,750 --> 00:02:41,760
so actually

77
00:02:45,750 --> 00:02:43,760
wrenching of the of the wall by lateral

78
00:02:47,830 --> 00:02:45,760
movement so i've been making

79
00:02:50,070 --> 00:02:47,840
measurements from space for some time on

80
00:02:52,630 --> 00:02:50,080
of of the movements that these balls

81
00:02:54,710 --> 00:02:52,640
cause so the technique i use

82
00:02:57,110 --> 00:02:54,720
uh in in most of my research is a

83
00:02:59,030 --> 00:02:57,120
technique known as instar which uses

84
00:03:00,630 --> 00:02:59,040
satellites that that beam radar

85
00:03:03,430 --> 00:03:00,640
essentially to the ground

86
00:03:05,509 --> 00:03:03,440
and they're in orbits which repeat every

87
00:03:07,430 --> 00:03:05,519
few weeks in the case of this particular

88
00:03:09,830 --> 00:03:07,440

satellite which is a european satellite

89
00:03:12,390 --> 00:03:09,840
known as an ers2

90
00:03:14,390 --> 00:03:12,400
that has a five-week repeat so every 35

91
00:03:17,509 --> 00:03:14,400
days it passes over the same point and

92
00:03:18,630 --> 00:03:17,519
it emits beams of radar and microwave

93
00:03:21,910 --> 00:03:18,640
wavelengths

94
00:03:23,750 --> 00:03:21,920
and um

95
00:03:25,190 --> 00:03:23,760
norm and it

96
00:03:27,270 --> 00:03:25,200
scatters off the ground and is returned

97
00:03:29,190 --> 00:03:27,280
to the satellite what we measure is the

98
00:03:31,509 --> 00:03:29,200
amplitude and the phase of the return of

99
00:03:33,509 --> 00:03:31,519
the radar to the satellite so the phase

100
00:03:35,670 --> 00:03:33,519
is essentially the number of wavelengths

101
00:03:37,750 --> 00:03:35,680
between satellite and the ground and if

102
00:03:39,270 --> 00:03:37,760
the ground should move then that phase

103
00:03:40,949 --> 00:03:39,280
will change

104
00:03:42,550 --> 00:03:40,959
red colors indicate movement away from

105
00:03:44,070 --> 00:03:42,560
the satellite the satellite is flying

106
00:03:47,030 --> 00:03:44,080
from north to south and it's looking

107
00:03:48,070 --> 00:03:47,040
down into the west so red movements are

108
00:03:49,910 --> 00:03:48,080
movements

109
00:03:51,110 --> 00:03:49,920
either down or to the west

110
00:03:52,949 --> 00:03:51,120
blue movements are the opposite their

111
00:03:54,869 --> 00:03:52,959
movements are part of the east the

112
00:03:56,470 --> 00:03:54,879
project i came up with the name citizen

113
00:04:00,390 --> 00:03:56,480

creep meter

114
00:04:02,149 --> 00:04:00,400
designed to measure creep on faults and

115
00:04:03,910 --> 00:04:02,159
there were a few of them in the area but

116
00:04:05,910 --> 00:04:03,920
there seems to be quite difficult to get

117
00:04:07,670 --> 00:04:05,920
permission to install and so

118
00:04:09,990 --> 00:04:07,680
instead of using instruments i thought i

119
00:04:12,789 --> 00:04:10,000
could use people because people are much

120
00:04:18,629 --> 00:04:16,310
and the idea for the project was that uh

121
00:04:20,069 --> 00:04:18,639
wherever uh a creeping fault interacts

122
00:04:21,990 --> 00:04:20,079
with the built environment in one way or

123
00:04:23,990 --> 00:04:22,000
another you'll you'll have changes to

124
00:04:25,990 --> 00:04:24,000
that to those those structures which are

125
00:04:29,430 --> 00:04:26,000
obvious and visible and should increase

126
00:04:31,270 --> 00:04:29,440
with the changes that breaks the offsets

127
00:04:33,350 --> 00:04:31,280
should increase with time

128
00:04:35,590 --> 00:04:33,360
at the moment we have involved

129
00:04:36,710 --> 00:04:35,600
two local high schools in the in the

130
00:04:39,909 --> 00:04:36,720
project

131
00:04:41,830 --> 00:04:39,919
through this non-profit in fremont

132
00:04:43,830 --> 00:04:41,840
we have teachers that show up from those

133
00:04:46,870 --> 00:04:43,840
schools to our outreach presentations

134
00:04:48,950 --> 00:04:46,880
and from there certain students uh then

135
00:04:52,710 --> 00:04:48,960
volunteered to take part so this is one

136
00:04:54,070 --> 00:04:52,720
of our original photos from 2009

137
00:04:55,590 --> 00:04:54,080
in one of the residential neighborhoods

138
00:04:56,790 --> 00:04:55,600

in the south of the city

139
00:04:59,670 --> 00:04:56,800
and you can see

140
00:05:02,310 --> 00:04:59,680
there's a small offset in the curb

141
00:05:05,430 --> 00:05:02,320
and this is a photo taken

142
00:05:06,469 --> 00:05:05,440
18 months later by one of our students

143
00:05:07,749 --> 00:05:06,479
and

144
00:05:08,950 --> 00:05:07,759
well if you look at the difference

145
00:05:10,310 --> 00:05:08,960
between the two

146
00:05:11,830 --> 00:05:10,320
we haven't managed to completely

147
00:05:14,469 --> 00:05:11,840
co-register them but you can see that

148
00:05:17,510 --> 00:05:14,479
there are some some visually obvious

149
00:05:20,629 --> 00:05:17,520
changes in the curve

150
00:05:22,710 --> 00:05:20,639
so a centimeter of movement

151
00:05:25,430 --> 00:05:22,720
um actually is is very consistent with

152
00:05:27,350 --> 00:05:25,440
the rate that we would expect to see

153
00:05:30,070 --> 00:05:27,360
if the centimeter essentially means that

154
00:05:32,390 --> 00:05:30,080
we are doing in 18 months there's about

155
00:05:34,390 --> 00:05:32,400
six to seven millimeters