



1  
00:00:01,300 --> 00:00:06,220  
THE ARCTIC, A VAST EXPANSE  
OF SNOW AND ICE AND SEA.

2  
00:00:06,220 --> 00:00:09,720  
OUR NORTHERN POLE REGION IS  
UNDERGOING SOME MAJOR CHANGES.

3  
00:00:09,720 --> 00:00:16,040  
WE'LL DISCUSS WHAT'S HAPPENING  
IN THE ARCTIC ON "INSIDE NASA

4  
00:00:16,040 --> 00:00:19,099  
SCIENCE."  
THE ARCTIC IS IN THE NEWS.

5  
00:00:19,099 --> 00:00:23,230  
HUGE GLACIERS ARE BREAKING OFF.  
SEA ICE IS DISAPPEARING.

6  
00:00:23,230 --> 00:00:26,710  
I'M TIFFANY NAIL AND WE'RE HERE TO  
FIND OUT WHAT'S GOING ON IN THE

7  
00:00:26,710 --> 00:00:29,750  
ARCTIC AND WHAT NASA'S ROLE  
IS WITH IT.

8  
00:00:29,750 --> 00:00:34,079  
HERE JOINING ME IS TOM WAGNER  
THE SNOW AND ICE SCIENTIST

9  
00:00:34,079 --> 00:00:35,200  
EXPERT.  
WELCOME, TOM.

10  
00:00:35,200 --> 00:00:37,059  
THANKS.  
OKAY.

11  
00:00:37,059 --> 00:00:41,679  
SO FIRST OF ALL, LET'S TALK  
ABOUT WHY NASA, A SPACE AGENCY,

12  
00:00:41,679 --> 00:00:44,550  
IS INVOLVED.  
THAT'S A GOOD QUESTION.

13  
00:00:44,550 --> 00:00:47,030  
WHEN MOST PEOPLE THINK OF NASA  
THEY THINK OF ASTRONAUT IN THE

14  
00:00:47,030 --> 00:00:49,629  
SPACE STATION OR GOING TO MARS  
AND THE MOON.

15  
00:00:49,629 --> 00:01:02,539  
TO STUDY THE EARTH YOU NEED  
SATELLITES TO DO IT.

16  
00:01:02,539 --> 00:01:04,640  
WHAT TOOLS DOES NASA USE?  
YEAH.

17  
00:01:04,640 --> 00:01:09,370  
THIS IS A GOOD QUESTION TOO.  
BECAUSE IT'S NOT JUST

18  
00:01:09,370 --> 00:01:12,290  
SATELLITES.  
HUGE RESEARCH AIRCRAFT PROGRAM

19  
00:01:12,290 --> 00:01:16,220  
TO GO OUT AND STUDY EVERYTHING  
FROM STORMS TO VOLCANOES AND THE

20  
00:01:16,220 --> 00:01:26,490  
ICE.  
TRYING TO CONNECT DATA FROM THE

21  
00:01:26,490 --> 00:01:29,221  
GROUND TO SATELLITE DATE.  
WE'VE HEARD A LOT ABOUT

22  
00:01:29,221 --> 00:01:32,550  
CLIMATE CHANGE AND GLOBAL  
WARMING AND SEEN UNUSUAL

23  
00:01:32,550 --> 00:01:35,870  
WEATHER.  
FOR EXAMPLE, BLIZZARDS IN D.C.

24  
00:01:35,870 --> 00:01:37,720  
AS WELL AS DROUGHT IN THE  
SOUTHWEST.

25  
00:01:37,720 --> 00:01:41,472  
HOW IS ALL OF THAT RELATED?  
THAT'S PROBABLY THE QUESTION

26  
00:01:41,472 --> 00:01:44,480  
I GET MOST ASKED BY PEOPLE, IS  
CLIMATE CHANGE CAUSING ALL THIS

27  
00:01:44,480 --> 00:01:46,870  
WEATHER?  
THE FACT IS A LOT OF THE CHANGES

28  
00:01:46,870 --> 00:01:51,050  
WE SEE IN WEATHER ARE CONSISTENT  
WITH SOME OF THE PREDICTIONS

29  
00:01:51,050 --> 00:01:54,240  
PEOPLE HAVE MADE BASED ON A  
WARMING CLIMATE.

30  
00:01:54,240 --> 00:01:56,190  
BUT THAT RESEARCH IS STILL BEING  
DONE.

31  
00:01:56,190 --> 00:02:00,200  
THE SIMPLE FACT IS THIS, THE  
PLANET IS WARMING UP AND WITH

32  
00:02:00,200 --> 00:02:02,761  
WARMING UP BECAUSE WE HAVE  
RECORDS THAT SHOW HOW THE PLANET

33  
00:02:02,761 --> 00:02:06,250  
HAS GONE ON LIKE A DECADE TIME  
SCALE AND THAT'S WHAT WE CALL

34  
00:02:06,250 --> 00:02:07,760  
CLIMATE.  
WEATHER IS THE KIND OF

35  
00:02:07,760 --> 00:02:09,570  
DAY-TO-DAY STUFF AND IT'S HARDER  
TO PREDICT.

36  
00:02:09,570 --> 00:02:11,940  
YOU CAN'T ATTRIBUTE ONE STORM TO  
CLIMATE CHANGE.

37  
00:02:11,940 --> 00:02:16,360  
IN THIS VIDEO I'M SEEING A  
LOT OF RED IN THE TOP IN THE

38  
00:02:16,360 --> 00:02:19,190  
ARCTIC.  
THAT TO ME IS KIND OF SIGNIFYING

39  
00:02:19,190 --> 00:02:22,390  
WE'RE HAVING A MELTING -- WE'RE  
MELTING ICE UP THERE.

