1
00:00:04,309 --> 00:00:02,550
for hagerstown and martinsburg tomorrow

2
00:00:06,550 --> 00:00:04,319
weather forecasters use them to create

3
00:00:08,549 --> 00:00:06,560
the nightly weather report

4
00:00:10,629 --> 00:00:08,559
airline pilots use them to learn how to

5
00:00:12,310 --> 00:00:10,639
fly planes

6
00:00:14,390 --> 00:00:12,320
experts use them in virtually every

7
00:00:17,590 --> 00:00:14,400
industry and discipline

8
00:00:20,470 --> 00:00:17,600
their computer models

9
00:00:22,230 --> 00:00:20,480
at nasa scientists use computer models

10
00:00:23,189 --> 00:00:22,240
to enhance their understanding of the

11
00:00:32,790 --> 00:00:23,199
earth

12
00:00:34,950 --> 00:00:32,800
immense amounts of data back to

13
00:00:37,110 --> 00:00:34,960

scientists on the ground who can then

14
00:00:38,630 --> 00:00:37,120
enter that data into computer model

15
00:00:42,470 --> 00:00:38,640
simulations

16
00:00:45,910 --> 00:00:42,480
we have then equations and then we have

17
00:00:49,510 --> 00:00:45,920
computer code which solves those

18
00:00:51,430 --> 00:00:49,520
equations on a day-to-day basis

19
00:00:53,590 --> 00:00:51,440
nasa is the source for most of the

20
00:00:56,630 --> 00:00:53,600
research satellite observations of the

21
00:00:58,470 --> 00:00:56,640
atmosphere land and oceans

22
00:01:00,869 --> 00:00:58,480
so the nasa scientists will look at the

23
00:01:03,110 --> 00:01:00,879
observational data and

24
00:01:05,030 --> 00:01:03,120
make theoretical projections of what a

25
00:01:06,950 --> 00:01:05,040
model might look like and they will

26
00:01:09,910 --> 00:01:06,960
build a numerical model

27
00:01:11,990 --> 00:01:09,920
based on the data and then run that on

28
00:01:14,149 --> 00:01:12,000
our computers and then compare that to

29
00:01:16,070 --> 00:01:14,159
reality

30
00:01:18,550 --> 00:01:16,080
with rapid increases in computer

31
00:01:20,950 --> 00:01:18,560
technology models are becoming ever more

32
00:01:23,270 --> 00:01:20,960
powerful and sophisticated allowing us

33
00:01:25,510 --> 00:01:23,280
to simulate our complex environment in

34
00:01:27,990 --> 00:01:25,520
greater detail

35
00:01:29,670 --> 00:01:28,000
nasa uses a variety of weather models

36
00:01:32,550 --> 00:01:29,680
such as the goddard earth observing

37
00:01:34,390 --> 00:01:32,560
system model or geos-5

38
00:01:36,950 --> 00:01:34,400

it creates an extraordinarily high

39
00:01:38,950 --> 00:01:36,960
resolution realistic looking view of our

40
00:01:41,910 --> 00:01:38,960
atmosphere

41
00:01:44,149 --> 00:01:41,920
these geos5 simulations showcase the

42
00:01:46,310 --> 00:01:44,159
model's ability to capture fine-scale

43
00:01:48,389 --> 00:01:46,320
cloud features worldwide

44
00:01:54,069 --> 00:01:48,399
like the swirling clouds in the atlantic

45
00:01:57,670 --> 00:01:55,670
the goal of weather models is to give

46
00:02:01,590 --> 00:01:57,680
the most accurate prediction of weather

47
00:02:06,389 --> 00:02:04,389
in 2005 when hurricane katrina formed

48
00:02:08,469 --> 00:02:06,399
over the atlantic ocean scientists

49
00:02:11,029 --> 00:02:08,479
wanted to understand the storm

50
00:02:13,190 --> 00:02:11,039
how intense was it what was its size and

51
00:02:14,790 --> 00:02:13,200
structure and what would be its final

52
00:02:17,110 --> 00:02:14,800
path

53
00:02:19,190 --> 00:02:17,120
nasa satellites continuously monitored

54
00:02:21,030 --> 00:02:19,200
many aspects of the storm from wind

55
00:02:22,790 --> 00:02:21,040
speed rainfall and sea surface

56
00:02:25,990 --> 00:02:22,800
temperature to the storm's

57
00:02:27,510 --> 00:02:26,000
three-dimensional structure

58
00:02:29,670 --> 00:02:27,520
to get a more complete picture of the

59
00:02:31,350 --> 00:02:29,680
storm and predict its evolution

60
00:02:32,710 --> 00:02:31,360
scientists entered the data into a

61
00:02:35,350 --> 00:02:32,720
computer model

62
00:02:37,509 --> 00:02:35,360
then high-powered supercomputers capable

63
00:02:40,229 --> 00:02:37,519

of trillions of calculations per second

64
00:02:42,550 --> 00:02:40,239
crunch the numbers this process is

65
00:02:44,949 --> 00:02:42,560
called data assimilation

66
00:02:46,949 --> 00:02:44,959
data assimilation is a two-step cycle

67
00:02:48,550 --> 00:02:46,959
that repeats itself whenever new data

68
00:02:50,550 --> 00:02:48,560
becomes available

69
00:02:52,630 --> 00:02:50,560
in the first step the model runs forward

70
00:02:55,030 --> 00:02:52,640
