



1  
00:00:08,650 --> 00:00:06,910  
climate changes something that affects

2  
00:00:11,770 --> 00:00:08,660  
all of our lives whether we're a student

3  
00:00:13,330 --> 00:00:11,780  
a teacher or a scientist speaking of

4  
00:00:15,430 --> 00:00:13,340  
scientists I have a guest here with me

5  
00:00:17,920 --> 00:00:15,440  
today that can tell us a lot more about

6  
00:00:19,689 --> 00:00:17,930  
climate change Josh Willis now you're an

7  
00:00:21,490 --> 00:00:19,699  
oceanographer here at JPL correct well

8  
00:00:24,040 --> 00:00:21,500  
I'm an oceanographer but I study sea

9  
00:00:25,450 --> 00:00:24,050  
level rise and global warming and really

10  
00:00:27,609 --> 00:00:25,460  
how the ocean fits into that whole

11  
00:00:29,260 --> 00:00:27,619  
global warming picture global warming is

12  
00:00:31,480 --> 00:00:29,270  
happening because people are emitting

13  
00:00:32,889 --> 00:00:31,490

billions of tons of carbon dioxide and

14

00:00:34,840 --> 00:00:32,899

other greenhouse gases into the

15

00:00:37,420 --> 00:00:34,850

atmosphere now when they get there at

16

00:00:39,010 --> 00:00:37,430

these greenhouse gases cause extra heat

17

00:00:40,780 --> 00:00:39,020

to be trapped on the earth

18

00:00:43,030 --> 00:00:40,790

so heat that would have otherwise been

19

00:00:44,979 --> 00:00:43,040

radiated back out into space is now

20

00:00:47,470 --> 00:00:44,989

sticking around and warming up our

21

00:00:49,270 --> 00:00:47,480

planet now all that heat is trapped in

22

00:00:51,970 --> 00:00:49,280

our atmosphere but is it also affecting

23

00:00:53,740 --> 00:00:51,980

the oceans it turns out that 80 to 90

24

00:00:56,110 --> 00:00:53,750

percent of the heat from global warming

25

00:00:58,299 --> 00:00:56,120

is actually going into the oceans so the

26

00:01:00,069 --> 00:00:58,309

oceans are really the big earth heat

27

00:01:02,290 --> 00:01:00,079

bucket that's where all the heat winds

28

00:01:04,539 --> 00:01:02,300

up going it turns out that the oceans

29

00:01:06,340 --> 00:01:04,549

can absorb a thousand times the amount

30

00:01:07,719 --> 00:01:06,350

of heat as the atmosphere without really

31

00:01:09,850 --> 00:01:07,729

changing their temperature all that much

32

00:01:12,250 --> 00:01:09,860

and the reason is because of something

33

00:01:14,170 --> 00:01:12,260

called heat capacity do you have an

34

00:01:16,270 --> 00:01:14,180

example that could maybe explain heat

35

00:01:18,010 --> 00:01:16,280

capacity let's imagine that this balloon

36

00:01:21,490 --> 00:01:18,020

represents the whole Earth's atmosphere

37

00:01:23,050 --> 00:01:21,500

so now my candle my little lighter here

38

00:01:24,520 --> 00:01:23,060

represents the Sun so let's add some

39

00:01:25,960 --> 00:01:24,530

heat to it and see what happens I don't

40

00:01:30,480 --> 00:01:25,970

try this at home without adult

41

00:01:37,120 --> 00:01:34,840

whoa so obviously the heat capacity of

42

00:01:38,920 --> 00:01:37,130

air is very low because it didn't

43

00:01:40,630 --> 00:01:38,930

absorbing heat at all well that's right

44

00:01:42,580 --> 00:01:40,640

almost as soon as we put the candle to

45

00:01:45,100 --> 00:01:42,590

the balloon it exploded the reason is

46

00:01:46,390 --> 00:01:45,110

because since the air inside the balloon

47

00:01:48,730 --> 00:01:46,400

couldn't really absorb the heat that

48

00:01:50,350 --> 00:01:48,740

fast all the heat went toward melting

49

00:01:52,330 --> 00:01:50,360

the rubber as soon as the rubber melted

50

00:01:53,770 --> 00:01:52,340

the bullet explodes oh hey cool now

51  
00:01:55,480 --> 00:01:53,780  
that's a good demonstration of the heat

52  