40  
00:02:22,390 --> 00:02:26,520  
THIS IS A GREAT VIDEO AND IT  
ACTUALLY TAKES ALL OF THE

41  
00:02:26,520 --> 00:02:28,770  
TEMPERATURE DATA THAT WE HAVE  
OVER THE PLANET, EVERYTHING FROM

42  
00:02:28,770 --> 00:02:31,830  
THERMOMETERS ON THE GROUND TO  
SATELLITE RECORDS AND CREATES A

43  
00:02:31,830 --> 00:02:33,910  
TEMPERATURE RECORD GOING BACK TO  
THE 1800s.

44  
00:02:33,910 --> 00:02:37,190  
THE IMPORTANT THING YOU CAN TAKE  
AWAY FROM THIS, THE WHOLE PLANET

45  
00:02:37,190 --> 00:02:41,060  
IS WARMING UP BUT THE POLES WARM  
UP FASTER THAN THE REST OF THE

46  
00:02:41,060 --> 00:02:43,140  
PLANET.  
THAT'S WHY THEY'RE REDDER.

47  
00:02:43,140 --> 00:02:45,640  
THAT'S WHERE WE'RE SEEING A LOT  
OF THE REAL CHANGE ASSOCIATED

48  
00:02:45,640 --> 00:02:47,819  
WITH ICE MELTING AND OTHER  
THINGS.

49  
00:02:47,819 --> 00:02:49,940  
NOW, LET'S TALK ABOUT THE ICE  
THAT IS IN THE ARCTIC.

50  
00:02:49,940 --> 00:02:52,350  
THERE'S TWO TYPES.  
CAN YOU TELL US THOSE WHO TYPES

51

00:02:52,350 --> 00:02:53,420

AND EXPLAIN THEM?

YEAH.

52

00:02:53,420 --> 00:02:56,670

THERE'S REALLY TWO MAJOR TYPES.

THE FIRST ONE IS SEA ICE AND THE

53

00:02:56,670 --> 00:02:59,790

WHOLE TOP OF THE PLANET IS

COVERED WITH THE ARCTIC OCEAN

54

00:02:59,790 --> 00:03:02,150

WHICH IS ABOUT TWICE THE SIZE OF

THE CONTINENTAL U.S.

55

00:03:02,150 --> 00:03:05,010

AND LIKE LAKES FREEZE OVER IN

THE WINTER AND FORM THE SURFACE

56

00:03:05,010 --> 00:03:08,490

LAYER OF ICE THE ARCTIC OCEAN IS

COVERED WITH SEA ICE.

57

00:03:08,490 --> 00:03:14,620

THE OTHER TYPES ARE GLACIERS AND

ICE SHEETS, ICE ON THE LAND.

58

00:03:14,620 --> 00:03:17,500

IN THE CASE OF ALASKA YOU GET

MOUNTAIN GLACIERS.

59

00:03:17,500 --> 00:03:21,900

IN THE CASE OF GREENLAND YOU GET

MILD THICK SHEETS OF ICE

60

00:03:21,900 --> 00:03:26,280

COVERING THE WHOLE CONTINENT.

CAN I GO AND WALK ON THE SEA

61  
00:03:26,280 --> 00:03:27,340  
ICE?  
YOU COULD.

62  
00:03:27,340 --> 00:03:30,040  
IT'S A PRETTY DYNAMIC PLACE.  
WE'VE HAD SITUATIONS WHERE

63  
00:03:30,040 --> 00:03:32,921  
RESEARCHERS WERE OUT THERE AND A  
BUNCH OF CRACKS CAME UP AND THEY

64  
00:03:32,921 --> 00:03:35,080  
HAD TO BE EMERGENCY EVACED OUT  
BY AIRCRAFT.

65  
00:03:35,080 --> 00:03:37,870  
THAT'S NOT GOOD.  
AND IT IS -- IT'S A LITTLE

66  
00:03:37,870 --> 00:03:41,130  
DIFFERENT THAN LIKE ICE IN THAT  
THIS ICE CRACKS UP, GETS BLOWN

67  
00:03:41,130 --> 00:03:44,280  
AROUND BY WIND, PILES ON ITSELF  
AND ALL KINDS OF OTHER THINGS.

68  
00:03:44,280 --> 00:03:48,220  
IT'S A DYNAMIC FEATURE.  
LET'S TALK ABOUT ICE SHEET.

69  
00:03:48,220 --> 00:03:53,560  
HOW DOES THE ICE MOVE AND DOES  
EXTRA HEAT IN THE AIR HELP IT

70  
00:03:53,560 --> 00:03:55,770  
MELT FASTER AND CAUSE IT TO MOVE  
FASTER?



71  
00:03:55,770 --> 00:03:58,849  
HERE'S THE GREENLAND ICE  
SHEETS AND AGAIN, PICTURE THIS

72  
00:03:58,849 --> 00:04:03,830  
THING, THIS ICE IS ONE TO TWO  
MILES THICK IN THE CENTER.

73  
00:04:03,830 --> 00:04:06,500  
WHAT HAPPENS IS, SNOW FALLS IN  
THE MIDDLE AND BUILDS UP, THE

74  
00:04:06,500 --> 00:04:10,510  
SNOW COMPACTS AND FORMS ICE.  
IT'S SO THICK THAT IT ACTUALLY

75  
00:04:10,510 --> 00:04:14,510  
DEFORMS JUST LIKE MODELING CLAY  
AND BEGINS TO FLOW TOWARDS THE

76  
00:04:14,510 --> 00:04:17,070  
COAST.  
WHAT'S HAPPENING NOW AS THINGS

77  
00:04:17,070 --> 00:04:20,329  
SEEM TO BE OUT OF BALANCE USED  
TO BE THERE WAS ENOUGH SNOW IN

78  
00:04:20,329 --> 00:04:26,129  
THE MIDDLE TO BALANCE THE AMOUNT  
OF ICE FLOEING ON THE SIDES.

