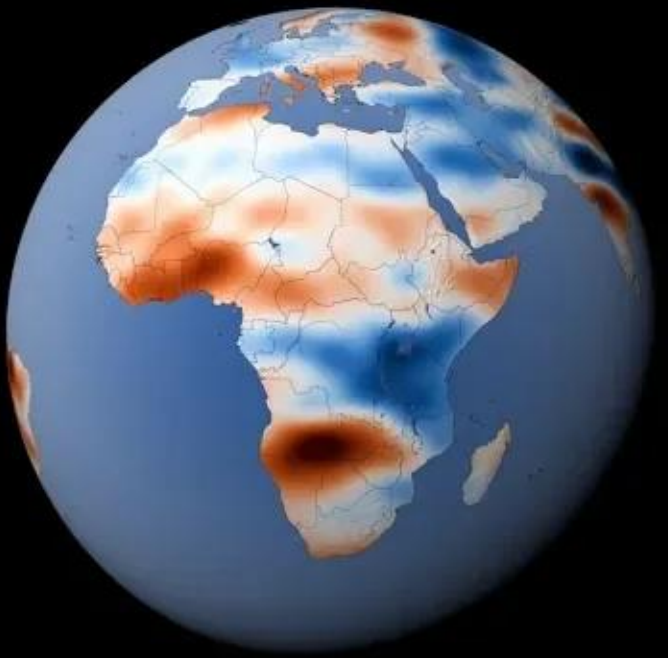
Jun 21, 2002

1
00:00:00,040 --> 00:00:04,170
Around the world, water

2
00:00:04,170 --> 00:00:08,280
is constantly moving. From 2002 to

3
00:00:08,280 --> 00:00:12,480
2016, a pair of NASA satellites witnessed massive shifts

4
00:00:12,480 --> 00:00:16,910
in the freshwater stored on land related to water management, climate change

5
00:00:16,910 --> 00:00:21,350
and natural cycles. The Gravity Recovery and Climate Experiment,

6
00:00:21,350 --> 00:00:25,450
or GRACE mission, used precise measurements of the motions of two

7
00:00:25,450 --> 00:00:29,660
spacecraft in Earth’s orbit to track the movement of water through the oceans, land

8
00:00:29,660 --> 00:00:34,050
and atmosphere. NASA scientists combined GRACE

9
00:00:34,050 --> 00:00:38,050
data with satellite-based observations of precipitation and crop irrigation,

10
00:00:38,050 --> 00:00:42,370
climate model predictions, and other information in order to identify

11
00:00:42,370 --> 00:00:46,500
the causes of regional trends in freshwater storage.

12
00:00:46,500 --> 00:00:51,940
In this visualization, blues indicate areas with more stored freshwater

13
00:00:51,940 --> 00:00:56,210

than the average, and oranges and reds denote areas with less.

14
00:00:56,210 --> 00:01:00,340
The science team classified the major trends observed by GRACE as driven by:

15
00:01:00,340 --> 00:01:04,400
Natural variability, human activity or climate change.

16
00:01:04,400 --> 00:01:08,840
For instance, the steady decrease

17
00:01:08,840 --> 00:01:12,950
in freshwater storage in Greenland is caused by the melting of glaciers,

18
00:01:12,950 --> 00:01:17,010
which drain water into the oceans.

19
00:01:17,010 --> 00:01:21,110
In the western United States, a long drought reduced mountain snowpack and river flows,

20
00:01:21,110 --> 00:01:25,120
causing heavy reliance on aquifers for crop irrigation and

21
00:01:25,120 --> 00:01:29,230
severe depletion of freshwater resources.

22
00:01:29,230 --> 00:01:33,380
Precipitation measurements together with GRACE data show how natural variations

23
00:01:33,380 --> 00:01:37,390
in the weather and unsustainable rates of water use conspired to deplete

24
00:01:37,390 --> 00:01:41,490
groundwater in California.

25
00:01:41,490 --> 00:01:45,830
In southern Africa, the Okavango Delta region experienced a huge

26
00:01:45,830 --> 00:01:50,400
increase in stored freshwater during the period of the GRACE mission.

27
00:01:50,400 --> 00:01:54,550
The science team analyzed precipitation data for the area and found that it was caused

28
00:01:54,550 --> 00:01:58,550
by a pronounced increase in rainfall.

29
00:01:58,550 --> 00:02:02,960
Between 2004 and 2012, the region saw about 15% more

30
00:02:02,960 --> 00:02:06,970
annual rainfall than during the previous twenty-five years.

31
00:02:06,970 --> 00:02:11,050
The rain ended a regional drought, and replenished water storage in the area.

32
00:02:11,050 --> 00:02:15,140
In northern Saudi Arabia, GRACE detected a dramatic

33
00:02:15,140 --> 00:02:19,550
decrease in fresh water stored in aquifers. Images taken by

34
00:02:19,550 --> 00:02:23,630
NASA’s Landsat program show a rapid increase in irrigated cropland,

35
00:02:23,630 --> 00:02:27,760
supported by water pumped from those aquifers.

36
00:02:27,760 --> 00:02:32,170
Most of that water is non-renewable on human timescales, but in 2014

37
00:02:32,170 --> 00:02:36,330
the Saudi government ended a domestic wheat farming program, and GRACE data

38
00:02:36,330 --> 00:02:40,390

suggest that aquifer levels may be stabilizing.

39
00:02:40,390 --> 00:02:44,590
In northwest China, GRACE revealed a rapid

40
00:02:44,590 --> 00:02:48,980
decrease in freshwater storage without an obvious cause.

41
00:02:48,980 --> 00:02:52,980
Scientists knew that mountain glaciers were melting, but the melt-water did not leave the region,

42
00:02:52,980 --> 00:02:57,140
so they looked for another explanation.

43
00:02:57,140 --> 00:03:01,250
As it turns out, much of the region’s surface water is redirected to

44
00:03:01,250 --> 00:03:06,010
agricultural areas and the desert to the south, where it evaporates,

45
00:03:06,010 --> 00:03:11,080
leaving the region with a net loss of water.

46
00:03:11,080 --> 00:03:15,830
The original GRACE satellites stopped operating in 2017,

47
00:03:15,830 --> 00:03:20,390
but NASA and the German Research Center for Geosciences are partnering to launch a new