
Feb 15 03:20 GMT
observations: 000
meteor
Chelyabinsk

1
00:00:00,020 --> 00:00:04,170
(music)

2
00:00:04,190 --> 00:00:08,350
It's early morning

3
00:00:08,370 --> 00:00:12,520
on February 15th, 2013.

4
00:00:12,540 --> 00:00:16,550
A meteor weighing 10,000

5
00:00:16,570 --> 00:00:20,680
metric tons is about to explode nearly 23 km

6
00:00:20,700 --> 00:00:24,810
above Chelyabinsk.

7
00:00:24,830 --> 00:00:28,930
Shortly after local sunrise:

8
00:00:28,950 --> 00:00:32,970
a blinding sight for the stunned spectators on the ground,

9
00:00:32,990 --> 00:00:37,060
(sound of explosion)

10
00:00:37,080 --> 00:00:41,130
a massive explosion equivalent to 440 kilotons of TNT,

11
00:00:41,150 --> 00:00:45,200
hundreds of tons of debris released, and quickly moved up into the atmosphere.

12
00:00:45,220 --> 00:00:49,230
The highly sensitive

13
00:00:49,250 --> 00:00:53,400

OMPS instrument on board the Suomi/NPP satellite made its first observation

14
00:00:53,420 --> 00:00:57,590
of the plume nearly three and a half hours later, an entire

15
00:00:57,610 --> 00:01:01,760
1,100km east of the explosion and already at

16
00:01:01,780 --> 00:01:05,930
40km altitude well, into the Earth's stratosphere!

17
00:01:05,950 --> 00:01:10,120
A surprising observation since the stratosphere usually acts as a

18
00:01:10,140 --> 00:01:14,310
bumper that caps aerosols trying to rise up from the lower atmosphere.

19
00:01:14,330 --> 00:01:18,470
By inserting a column of data

20
00:01:18,490 --> 00:01:22,650
from the first plume observation into to two NASA models,

21
00:01:22,670 --> 00:01:26,800
scientists were able to project the plume's trajectory.

22
00:01:26,820 --> 00:01:30,940
The models showed that the plume had higher altitudes, shown in red, would

23
00:01:30,960 --> 00:01:34,950
move ahead of the lower layer, shown in yellow.

24
00:01:34,970 --> 00:01:39,070
The reason would be the difference in wind velocity at the lower and

25
00:01:39,090 --> 00:01:43,110
higher altitudes. Also

26
00:01:43,130 --> 00:01:47,180
illustrated here is how accurately the satellite observations coincided

27
00:01:47,200 --> 00:01:51,210
with the projected path of the plume.

28
00:01:51,230 --> 00:01:55,380
(music)

29
00:01:55,400 --> 00:01:59,570
When OMPS made its second observation back at Chelyabinsk,

30
00:01:59,590 --> 00:02:03,750
nearly 5 hours after the bolide, there was still evidence of

31
00:02:03,770 --> 00:02:07,920
the plume at a lower 30km altitude.

32
00:02:07,940 --> 00:02:12,090
On February 16, one day after the bolide, the OMPS instrument

33
00:02:12,110 --> 00:02:16,250
detected the far end of the plume even further, at 1,700

34
00:02:16,270 --> 00:02:20,450
to 4,300 km eastward from the explosion.

35
00:02:20,470 --> 00:02:24,590
By February 19th,

36
00:02:24,610 --> 00:02:28,720
four days after the explosion, the satellite observation showed that

37
00:02:28,740 --> 00:02:32,880
the meteor debris had circumnavigated the entire globe and returned to

38
00:02:32,900 --> 00:02:37,020

Chelyabinsk, forming a complete global belt.

39
00:02:37,040 --> 00:02:41,140
The clean shape of the belt was another

40
00:02:41,160 --> 00:02:45,240
surprising prediction, considering that Northern hemisphere winds during the winter

41
00:02:45,260 --> 00:02:49,280
are usually rather inconsistent in direction.

42
00:02:49,300 --> 00:02:53,330
A further look into the model simulation showed that evidence of the plume

43
00:02:53,350 --> 00:02:57,370
persist for a long time, which also coincided with the satellite

44
00:02:57,390 --> 00:03:01,410
observations.

45
00:03:01,430 --> 00:03:05,590
We have now seen how accurately the models were able to project the plume's

46
00:03:05,610 --> 00:03:09,770
trajectory. This is critical since the same models

47
00:03:09,790 --> 00:03:13,960
are used to study climate and ozone depletion. The

48
00:03:13,980 --> 00:03:18,150
unprecedented sensitivity of the OMPS instrument and its ability to see

49
00:03:18,170 --> 00:03:22,340
vertical profile the atmosphere help scientists track

50
00:03:22,360 --> 00:03:26,500
and study the meteor plume for months, revealing a much

51
00:03:26,520 --> 00:03:30,640
better picture of what the aftermath on the atmosphere could be

52
00:03:30,660 --> 00:03:34,770
from potential future, and even bigger events.