79  
00:04:26,129 --> 00:04:30,309  
THE FLOE HAS SPED UP.  
IT'S LIKE YOU CAN SEE RIGHT

80  
00:04:30,309 --> 00:04:32,469  
HERE.  
THAT'S ACTUALLY DRAINING MORE

81  
00:04:32,469 --> 00:04:36,240  
ICE THAN BUILDING UP OF SNOW.  
BUT THE OTHER THING IS, IT'S NOT

82  
00:04:36,240 --> 00:04:39,960  
JUST THE FLOE OF THE GLACIAL ICE  
INTO THE OCEAN IT'S DIRECT

83  
00:04:39,960 --> 00:04:41,229  
MELTING.  
THAT'S ONE OF THE THINGS WE'RE

84  
00:04:41,229 --> 00:04:43,940  
TRYING TO UNDERSTAND.  
HOW DOES THE ICE TURN TO WATER,

85  
00:04:43,940 --> 00:04:46,969  
WHERE DOES THE WATER GO.  
THERE'S PLACES WHERE GIANT LAKES

86  
00:04:46,969 --> 00:04:49,650  
HAVE FORMED ON THE SURFACE OF  
THE GREENLAND ICE SHEET AND

87  
00:04:49,650 --> 00:04:53,139  
DRAINED DOWN THROUGH CRACKS AS  
MUCH WATER FLOWS THROUGH NIAGARA

88  
00:04:53,139 --> 00:04:56,499  
FALLS.  
IT'S MOVING PRETTY FAST?

89  
00:04:56,499 --> 00:04:59,080  
OH, YEAH.  
THE ICE IN SOME CASES IT'S

90  
00:04:59,080 --> 00:05:01,960  
MOVING ON THE ORDER OF LIKE 90  
FEET A DAY.

91  
00:05:01,960 --> 00:05:03,949  
WOW.  
YOU CAN STAND THERE ON A ROCK

92  
00:05:03,949 --> 00:05:06,180  
AND WATCH IT GO BY.  
WOW.

93  
00:05:06,180 --> 00:05:08,500  
WHAT'S INTERESTING, THIS IS A  
SHOT OF PETERMANN GLACIER IN

94  
00:05:08,500 --> 00:05:11,539  
NORTHERN GREENLAND.  
WHEN THIS ICE HITS THE OCEAN AND

95  
00:05:11,539 --> 00:05:14,539  
BREAKS OFF WE'RE TALKING ABOUT  
GIGANTIC ICEBERGS.

96  
00:05:14,539 --> 00:05:17,992  
THIS ONE LAST YEAR IS ABOUT 100  
SQUARE KILOMETERS, ONE AND A

97  
00:05:17,992 --> 00:05:20,439  
HALF TIMES THE SIZE OF  
WASHINGTON, D.C.

98  
00:05:20,439 --> 00:05:23,400  
THAT'S HOW BIG IT WAS.  
IT WAS PROBABLY BROUGHT ON BY

99  
00:05:23,400 --> 00:05:25,410  
WARMING OF THE OCEAN OUT IN  
FRONT OF THIS GLACIER.

100  
00:05:25,410 --> 00:05:28,189  
I THINK WE HAVE SOME  
INDIVIDUAL GLACIERS WE'RE

101

00:05:28,189 --> 00:05:31,320

TALKING ABOUT AND THEN ALSO,  
WHAT'S HAPPENED HAPPENING WITH

102

00:05:31,320 --> 00:05:33,919

THE WHOLE SHEET THAT'S COVERING  
GREENLAND?

103

00:05:33,919 --> 00:05:37,969

A COUPLE OF DIFFERENT THINGS.  
FIRST ONE, THIS IS A SHOT OF A

104

00:05:37,969 --> 00:05:40,960

GLACIER, THE FASTEST MOVING  
GLACIER IN THE WORLD.

105

00:05:40,960 --> 00:05:43,809

WHAT'S HAPPENED IS FIRST THAT  
FRONT HAS BEEN RETREATING BACK,

106

00:05:43,809 --> 00:05:46,559

BUT YOU CAN ALSO SEE HOW THE  
FLOE LINES COME IN.

107

00:05:46,559 --> 00:05:50,469

THIS BIG PART IS FEEDING INTO  
THIS ONE OUTLET WHICH COMES OUT

108

00:05:50,469 --> 00:05:53,020

TO THE OCEAN.  
THIS IS THE STUFF I WAS TALKING

109

00:05:53,020 --> 00:05:54,270

ABOUT.  
SOME PLACES IT FLOWS LIKE 90

110

00:05:54,270 --> 00:05:56,029

FEET A DAY.  
YOU CAN STAND ON THE SIDE AND

111

00:05:56,029 --> 00:05:58,870

WATCH THE ICE MOVING.

IT HITS THE OCEAN AND BEGINS TO

112

00:05:58,870 --> 00:06:01,819

BREAK OFF IN ICEBERGS WHICH

FLOAT OUT.

113

00:06:01,819 --> 00:06:07,869

THE BOTTOM LINE IS, WHAT --

HOW DO WE KNOW THIS IS HAPPENING

114

00:06:07,869 --> 00:06:11,550

ON SUCH A HUGE SCALE ACROSS ALL

OF GREENLAND?

115

00:06:11,550 --> 00:06:13,740

TWO REALLY IMPORTANT THINGS

GOING ON.

116

00:06:13,740 --> 00:06:15,490

FIRST ONE IS THIS.

IF WE LOOK AT THE AMOUNT OF

117

00:06:15,490 --> 00:06:18,139

MELTING THAT OCCURS IN GREENLAND

AND THIS IS WHEN WE TAKE

118

00:06:18,139 --> 00:06:21,740

SATELLITE AND OTHER RECORDS AND

WE LITERALLY FIGURE OUT WHEN IS

119

00:06:21,740 --> 00:06:25,800

THERE LIQUID WATER ON THE SNOW,

WHAT'S BEEN HAPPENING IS, IT

120

00:06:25,800 --> 00:06:28,509

USED TO BE JUST THAT RIGHT ALONG

THE COAST YOU WOULD HAVE A FEW

121

00:06:28,509 --> 00:06:31,009

DAYS A YEAR WHERE YOU WOULD HAVE  
MELTING.

