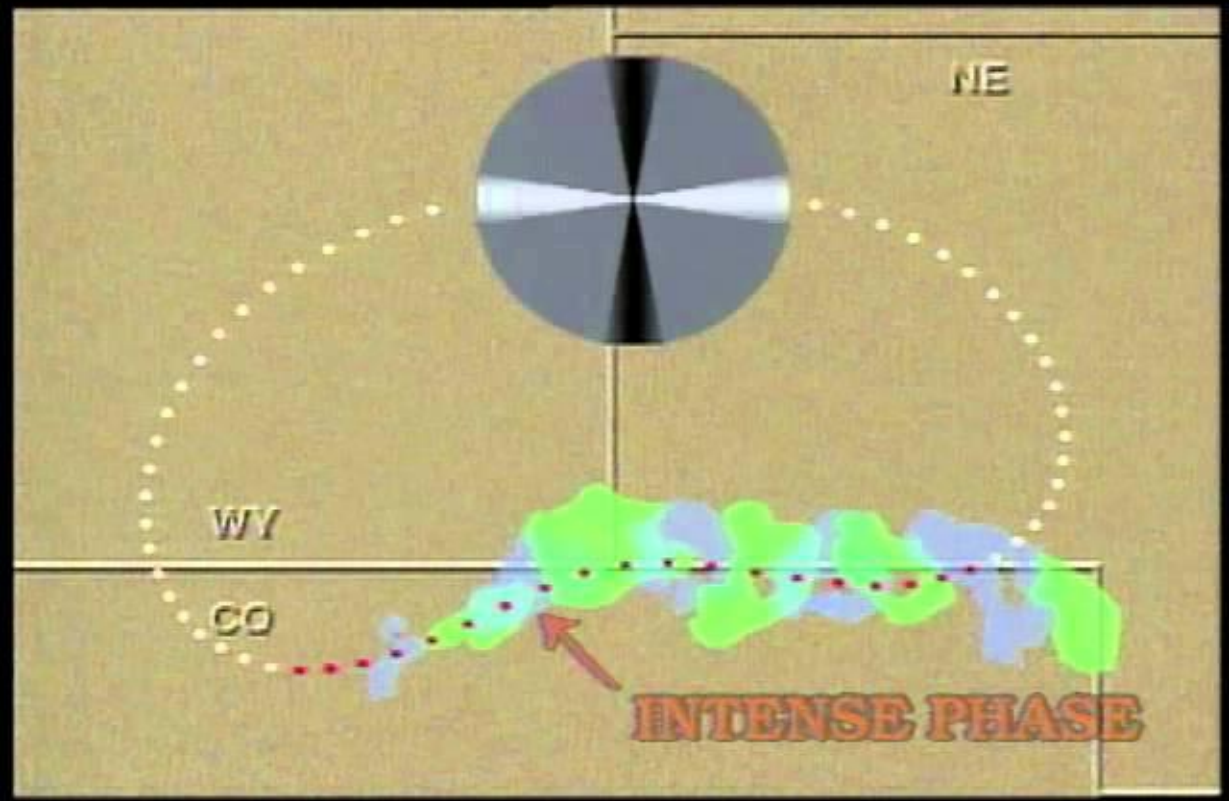
NE
WY
CO
INTENSE PHASE

1
00:00:42,370 --> 00:00:38,800
supercells are rotating thunderstorms

2
00:00:44,530 --> 00:00:42,380
that can cause tornadoes and hail the

3
00:00:46,420 --> 00:00:44,540
most widely accepted theory for storm

4
00:00:49,450 --> 00:00:46,430
spin up produces a pair of counter

5
00:00:51,940 --> 00:00:49,460
rotating supercells but such pairs are

6
00:00:54,130 --> 00:00:51,950
rarely observed in the troposphere and a

7
00:00:58,660 --> 00:00:54,140
theory is needed that produces a single

8
00:01:01,570 --> 00:00:58,670
supercell a new mathematical model

9
00:01:03,280 --> 00:01:01,580
called vertical rotating draft has been

10
00:01:05,770 --> 00:01:03,290
developed that includes the gross

11
00:01:09,430 --> 00:01:05,780
features of a supercell in highly

12
00:01:13,870 --> 00:01:09,440
idealized form this new model produces a

13
00:01:15,850 --> 00:01:13,880

single supercell principal ingredients

14
00:01:20,680 --> 00:01:15,860
of the model include rotation about a

15
00:01:22,210 --> 00:01:20,690
vertical axis horizontal convergence in

16
00:01:27,420 --> 00:01:22,220
the middle troposphere caused by the

17
00:01:27,430 --> 00:01:32,920
buoyancy

18
00:01:32,930 --> 00:01:40,610
and the Coriolis force

19
00:01:45,230 --> 00:01:42,860
when these ingredients are used in fluid

20
00:01:47,090 --> 00:01:45,240
dynamic equations the horizontal

21
00:01:49,760 --> 00:01:47,100
pressure gradient is found to be zero

22
00:01:51,200 --> 00:01:49,770
and air parcels move along inertial

23
00:01:54,320 --> 00:01:51,210
circles projected on a horizontal

24
00:01:56,210 --> 00:01:54,330
surface this circular motion gives the

25
00:01:57,860 --> 00:01:56,220
model and inertial oscillation that

26
00:02:03,380 --> 00:01:57,870
appears to have been overlooked in

27
00:02:05,870 --> 00:02:03,390
previous supercell models the inertial

28
00:02:08,210 --> 00:02:05,880
oscillation consists of a long quiescent

29
00:02:12,530 --> 00:02:08,220
phase when the draft diameter is large

30
00:02:14,780 --> 00:02:12,540
and rotates anti cyclonic Lee and a

31
00:02:17,630 --> 00:02:14,790
short intense phase when the draft

32
00:02:21,410 --> 00:02:17,640
diameter is small and rotates cyclonic

33
00:02:23,960 --> 00:02:21,420
ly one cycle of mathematically driven

34
00:02:25,910 --> 00:02:23,970
animation represents 13 hours of

35
