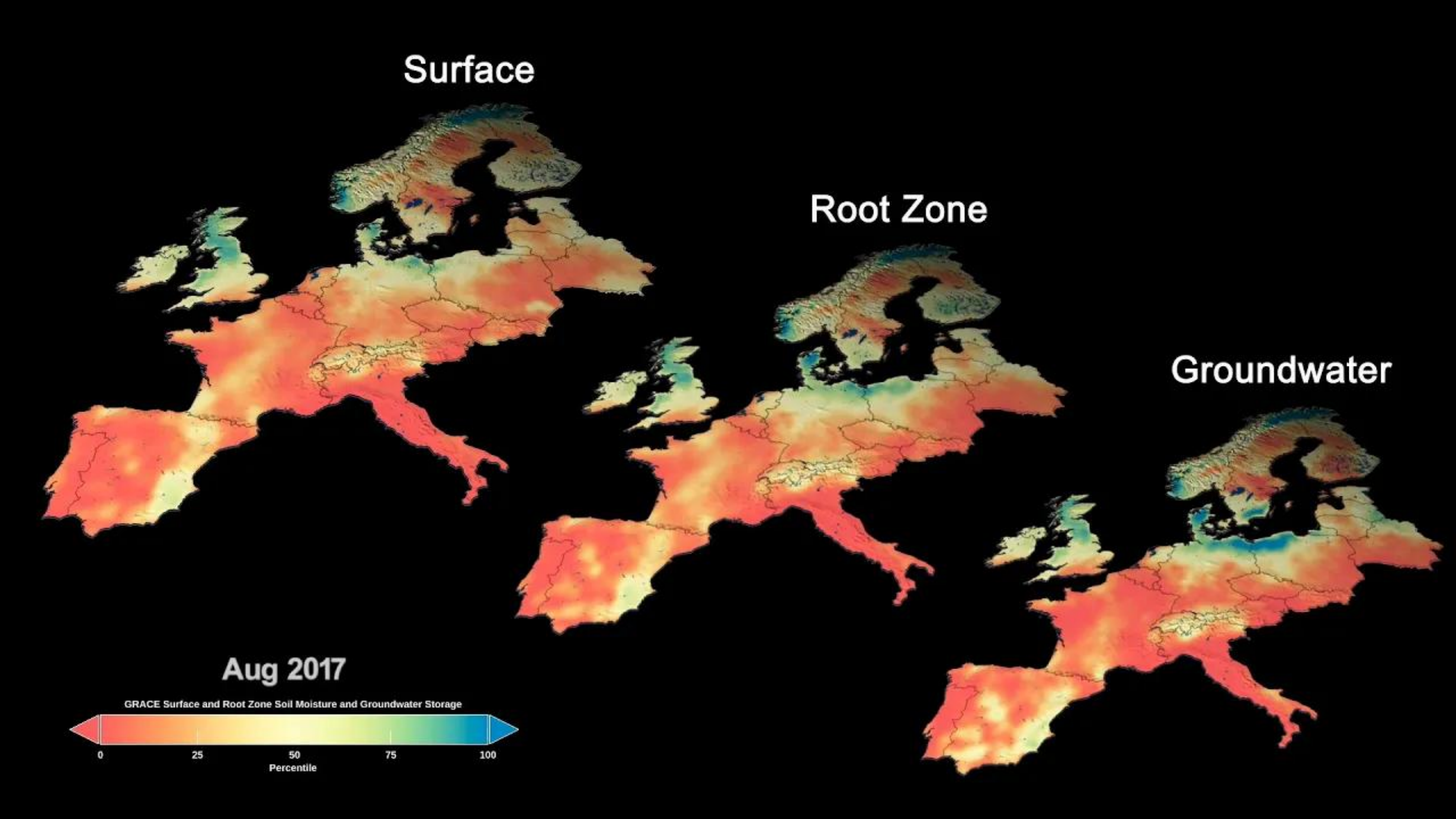
Surface
Root Zone
Groundwater
Aug 2017
GRACE Surface and Root Zone Soil Moisture and Groundwater Storage
0
25
50
75
100
Percentile

1
00:00:00,000 --> 00:00:04,000
Gravity. It keeps Earth

2
00:00:04,000 --> 00:00:08,000
orbiting around the Sun, satellites in Earth’s orbit and all of us

3
00:00:08,000 --> 00:00:12,000
standing on the ground. Gravity also allows us to track how

4
00:00:12,000 --> 00:00:16,000
water moves around our home planet. By measuring minute

5
00:00:16,000 --> 00:00:20,000
changes in gravity from space, the Gravity Recovery and Climate Experiment,

6
00:00:20,000 --> 00:00:24,000
or GRACE mission, and its successor, GRACE Follow-on, have helped us

7
00:00:24,000 --> 00:00:28,000
follow water moving on and below Earth’s surface for more than 15 years.