122

00:06:31,009 --> 00:06:34,369

WHAT'S HAPPENING IS WE'RE MOVING  
UP ELEVATION INTO THE INTERIOR

123

00:06:34,369 --> 00:06:37,849

AND NOW MUCH VASTER TRACKS OF  
GREENLAND ARE STARTING TO HAVE

124

00:06:37,849 --> 00:06:41,729

MELT WATER ON TOP OF THEM.  
WE HAVE SATELLITES LIKE ISAT AND

125

00:06:41,729 --> 00:06:45,249

GRAYS WHICH TELL US ABOUT  
DIRECTLY HOW MUCH MASS ARE WE

126

00:06:45,249 --> 00:06:47,680

LOSING FROM THE GREENLAND ICE  
SHEETS.

127

00:06:47,680 --> 00:06:49,589

AND GRACE IS THIS -- THIS IS  
SOME OF THE IMAGERY.

128

00:06:49,589 --> 00:06:54,069

THIS IS -- WE TAKE THE GRACE  
DATA OVER GREENLAND AND WE TRY

129

00:06:54,069 --> 00:06:57,039

TO FIGURE OUT WHAT'S HAPPENING.  
WHAT WE FIND OUT IS THAT THE

130

00:06:57,039 --> 00:07:00,499

PURPLE AREAS AND THE BLUE AREAS  
AND GREEN AREAS ARE AREAS WHERE

131

00:07:00,499 --> 00:07:04,169

WE'RE LOSING ICE FROM GREENLAND.  
THE YELLOW AREAS ARE AREAS WHERE

132

00:07:04,169 --> 00:07:06,630

WE'RE GAINING.  
WHAT'S FANTASTIC IS THIS -- WE

133

00:07:06,630 --> 00:07:08,749

HAVE THESE TWO SATELLITES IN  
SPACE CALLED GRACE.

134

00:07:08,749 --> 00:07:11,809

THEY COMMUNICATE TO EACH OTHER  
BY RADIOWAVES AND THEY KNOW HOW

135

00:07:11,809 --> 00:07:14,920

FAR THEY ARE FROM EACH OTHER.  
THEY'RE FLYING LET'S SAY THE MUG

136

00:07:14,920 --> 00:07:17,710

IS A MOUNTAIN RANGE.  
SATELLITES ARE COMING ALONG,

137

00:07:17,710 --> 00:07:19,809

FIRST SATELLITE BEGINS TO SENSE  
THE GRAVITATIONAL PULL OF THE

138

00:07:19,809 --> 00:07:22,999

MUG, GETS PULLED, SPEEDS UP A  
LITTLE BIT.

139

00:07:22,999 --> 00:07:25,199

BY PRECISELY MEASURING THAT  
DISTANCE WE CAN MEASURE

140

00:07:25,199 --> 00:07:28,869

VARIATIONS IN THE MASS OVER THE  
SURFACE OF THE EARTH.

141

00:07:28,869 --> 00:07:32,879

IT'S SO SENSITIVE, YOU CAN  
DETECT TEN MILLIMETERS OF ICE

142

00:07:32,879 --> 00:07:36,759

LOSS OVER LIKE A DISK, LIKE A  
THOUSAND SQUARE KILOMETERS.

143

00:07:36,759 --> 00:07:40,370

IT'S ENOUGH FOR US TO DETECT  
CHANGES IN THE ICE MASS IN

144

00:07:40,370 --> 00:07:43,029

GREENLAND.  
THE TAKE HOME POINT IS THIS.

145

00:07:43,029 --> 00:07:45,569

IT USED TO BE THAT WE WERE ONLY  
LOSING ICE FROM SOUTHERN

146

00:07:45,569 --> 00:07:48,159

GREENLAND.  
NOW WE'RE ALSO LOSING ICE FROM

147

00:07:48,159 --> 00:07:51,279

NORTHERN GREENLAND, THE COLDER  
PART OF GREENLAND AND THIS HAS

148

00:07:51,279 --> 00:07:53,349

ALL HAPPENED IN JUST THE LAST  
FIVE YEARS.

149

00:07:53,349 --> 00:07:56,460

THE BOTTOM LINE IS THAT THE  
ICE IS GOING INTO THE OCEAN AND

150

00:07:56,460 --> 00:07:59,409

IS MAKING THE SEA LEVEL RISE?  
RIGHT.



151

00:07:59,409 --> 00:08:01,249

AND THAT'S THE THING.

WHAT PEOPLE DON'T REALIZE IS

152

00:08:01,249 --> 00:08:04,819

THAT BETWEEN GREENLAND AND

ANTARCTICA YOU HAVE OVER 200

153

00:08:04,819 --> 00:08:08,069

FEET OF SEA LEVEL RISE TIED UP

IN THE FRESH WATER THAT'S LOCKED

154

00:08:08,069 --> 00:08:10,680

UP IN ALL THAT ICE.

NOW NOBODY THINKS THAT WE'RE

155

00:08:10,680 --> 00:08:12,819

GOING TO MELT ALL THAT AT ONCE

AND RAISE SEA LEVEL RIGHT AWAY,

156

00:08:12,819 --> 00:08:16,249

BUT THE POINT IS SMALL CHANGES

IN WHAT HAPPENED IN GREENLAND

157

00:08:16,249 --> 00:08:20,259

AND ANTARCTICA CAN RESULT IN BIG

CHANGES IN SEA LEVEL.

158

00:08:20,259 --> 00:08:24,059

RIGHT NOW SEA LEVEL IS RISING AT

3 MILLIMETERS A YEAR, IT'S

159

00:08:24,059 --> 00:08:26,710

ALREADY GOING UP.