in time to provide an estimate of the

71
00:02:56,630 --> 00:02:55,040
atmosphere in the second step this

72
00:02:58,070 --> 00:02:56,640
estimate gets corrected using

73
00:03:00,470 --> 00:02:58,080
observations

74
00:03:02,630 --> 00:03:00,480
and the cycle begins again each step

75
00:03:04,470 --> 00:03:02,640
building upon the last and accumulating

76
00:03:06,390 --> 00:03:04,480
the information from satellite and

77
00:03:08,790 --> 00:03:06,400
ground observations

78
00:03:10,949 --> 00:03:08,800
weather models are updated every 6 hours

79
00:03:13,430 --> 00:03:10,959
to include the most current observations

80
00:03:15,350 --> 00:03:13,440
for the next forecast this approach

81
00:03:17,509 --> 00:03:15,360
prevents the model from straying too far

82
00:03:19,270 --> 00:03:17,519
from reality and acts as a checks and

83
00:03:23,190 --> 00:03:19,280
balance system to achieve the most

84
00:03:27,750 --> 00:03:25,030
while weather models predict conditions

85
00:03:30,550 --> 00:03:27,760
for up to 10 days climate models predict

86
00:03:32,390 --> 00:03:30,560
trends over much longer periods of time

87
00:03:36,229 --> 00:03:32,400
the climate models that are run at the

88
00:03:38,470 --> 00:03:36,239

nccs are numerical expressions of the

89
00:03:40,949 --> 00:03:38,480
various processes that make up the

90
00:03:43,830 --> 00:03:40,959
climate this includes things like land

91
00:03:45,430 --> 00:03:43,840
surface movement of water in the ocean

92
00:03:46,550 --> 00:03:45,440
and the movement of air in the

93
00:03:48,550 --> 00:03:46,560
atmosphere

94
00:03:50,470 --> 00:03:48,560
just as in weather prediction data

95
00:03:52,550 --> 00:03:50,480
assimilation is a way of bringing all

96
00:03:55,110 --> 00:03:52,560
the observations of the earth together

97
00:03:57,670 --> 00:03:55,120
to provide an analysis of our climate

98
00:04:00,149 --> 00:03:57,680
one example of this technique is mera

99
00:04:02,789 --> 00:04:00,159
the modern era retrospective analysis

100
00:04:05,110 --> 00:04:02,799
for research and application

101
00:04:08,309 --> 00:04:05,120
mera incorporates data from the entire

102
00:04:10,710 --> 00:04:08,319
satellite record over 30 years of data

103
00:04:13,830 --> 00:04:10,720
its results are a data encyclopedia that

104
00:04:15,990 --> 00:04:13,840
can be used for research and

105
00:04:18,229 --> 00:04:16,000
mera can help meteorologists understand

106
00:04:20,310 --> 00:04:18,239
the variations associated with specific

107
00:04:22,150 --> 00:04:20,320
weather events in the past

108
00:04:24,790 --> 00:04:22,160
while mera gives us a climate picture

109
00:04:27,510 --> 00:04:24,800
across decades the goddard institute for

110
00:04:29,430 --> 00:04:27,520
space studies or gis can extend that

111
00:04:31,270 --> 00:04:29,440
view across centuries

112
00:04:33,350 --> 00:04:31,280
gis models have already unraveled

113
00:04:34,310 --> 00:04:33,360

average temperature trends over 200

114
00:04:36,710 --> 00:04:34,320
years

115
00:04:39,990 --> 00:04:36,720
nuc simulations will cover the last 1

116
00:04:42,070 --> 00:04:40,000
000 years to verify the model's accuracy

117
00:04:44,230 --> 00:04:42,080
they'll also look forward projecting

118
00:04:45,510 --> 00:04:44,240
climate trends to the end of the 21st

119
00:04:47,510 --> 00:04:45,520
century

120
00:04:49,189 --> 00:04:47,520
with each satellite launched we gain

121
00:04:51,270 --> 00:04:49,199
millions of measurements that tell us

122
00:04:53,430 --> 00:04:51,280
more about our planet

123
00:04:55,350 --> 00:04:53,440
having so much more data will require

124
00:04:57,189 --> 00:04:55,360
increases in computing power to

125
00:04:59,030 --> 00:04:57,199
synthesize this information into

126
00:05:01,110 --> 00:04:59,040
meaningful representations of the

127
00:05:03,590 --> 00:05:01,120
climate system as a whole

128
00:05:06,070 --> 00:05:03,600
at goddard space flight center we have a

129
00:05:08,550 --> 00:05:06,080
tremendous amount of observational data

130
00:05:11,110 --> 00:05:08,560
which is captured by our satellites we

131
00:05:13,270 --> 00:05:11,120
have probably the largest collection of

132
00:05:15,670 --> 00:05:13,280
earth scientists anywhere in the world

133
00:05:18,629 --> 00:05:15,680
and we have this new state-of-the-art

134
00:05:20,950 --> 00:05:18,639
computing center so the combination of

135
00:05:23,350 --> 00:05:20,960
the scientists the data and the

136
00:05:24,550 --> 00:05:23,360
computing puts us in a unique position