00:01:57,789 --> 00:01:55,490  
capacity of air how about the heat

53  
00:01:59,109 --> 00:01:57,799  
capacity of water of the oceans yeah

54  
00:02:01,870 --> 00:01:59,119  
let's do the oceans how about a water

55  
00:02:03,910 --> 00:02:01,880  
boots sounds great all right

56  
00:02:06,459 --> 00:02:03,920  
alright Steve so this balloon filled

57  
00:02:08,740 --> 00:02:06,469  
with water represents the oceans and my

58  
00:02:11,550 --> 00:02:08,750  
lighter here represents the Sun let's

59  
00:02:15,759 --> 00:02:11,560  
put some heat on it and see what happens

60  
00:02:17,949 --> 00:02:15,769  
Wow obviously it's absorbing a great

61  
00:02:20,050 --> 00:02:17,959  
deal of heat right so you feeling the

62  
00:02:22,390 --> 00:02:20,060  
heat there Steve I am alright but the

63  
00:02:24,190 --> 00:02:22,400

balloon really isn't because it turns

64

00:02:26,890 --> 00:02:24,200

out that the water can absorb so much

65

00:02:28,660 --> 00:02:26,900

heat that it takes the heat away from

66

00:02:30,400 --> 00:02:28,670

the from the skin of the balloon before

67

00:02:32,740 --> 00:02:30,410

the rubber can melt so the balloon

68

00:02:34,960 --> 00:02:32,750

doesn't follow excellent example so the

69

00:02:37,210 --> 00:02:34,970

water has a tremendous ability to absorb

70

00:02:38,680 --> 00:02:37,220

heat and if that's an analogue for our

71

00:02:40,150 --> 00:02:38,690

oceans that means our oceans are

72

00:02:43,630 --> 00:02:40,160

absorbing a lot of heat as well that's

73

00:02:45,370 --> 00:02:43,640

right they sure are Steve well global

74

00:02:47,229 --> 00:02:45,380

warming sounds like quite a problem what

75

00:02:48,820 --> 00:02:47,239

can we do about it well the first thing

76

00:02:50,920 --> 00:02:48,830

we need to do Steve is really just to

77

00:02:52,830 --> 00:02:50,930

understand the problem scientists all

78

00:02:55,750 --> 00:02:52,840

around the globe including NASA

79

00:02:57,759 --> 00:02:55,760

scientists and here at JPL we study data

80

00:02:59,680 --> 00:02:57,769

from satellites that measure the oceans

81

00:03:01,479 --> 00:02:59,690

in the atmosphere and these tell us

82

00:03:03,250 --> 00:03:01,489

about how global warming proceeds and

83

00:03:05,140 --> 00:03:03,260

hopefully give us an idea of what the

84

00:03:06,970 --> 00:03:05,150

future is gonna look like that sounds

85

00:03:08,949 --> 00:03:06,980

like a pretty serious problem what is it

86

00:03:11,259 --> 00:03:08,959

we can do everything that we do almost

87

00:03:13,599 --> 00:03:11,269

uses some kind of energy and most of its

88

00:03:15,099 --> 00:03:13,609

produced by burning fossil fuels which

89

00:03:17,050 --> 00:03:15,109

release carbon dioxide into the

90

00:03:18,059 --> 00:03:17,060

atmosphere we can turn off the lights

91

00:03:20,500 --> 00:03:18,069

when we leave the room

92

00:03:22,720 --> 00:03:20,510

maybe power down that computer every

93

00:03:24,309 --> 00:03:22,730

once in a while and go outside take a

94

00:03:25,930 --> 00:03:24,319

bike ride instead of getting in your car

95

00:03:27,129 --> 00:03:25,940

well thanks Josh for coming in and

96

00:03:29,199 --> 00:03:27,139

talking to us today about climate change

97

00:03:30,250 --> 00:03:29,209

we really appreciate your expertise do

98

00:03:32,680 --> 00:03:30,260

you Beth Steve my pleasure

99

00:03:34,930 --> 00:03:32,690

all right thanks bunch to learn more

100

00:03:37,629 --> 00:03:34,940

about climate change in how NASA and JPL

101

00:03:41,860 --> 00:03:37,639

are studying the problem go to climate

102

00:03:43,870 --> 00:03:41,870

JPL nasa.gov and for more information

103

00:03:47,660 --> 00:03:43,880

about what NASA is doing in general go