EXTRAPOLATE THAT OUT 100 YEARS

160

00:08:26,710 --> 00:08:31,050

WE GET A FOOT OF SEA LEVEL RISE.

LET'S GO BACK TO ICE FLOATING

161

00:08:31,050 --> 00:08:35,169

ON THE SEA, THE SEA ICE.  
HOW DOES SEA ICE AFFECT THE SEA

162

00:08:35,169 --> 00:08:38,310

LEVEL AND ALSO WHAT DOES IT  
MATTER WHAT HAPPENS TO THE SEA

163

00:08:38,310 --> 00:08:42,180

ICE IF WE'RE GOING TO LOSE THE  
SEA ICE IN THE ARCTIC ANYWAY?

164

00:08:42,180 --> 00:08:43,319

THAT'S A REALLY GOOD  
QUESTION.

165

00:08:43,319 --> 00:08:45,750

THOSE ARE TWO REALLY IMPORTANT  
QUESTIONS.

166

00:08:45,750 --> 00:08:48,310

FIRST, THE SEA ICE IS FLOATING  
ON THE OCEAN ALREADY.

167

00:08:48,310 --> 00:08:49,751

IF IT MELTS IT DOES RAISE SEA  
LEVEL.

168

00:08:49,751 --> 00:08:55,820

THE SEA ICE IS LIKE THIS THE HAT  
ON THE TOP OF THE PLANET.

169

00:08:55,820 --> 00:08:59,110

ICE IS REFLECTIVE.  
IT GETS REFLECTED BACK INTO

170

00:08:59,110 --> 00:09:01,630

SPACE DOESN'T CAUSE THE PLANET  
TO WARM UP.

171

00:09:01,630 --> 00:09:06,201

AS YOU TAKE AWAY ICE YOU EXPOSE  
MORE DARK OCEAN, THE OCEAN

172

00:09:06,201 --> 00:09:09,490

BEGINS TO WARM UP AND CAUSES  
MORE FEEDBACK AND RETRACTION OF

173

00:09:09,490 --> 00:09:12,740

ICE AND WARMS THE PLANET UP  
OVERALL BY WARMING UP THE OCEAN.

174

00:09:12,740 --> 00:09:15,040

THIS IS WHY THE ARCTIC  
TEMPERATURES YOU SHOWED EARLIER

175

00:09:15,040 --> 00:09:18,110

ARE WARMING.  
THE PLANET IS WARMING UP

176

00:09:18,110 --> 00:09:20,420

BECAUSE OF THE INCREASING AMOUNT  
OF CARBON DIOXIDE IN THE

177

00:09:20,420 --> 00:09:24,270

ATMOSPHERE AND THAT CAUSES MORE  
WATER VAPOR INTO THE ATMOSPHERE

178

00:09:24,270 --> 00:09:27,339

WHICH IS AN IMPORTANT POINT THAT  
GETS LOST SOMETIMES.

179

00:09:27,339 --> 00:09:30,350

WE'RE GETTING WARMING IN THE  
ARCTIC OCEAN AND THAT'S CRITICAL

180

00:09:30,350 --> 00:09:33,370

FOR A FEW REASONS.  
THE NUMBER ONE THING IT CAUSE

181

00:09:33,370 --> 00:09:36,190

MORSE FEEDBACK TO MELT MORE OF  
THAT SEA ICE.

182

00:09:36,190 --> 00:09:39,500

THE NUMBER TWO THING, YOU ALSO  
THEN HAVE MORE HEAT TO BE

183

00:09:39,500 --> 00:09:42,769

TRANSFERRED ON TO LAND.  
WHAT PEOPLE HAVE TO REALIZE ALL

184

00:09:42,769 --> 00:09:45,930

THE CONTINENTS THAT SURROUND THE  
ARCTIC OCEAN THEY'RE FROZEN.

185

00:09:45,930 --> 00:09:49,009

THE SOIL IS FROZEN.  
AND WHAT HAPPENS AS THAT OCEAN

186

00:09:49,009 --> 00:09:52,730

WARPS UP HEAT IS TRANSFERRED ON  
TO LAND BY WIND THAT STUFF

187

00:09:52,730 --> 00:09:56,300

MELTS, RELEASES MORE METHANE AND  
CARBON DIOXIDE INTO THE AREA.

188

00:09:56,300 --> 00:09:59,761

ANOTHER THING THAT'S REALLY  
IMPORTANT, THINK OF THE ARCTIC

189

00:09:59,761 --> 00:10:02,630

OCEAN LIKE THE MOTOR AT THE  
BOTTOM OF YOUR REFRIGERATOR.

190

00:10:02,630 --> 00:10:08,210

AND THE FACT IS, WARM WATER  
COMES IN ALONG ALASKA AND FROM

191

00:10:08,210 --> 00:10:11,600

THE PACIFIC, AND GOES KNEW THE  
ARC ARCTIC OCEAN, GETS COOLED

192

00:10:11,600 --> 00:10:16,389

DOWN AND FLOWS AROUND GREENLAND  
BETWEEN EUROPE AND FLOWS DOWN

193

00:10:16,389 --> 00:10:19,350

TOWARDS ANTARCTICA AND HELPS  
DRIVE THE CONVEYOR BELT OF

194

00:10:19,350 --> 00:10:22,810

CIRCULATION IN THE WORLD OCEAN.  
LET'S TALK ABOUT THE WARMING

195

00:10:22,810 --> 00:10:25,250

TEMPERATURE.  
THAT'S GOT TO AFFECT THE

196

00:10:25,250 --> 00:10:26,639

FISHERIES.  
RIGHT.

197

00:10:26,639 --> 00:10:28,620

SO TELL US A LITTLE BIT MORE  
ABOUT THAT.