00:02:29,150 --> 00:02:25,920
quiescent phase and five hours of

36
00:02:31,640 --> 00:02:29,160
intense phase during the intense phase

37
00:02:36,500 --> 00:02:31,650
of the inertial oscillation the rotating

38
00:02:39,530 --> 00:02:36,510

draft resembles a supercell rising

39
00:02:41,990 --> 00:02:39,540
parcels of air expand causing the draft

40
00:02:46,150 --> 00:02:42,000
to expand and rotate anti cyclonic Li

41
00:02:53,260 --> 00:02:46,160
the updraft changes to a downdraft

42
00:02:57,949 --> 00:02:55,670
downdraft is driven by evaporative

43
00:03:01,580 --> 00:02:57,959
cooling and updraft by condensation

44
00:03:04,130 --> 00:03:01,590
aletan expanding flow interacts with the

45
00:03:13,150 --> 00:03:04,140
Coriolis force to produce anti cyclonic

46
00:03:17,990 --> 00:03:15,380
contracting flow interacts with the

47
00:03:23,380 --> 00:03:18,000
Coriolis force to produce cyclonic

48
00:03:27,560 --> 00:03:25,610
additional physical ingredients of the

49
00:03:30,460 --> 00:03:27,570
model include translation of the

50
00:03:33,440 --> 00:03:30,470
rotating draft and vertical wind shear

51
00:03:35,120 --> 00:03:33,450
the rotating draft moves at a constant

52
00:03:38,150 --> 00:03:35,130
height above the surface of the earth

53
00:03:40,970 --> 00:03:38,160
the intense phase has a small buoyant

54
00:03:44,030 --> 00:03:40,980
draft cyclonic rotation marked by a

55
00:03:46,340 --> 00:03:44,040
track that turns to the right this right

56
00:03:49,700 --> 00:03:46,350
turn is a salient feature of actual

57
00:03:51,950 --> 00:03:49,710
supercells the quiescent phase has a

58
00:03:55,550 --> 00:03:51,960
large negatively buoyant draft with

59
00:03:58,010 --> 00:03:55,560
antipsychotic rotation latent heating

60
00:04:00,410 --> 00:03:58,020
changes the downdraft to an updraft in

61
00:04:02,300 --> 00:04:00,420
the middle of the intense phase this

62
00:04:04,460 --> 00:04:02,310
flow reversal interacts with the

63
00:04:07,790 --> 00:04:04,470

vertical wind shear to cause the right

64
00:04:09,650 --> 00:04:07,800
turn the latent energy required to

65
00:04:12,290 --> 00:04:09,660
support this inertial oscillation is

66
00:04:18,770 --> 00:04:12,300
greatest during the quiescent phase when

67
00:04:20,479 --> 00:04:18,780
the draft diameter is large a supercell

68
00:04:23,270 --> 00:04:20,489
storm that produced one and one half

69
00:04:26,630 --> 00:04:23,280