8
00:00:28,000 --> 00:00:32,000
Now, integrating these and other measurements

9
00:00:32,000 --> 00:00:36,000
into advanced computer models allows researchers to distinguish water

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00:00:36,000 --> 00:00:40,000
in the soil, root zone and deeper in the ground – and to forecast

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00:00:40,000 --> 00:00:44,000
into the future. Working with the National Drought Mitigation Center,

12
00:00:44,000 --> 00:00:48,000
NASA scientists are providing global water availability maps

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00:00:48,000 --> 00:00:52,000

and U.S. forecasts to the public. The forecasts look

14
00:00:52,000 --> 00:00:56,000
30, 60 and 90 days into the future and allow farmers,

15
00:00:56,000 --> 00:01:00,000
community managers and researchers to prepare for flash droughts and floods.

16
00:01:00,000 --> 00:01:04,000
The ability to forecast where water will be comes from knowing

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00:01:04,000 --> 00:01:08,000
where water has been, measuring soil moisture and how much water has been gained

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00:01:08,000 --> 00:01:12,000
or lost from aquifers. Using the models to separate the water

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00:01:12,000 --> 00:01:16,000
into layers, we can better predict events like flash floods, which are more likely

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00:01:16,000 --> 00:01:20,000
when the surface soil is already saturated, and anticipate droughts

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00:01:20,000 --> 00:01:24,000
as aquifers run out of water and take time to recharge.

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00:01:24,000 --> 00:01:28,000
Among the layers, surface soil moisture responds most rapidly to the weather,

23
00:01:28,000 --> 00:01:32,000
while root zone soil moisture – the water available to plants – changes more

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00:01:32,000 --> 00:01:36,000
slowly, and groundwater – a vital resource for drinking water

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00:01:36,000 --> 00:01:40,000
and agriculture – evolves over months and longer.

26
00:01:40,000 --> 00:01:44,000
Like here in the Okavango Delta. In the 25 years before

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00:01:44,000 --> 00:01:48,000
GRACE launched, the region experienced a prolonged drought.

28
00:01:48,000 --> 00:01:52,000
Around the time GRACE started collecting data in 2002

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00:01:52,000 --> 00:01:56,000
precipitation picked back up. While the soil moisture quickly responded, it took longer

30
00:01:56,000 --> 00:02:00,000
for the aquifers to refill.Although groundwater is not immediately

31
00:02:00,000 --> 00:02:04,000
immediately affected by drought, it also takes longer to recover from drought.

32
00:02:04,000 --> 00:02:08,000
In Australia, a historic drought in the early 2000s impacted

33
00:02:08,000 --> 00:02:12,000
all of the layers. Another drought at the end of 2019

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00:02:12,000 --> 00:02:16,000
was seen by the GRACE-FO mission and dried out vegetation in the region,

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00:02:16,000 --> 00:02:20,000
leading to intense fires that burned through early 2020.

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00:02:20,000 --> 00:02:24,000
Let’s take another look at Europe. A heatwave scorched western Europe,

37
00:02:24,000 --> 00:02:28,000
melting glaciers and drying out the region. Soil moisture dries

38
00:02:28,000 --> 00:02:32,000

up almost immediately, while the root zone, which crops rely on, takes

39
00:02:32,000 --> 00:02:36,000
longer to catch up. This computer model, by assimilating

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00:02:36,000 --> 00:02:40,000
satellite observations, helps monitor drought and wetness conditions.

41
00:02:40,000 --> 00:02:44,000
NASA scientists originally developed the capability for the United States,

42
00:02:44,000 --> 00:02:48,000
but it is now providing valuable information on the whole world.

43
00:02:48,000 --> 00:02:52,000
Combining NASA’s spaceborne view with research and high end computing

44
00:02:52,000 --> 00:02:56,000
helps us better prepare for extremes in water availability.