198

00:10:28,620 --> 00:10:31,199

SO WARMER OCEANS ALSO  
COMPLETELY AFFECT THE FOOD

199

00:10:31,199 --> 00:10:32,420

CHAIN.  
YOU CAN SEE THERE'S AN IMAGE

200

00:10:32,420 --> 00:10:35,130

THAT SHOWS A BALLOON THAT  
HAPPENED OFF THE COAST OF

201  
00:10:35,130 --> 00:10:37,810  
ALASKA.  
WHAT HAPPENS IS WARMER WATER

202  
00:10:37,810 --> 00:10:40,690  
GIVES YOU DIFFERENT KIND OF  
ALGAE, DIFFERENT KINDS OF FISH,

203  
00:10:40,690 --> 00:10:44,160  
ALL KINDS OF WILDLIFE.  
WHAT WE'RE SEEING IS A RADICAL

204  
00:10:44,160 --> 00:10:46,660  
CHANGE TO THE ARCTIC ECO SYSTEM  
OVERALL.

205  
00:10:46,660 --> 00:10:50,759  
THE COVERAGE OR EXTENT OF SEA  
ICE HAS BEEN DECREASING QUITE A

206  
00:10:50,759 --> 00:10:53,100  
LOT.  
OVER THE LAST 30 YEARS, IT'S

207  
00:10:53,100 --> 00:10:54,220  
GONE DOWN.  
WE'RE TALKING ABOUT LOSING

208  
00:10:54,220 --> 00:10:57,560  
TEXAS-SIZED AREAS OF ICE.  
OKAY.

209  
00:10:57,560 --> 00:11:01,180  
RIGHT IN 2007 IT WAS THE  
SMALLEST THAT IT'S EVER BEEN.

210  
00:11:01,180 --> 00:11:05,360  
BUT UNDERSTAND, TOO, THE WAY  
THAT ICE WORKS IT GROWS IN THE

211

00:11:05,360 --> 00:11:08,560

WINTER, SHRINKS IN THE SUMMER.  
EVERY YEAR IT'S BEEN SHRINKING

212

00:11:08,560 --> 00:11:10,759

BACK MORE AND MORE IN THE  
SUMMER.

213

00:11:10,759 --> 00:11:15,710

IT DID RECOVER A LITTLE BIT  
IN '08 AND '09 AND '10 BUT IT'S

214

00:11:15,710 --> 00:11:19,959

STILL SOME OF THE LOWEST AMOUNTS  
OF SEA ICE EXTENT ON RECORD.

215

00:11:19,959 --> 00:11:24,060

BUT IT'S NOT JUST THE EXTENT.  
IT'S ALSO THE THICKNESS OF THE

216

00:11:24,060 --> 00:11:27,079

ICE.  
IT USED TO BE THE ARCTIC HAD ICE

217

00:11:27,079 --> 00:11:31,160

THAT SURVIVED FOR LIKE FIVE TO  
TEN TO 15 YEARS.

218

00:11:31,160 --> 00:11:33,850

WELL NOW, THE ICE IS ONLY  
SURVIVING FOR ONE SEASON SO IT'S

219

00:11:33,850 --> 00:11:37,180

ALL LIKE ONE TO TWO YEAR ICE AND  
IT'S THINNER.

220

00:11:37,180 --> 00:11:39,949

THIS IS A GRAPH THAT SHOWS YOU A  
BETTER EXAMPLE OF WHAT I WAS

221

00:11:39,949 --> 00:11:43,009

TALKING ABOUT.

THIS SHOWS THE TOTAL EXTENT OF

222

00:11:43,009 --> 00:11:46,070

ICE AND IT'S CUT OFF A LITTLE

BIT IN THE BOTTOM BUT THIS SHOWS

223

00:11:46,070 --> 00:11:48,750

YOU THE DIFFERENT SEASON.

IT STARTS AT THE START OF SUMMER

224

00:11:48,750 --> 00:11:52,459

IN JUNE AND GOES ALL THE WAY

THROUGH UNTIL THE START OF THE

225

00:11:52,459 --> 00:11:54,829

WINTER.

YOU CAN SEE WE KIND OF HAVE A

226

00:11:54,829 --> 00:11:57,010

DECREASE IN THE AMOUNT OF ICE

AND IT INCREASES AGAIN AS IT

227

00:11:57,010 --> 00:11:59,209

GROWS.

THE WHITE LINE IS THE 30-YEAR

228

00:11:59,209 --> 00:12:01,490

AVERAGE WHICH IS WHEN THE

SATELLITE RECORD STARTS.

229

00:12:01,490 --> 00:12:04,689

SHORT STORY IS THIS, RIGHT, THE

GREEN LINE IS 2007.

230

00:12:04,689 --> 00:12:06,740

WE HAVE THE LOWEST AMOUNT OF ICE

EVER.



231

00:12:06,740 --> 00:12:11,250

THE BLUE LINE IS 2010.

WHAT IS THE DATA WE GOT BACK.

232

00:12:11,250 --> 00:12:14,360

THE POINT IS WE'RE SEEING STILL

SEEING A LOT LESS ICE THAN WE'RE

233

00:12:14,360 --> 00:12:16,950

USED TO AND IT'S THINNER NOW

THAN EVER.

234

00:12:16,950 --> 00:12:21,779

SO AS WE SEE THIS DECLINE,

THIS KIND OF TO ME IS PROOF THAT

235

00:12:21,779 --> 00:12:24,839

GLOBAL WARMING IS HAPPENING.

WHAT DO YOU THINK?

236

00:12:24,839 --> 00:12:26,529

IS THAT WHAT THE SCIENTISTS ARE

TRYING TO TELL US?

237

00:12:26,529 --> 00:12:28,930

YEAH.