centimeter hail is documented by radar

70
00:04:29,060 --> 00:04:26,640
echoes spaced 30 minutes apart these

71
00:04:32,750 --> 00:04:29,070
echoes become increasingly stronger as

72
00:04:35,540 --> 00:04:32,760
the supercell bills the track turns to

73
00:04:38,450 --> 00:04:35,550
the right hail is produced and strong

74
00:04:41,409 --> 00:04:38,460
echoes are recorded the echoes then

75
00:04:43,580 --> 00:04:41,419
weaken as the supercell dissipates

76
00:04:45,530 --> 00:04:43,590
application of the mathematical model

77
00:04:48,830 --> 00:04:45,540
starts in the middle of the quiescent

78
00:04:51,140 --> 00:04:48,840
phase the first week radar echoes are in

79
00:04:54,440 --> 00:04:51,150
theory created by a growing up draft in

80
00:04:56,570 --> 00:04:54,450
a predominantly downward airflow after

81
00:04:58,580 --> 00:04:56,580
the turning point the strong echoes and

82
00:05:03,500 --> 00:04:58,590
hail are created in theory by a

83
00:05:05,690 --> 00:05:03,510
predominantly upward airflow data from

84
00:05:07,790 --> 00:05:05,700
the documented supercell storm generally

85
00:05:10,310 --> 00:05:07,800
support the intense phase of the model

86
00:05:12,220 --> 00:05:10,320
however the quiescent phase of the model

87
00:05:14,510 --> 00:05:12,230
is not supported by the storm data

88
00:05:18,440 --> 00:05:14,520

possibly because the quiescent phase

89
00:05:20,360 --> 00:05:18,450
requires too much latent energy the new

90
00:05:22,460 --> 00:05:20,370
mathematical model called vertical

91
00:05:24,380 --> 00:05:22,470
rotating draft has an inertial

92
00:05:26,540 --> 00:05:24,390
oscillation with an intense phase that

93
00:05:29,270 --> 00:05:26,550
resembles a single supercell

94
00:05:31,520 --> 00:05:29,280
this intense phase starts with a

95
00:05:34,550 --> 00:05:31,530
predominantly downward flow that causes

96
00:05:39,320 --> 00:05:34,560
the draft to contract and spin up partly

97
00:05:41,600 --> 00:05:39,330
by action of the Coriolis force more

98
00:05:43,340 --> 00:05:41,610
research remains to be done they

99
00:05:45,440 --> 00:05:43,350
predominantly downward flow that

100
00:05:47,780 --> 00:05:45,450
theoretically occurs before the turning

101
00:05:51,140 --> 00:05:47,790
point in a supercell track needs to be

102
00:05:53,690 --> 00:05:51,150
detected and measured this down flow if

103
00:05:56,510 --> 00:05:53,700
confirmed by measurements would strongly