1
00:00:15,600 --> 00:00:12,959
hundreds of miles above us a fleet of

2
00:00:20,220 --> 00:00:15,610
NASA spacecraft constantly scans the

3
00:00:22,560 --> 00:00:20,230
earth one of these has dramatically

4
00:00:26,670 --> 00:00:22,570
improved our ability to study severe

5
00:00:29,159 --> 00:00:26,680
weather trim the tropical rainfall

6
00:00:30,690 --> 00:00:29,169
measuring mission observes weather

7
00:00:34,860 --> 00:00:30,700
systems with the world's only

8
00:00:36,959 --> 00:00:34,870
space-based precipitation radar trim

9
00:00:40,529 --> 00:00:36,969
peers down through clouds revealing

10
00:00:42,330 --> 00:00:40,539
their internal structure using trim

11
00:00:44,189 --> 00:00:42,340
measurements scientists identified a

12
00:00:47,639 --> 00:00:44,199
dramatic feature in the structure of

13
00:00:49,919 --> 00:00:47,649

hurricane Bonnie towering rain clouds

14
00:00:54,270 --> 00:00:49,929
close to the eye wall nearly reached the

15
00:00:57,270 --> 00:00:54,280
stratosphere these structures called hot

16
00:01:00,750 --> 00:00:57,280
towers extended higher than commercial

17
00:01:03,119 --> 00:01:00,760
jets fly research into these

18
00:01:06,750 --> 00:01:03,129
observations has led scientists to new

19
00:01:09,480 --> 00:01:06,760
insights about hurricanes let's look at

20
00:01:12,960 --> 00:01:09,490
the role hot towers play in hurricanes

21
00:01:16,740 --> 00:01:12,970
a hurricane's eye is an intense

22
00:01:19,290 --> 00:01:16,750
low-pressure system near the ocean's

23
00:01:23,070 --> 00:01:19,300
surface air spirals inward in an attempt

24
00:01:25,890 --> 00:01:23,080
to fill the low-pressure region as air

25
00:01:28,110 --> 00:01:25,900
nears the eye it rises rapidly until

26
00:01:31,830 --> 00:01:28,120
forced outward at the barrier formed by

27
00:01:33,930 --> 00:01:31,840
the warm tropopause the net effect is a

28
00:01:34,770 --> 00:01:33,940
cycle of air moving inward near the

29
00:01:37,560 --> 00:01:34,780
ocean's surface

30
00:01:41,550 --> 00:01:37,570
upward at the eye wall and outward at

31
00:01:43,140 --> 00:01:41,560
high altitudes the air picks up energy

32
00:01:47,880 --> 00:01:43,150
from warm ocean water through

33
00:01:49,500 --> 00:01:47,890
evaporation this warm moist air rises in

34
00:01:51,660 --> 00:01:49,510
the eyewall and releases its energy

35
00:01:56,100 --> 00:01:51,670
through condensation sustaining the

36
00:01:58,320 --> 00:01:56,110
hurricane hot towers act like Express

37
00:02:02,430 --> 00:01:58,330
elevators accelerating the movement of

38
00:02:04,230 --> 00:02:02,440

energy into high-altitude clouds this

39
00:02:05,450 --> 00:02:04,240
energy boost tends to strengthen the

40
00:02:09,859 --> 00:02:05,460
hurricane

41
00:02:12,630 --> 00:02:09,869
what causes these hot towers to form

42
00:02:14,880 --> 00:02:12,640
there's a big difference in wind speeds

43
00:02:17,990 --> 00:02:14,890
between the fierce eyewall and the

44
00:02:20,580 --> 00:02:18,000
relatively calm winds inside the eye

45
00:02:22,710 --> 00:02:20,590
these rapid changes in wind speeds

46
00:02:25,020 --> 00:02:22,720
caused instabilities that can spin up

47
00:02:29,280 --> 00:02:25,030
intense vortices just inside the eye

48
00:02:31,140 --> 00:02:29,290
wall near the surface air spiraling

49
00:02:33,240 --> 00:02:31,150
inward collides with these vortices

50
00:02:37,260 --> 00:02:33,250
forcing the air upwards creating an

51
00:02:39,809 --> 00:02:37,270
updraft a very strong updraft in the eye

52
00:02:40,380 --> 00:02:39,819
wall carries moisture much higher than

53
00:02:44,400 --> 00:02:40,390
normal

54
00:02:46,770 --> 00:02:44,410
creating a hot Tower high resolution

55
00:02:50,759 --> 00:02:46,780
computer simulations of hurricanes show

56
00:02:53,340 --> 00:02:50,769
the formation of hot towers in this

57
00:02:57,240 --> 00:02:53,350
simulation of hurricane Bonnie hot

58
00:02:59,009 --> 00:02:57,250
towers are clearly visible the arrows

59
00:03:00,990 --> 00:02:59,019
show winds swirling near the surface

60
00:03:04,860 --> 00:03:01,000
where energy is picked up from the warm

61
00:03:07,440 --> 00:03:04,870
ocean some of this air moves into the

62
00:03:10,770 --> 00:03:07,450
hot Tower and rises rapidly boosting the

63
00:03:11,820 --> 00:03:10,780

hurricane strength but it's more

64
00:03:14,400 --> 00:03:11,830
complicated than that

65
00:03:16,530 --> 00:03:14,410
because hot towers move with the

66
00:03:20,310 --> 00:03:16,540
hurricane and there are often multiple

67
00:03:24,990 --> 00:03:20,320
updrafts when air passes into a hot

68
00:03:27,210 --> 00:03:25,000
tower it rapidly rises higher conditions

69
00:03:29,250 --> 00:03:27,220
are more favorable for vortices to form

70
00:03:32,550 --> 00:03:29,260
updrafts on one side of the hurricane

71
00:03:36,449 --> 00:03:32,560
because wind shear amplifies colliding

72
00:03:38,850 --> 00:03:36,459
winds in that area when shear causes

73
00:03:42,539 --> 00:03:38,860
these updrafts to weaken in other areas

74
00:03:44,910 --> 00:03:42,549
of the eye vortices can also pump eye

75
00:03:45,650 --> 00:03:44,920
energy air from the eye into the eye

76
00:03:47,910 --> 00:03:45,660
wall

77
00:03:51,620 --> 00:03:47,920
boosting the strength of the updrafts

78
00:03:54,120 --> 00:03:51,630
and intensifying the hurricane

79
00:03:56,160 --> 00:03:54,130
scientists have confirmed a connection

80
00:03:59,009 --> 00:03:56,170
between hot towers and hurricane

81
00:04:00,539 --> 00:03:59,019
intensification but forecasting

82
00:04:05,190 --> 00:04:00,549
intensification remains a difficult

83
00:04:07,860 --> 00:04:05,200
problem combining satellite observations

84
00:04:09,990 --> 00:04:07,870
with supercomputer simulations provides