I WOULD SAY IF THERE'S ONE THING

238

00:12:28,930 --> 00:12:31,660

THAT I WOULD WANT TO TELL EVERY

MEMBER OF THE PUBLIC, I THINK

239

00:12:31,660 --> 00:12:34,630

SOMETIMES THEY CAN GET BOGGED

DOWN IN THINGS LIKE THE

240

00:12:34,630 --> 00:12:37,649

TEMPERATURE RECORD AND PEOPLE

CAN ARGUE, WELL, THERE MAY HAVE

241

00:12:37,649 --> 00:12:40,810

BEEN THIS, YOU KNOW, WARM PERIOD  
IN THE '30s OR THESE SQUIGGLES

242

00:12:40,810 --> 00:12:42,959

ON A GRAPH I DON'T UNDERSTAND  
THEM.

243

00:12:42,959 --> 00:12:44,310

IT'S NOT JUST THE TEMPERATURE  
RECORD.

244

00:12:44,310 --> 00:12:47,950

WE HAVE MAJOR PIECES OF EVIDENCE  
LIKE ALL THE GLACIERS AROUND THE

245

00:12:47,950 --> 00:12:49,910

ARCTIC MELTING AND THE ARCTIC  
SEA ICE MELTING BACK.

246

00:12:49,910 --> 00:12:52,279

WE HAVE GLACIERS LETTING LOOSE  
IN ANTARCTICA.

247

00:12:52,279 --> 00:12:56,610

THERE'S A LOT OF EVIDENCE THAT  
TELLS US THIS.

248

00:12:56,610 --> 00:13:00,399

LET'S TALK MORE ABOUT THE  
THICKNESS OF THE ICE AND TALK US

249

00:13:00,399 --> 00:13:03,569

THROUGH THIS VIDEO RIGHT HERE.  
THIS IS A REALLY NEAT VIDEO

250

00:13:03,569 --> 00:13:06,069

THAT SHOWS YOU HOW THE THICKNESS  
HAS CHANGED.

251

00:13:06,069 --> 00:13:09,230

THIS IS SOMETHING WE FIGURED OUT  
HOW TO DO BY SATELLITE.

252

00:13:09,230 --> 00:13:12,089

THIS JUST WAS FIGURED OUT LIKE A  
YEAR AGO.

253

00:13:12,089 --> 00:13:15,949

THE SHORT STORY IS THE WHITE  
AREAS HERE, THAT'S YOUR THICKEST

254

00:13:15,949 --> 00:13:17,810

ICE.

ICE THAT MIGHT BE 10, 15 FEET

255

00:13:17,810 --> 00:13:19,769

THICK.

IT'S BEEN AROUND THROUGH

256

00:13:19,769 --> 00:13:22,389

MULTIPLE SEASONS.

IT GETS THICKER EVERY WINTER.

257

00:13:22,389 --> 00:13:25,550

THE BLUE ICE IS THIN ICE, FIRST  
YEAR ICE.

258

00:13:25,550 --> 00:13:29,660

WHAT'S HAPPENED IS, OVER TIME,  
WE'VE SEEN THE AMOUNT OF WHITE

259

00:13:29,660 --> 00:13:34,490

ICE DISAPPEAR, THE AMOUNT OF  
FIRST-YEAR ICE HAS INCREASED AND

260

00:13:34,490 --> 00:13:37,860

WHAT THIS IS TELLING US IS ON  
AVERAGE THE ICE IS THINNER.

261

00:13:37,860 --> 00:13:40,129

THINNER ICE IS A PROBLEM BECAUSE  
IT MELT MORE EASILY IN THE

262

00:13:40,129 --> 00:13:42,339

SUMMER.  
IT SEEMS LIKE WE'RE ON TRACK

263

00:13:42,339 --> 00:13:46,009

TOWARDS EVER DECREASING AMOUNTS  
OF ARCTIC SEA ICE.

264

00:13:46,009 --> 00:13:49,720

WHAT IS NASA DOING TO HELP  
FIGURE OUT AND LEARN MORE, WHAT

265

00:13:49,720 --> 00:13:51,430

DIRECTION WE SHOULD TAKE IN THE  
FUTURE?

266

00:13:51,430 --> 00:13:53,760

A BUNCH OF THINGS.  
WE'RE DOING EVERYTHING FROM

267

00:13:53,760 --> 00:13:56,850

SATELLITE STUDIES OF HOW THE ICE  
IS CHANGING ON THE LAND AND IN

268

00:13:56,850 --> 00:13:59,220

THE SEA.  
WE'RE ALSO SPENDING A LOT OF

269

00:13:59,220 --> 00:14:02,259

TIME TAKING THOSE RESULTS AND  
SYNTHESIZING THEM AND PUTTING

270

00:14:02,259 --> 00:14:05,089

THEM INTO PREDICATIVE MODELS.  
IT'S NOT ENOUGH FOR US TO

271

00:14:05,089 --> 00:14:06,689

DOCUMENT THE DEMISE OF THESE THINGS.

272

00:14:06,689 --> 00:14:10,480

IT'S WHERE WE'RE GOING TO BE IN THE NEXT HUNDRED YEARS.

273

00:14:10,480 --> 00:14:15,029

WE WANT TO UNDERSTAND HOW GLOBAL CLIMATE IS CHANGING.

274

00:14:15,029 --> 00:14:18,610

CHANGING THE SEA ICE CHANGES THE CLIMATE, CHANGES THE AMOUNT OF

275

00:14:18,610 --> 00:14:20,980

WATER IN THE ATMOSPHERE WHICH AFFECTS CLOUDS.

276

00:14:20,980 --> 00:14:25,019

WE'RE ALSO TALKING A REAL TANGIBLE THING IS RISING SEA

277

00:14:25,019 --> 00:14:26,810

LEVEL.  
WHAT THIS GRAPH SHOWS HERE, THIS

278

00:14:26,810 --> 00:14:28,689

IS FROM THE LAST INTERGOVERNMENTAL PANEL ON

279

00:14:28,689 --> 00:14:31,779

CLIMATE CHANGE REPORT.  
WHEN THE VERTICAL ACTS AS SEA

280

00:14:31,779 --> 00:14:36,540

LEVEL CHANGE, RUNS FROM NEGATIVE 200, THAT'S WHERE WE START

281

00:14:36,540 --> 00:14:39,910

OURSELVES IN THE 1800s UP TO 500  
MILLIMETERS.

282

00:14:39,910 --> 00:14:42,949

ZERO IS WHERE WE WERE A FEW  
YEARS AGO ON EARTH.

283

00:14:42,949 --> 00:14:45,319

THAT'S WHERE WE ARBITRARILY SET  
IT.

284

00:14:45,319 --> 00:14:47,389

NORMAL SEA LEVEL.  
RIGHT.

285

00:14:47,389 --> 00:14:51,269

THE BEST PREDICTIONS WE HAVE,  
PREDICT THAT SEA LEVEL COULD

286

00:14:51,269 --> 00:14:54,889

RISE BY LIKE ONE TO TWO FEET IN  
THE NEXT HUNDRED YEARS.

287

00:14:54,889 --> 00:14:57,829

WOW.  
AND THAT'S UNDERSTAND RIGHT

288

00:14:57,829 --> 00:15:02,079

NOW, SEA LEVEL IS RISING THREE  
MILLIMETERS A YEAR TODAY.

289

00:15:02,079 --> 00:15:04,410

AND THAT'S MEASURED BY  
SATELLITE, TIDE GAUGES ALL KINDS

290

00:15:04,410 --> 00:15:06,769

OF THINGS.  
IF YOU EXTRAPOLATE THAT OUT

291

00:15:06,769 --> 00:15:09,829

WE'RE GOING TO HAVE AT LEAST A  
FOOT OF SEA LEVEL RISE.

292

00:15:09,829 --> 00:15:13,360

WHAT WE'RE SCARED ABOUT, THOUGH,  
IS THAT THE GLACIERS SEEM TO BE

293

00:15:13,360 --> 00:15:16,089

SPEEDING UP AND PUTTING MORE ICE  
INTO THE OCEAN THROUGH THAT

294

00:15:16,089 --> 00:15:20,370

PHYSICAL FLOE AND MELTING.  
IF YOU WANT TO LOOK AT THIS CONE

295

00:15:20,370 --> 00:15:23,199

UP OVER HERE, YOU KNOW, WHY IS  
THERE UNCERTAINTY?

296

00:15:23,199 --> 00:15:26,569

VERY COMPLICATED SCIENCE TO DO.  
WE'RE DOING THE BEST WE CAN.

297

00:15:26,569 --> 00:15:29,629

WE'RE MAKING NEW OBSERVATIONS  
AND COMING UP WITH BETTER MODELS

298

00:15:29,629 --> 00:15:33,300

TO HELP NARROW THAT DOWN.  
TOM, HOW CAN PEOPLE LEARN

299

00:15:33,300 --> 00:15:36,290

MORE ABOUT WHAT NASA'S DOING AS  
FAR AS RESEARCHING THE ARCTIC?

300

00:15:36,290 --> 00:15:39,199

ONE OF THE BEST PLACES TO GO  
IS NASA.GOV.

301

00:15:39,199 --> 00:15:41,540

A LOT OF TABS WHERE YOU CAN SEE  
DIFFERENT THINGS ABOUT WHAT NASA

302

00:15:41,540 --> 00:15:45,069

IS DOING FROM THE SATELLITES TO  
THE AIRCRAFT CAMPAIGNS.

303

00:15:45,069 --> 00:15:48,209

ANOTHER ONE TO GO TO IS  
CLIMATE.NASA.GOV AND THAT'S A

304

00:15:48,209 --> 00:15:50,829

PLACE FOR PEOPLE TO SEE THE  
EVIDENCE FOR THEMSELVES.

305

00:15:50,829 --> 00:15:54,230

REAL DATA ON THERE AND GRAPHS  
AND THINGS YOU CAN SEE.

306

00:15:54,230 --> 00:15:57,430

ON THAT SITE ALSO, IS ANOTHER  
GREAT PAGE CALLED SOLUTIONS,

307

00:15:57,430 --> 00:16:00,100

WHICH TELLS YOU ABOUT ALL THE  
DIFFERENT THINGS THAT YOU CAN DO

308

00:16:00,100 --> 00:16:03,050

TO HELP CUT ON GREENHOUSE GAS  
RELEASE.

309

00:16:03,050 --> 00:16:06,180

AND WHAT I -- ONE OF MY FAVORITE  
SITES OF ALL, THOUGH, IS THE

310

00:16:06,180 --> 00:16:09,260

EARTH OBSERVATORY AND THIS IS A  
PLACE WHERE YOU CAN GO AND SEE



311

00:16:09,260 --> 00:16:12,779

THE LATEST NASA IMAGES AND IT'S  
FANTASTIC.

312

00:16:12,779 --> 00:16:16,290

THE IMAGES YOU CAN SEE OF OUR  
PLANET EVERY DAY FOR FREE ON

313

00:16:16,290 --> 00:16:18,470

THERE THAT TELL YOU ABOUT ALL  
KINDS OF THINGS THAT ARE GOING

314

00:16:18,470 --> 00:16:22,079

ON, EVERYTHING FROM CLOUD  
COVERAGE TO CHANGES IN THE ICE

315

00:16:22,079 --> 00:16:24,360

TO NEW MAPS OF THE TREES THAT  
COVER THE EARTH.

316

00:16:24,360 --> 00:16:27,519

THANKS, TOM, FOR EXPLAINING  
ABOUT ARCTIC.

317

00:16:27,519 --> 00:16:31,790

I KNOW I WILL ALSO, YOU KNOW,  
CHECK THOSE AND KEEP POSTED ON

318

00:16:31,790 --> 00:16:34,379

WHAT WE AT NASA ARE DOING.  
THANK YOU.

319

00:16:34,379 --> 00:16:35,709

IT'S BEEN FUN.

320

00:16:35,709 --> 00:16:37,790

FROM NASA HEADQUARTERS I'M  
TIFFANY NAIL.