



1

00:00:04,160 --> 00:00:08,200

Astronomers use radio telescopes to study distant stars and galaxies.

2

00:00:08,220 --> 00:00:12,210

They use a band of microwave frequencies reserved for scientists

3

00:00:12,230 --> 00:00:16,290

studying the heavens and the earth.

4

00:00:16,310 --> 00:00:20,320

By international treaty there are no transmissions allowed in this band, so I can't set up a television transmitter,

5

00:00:20,340 --> 00:00:24,360

say, and operate here. It's dedicated, set aside,

6

00:00:24,380 --> 00:00:28,370

for what we call "passive use," or in this case the microwave radiometer

7

00:00:28,390 --> 00:00:32,480

listening to the natural signals from the Earth.

8

00:00:32,500 --> 00:00:36,480

NASA is using this band to study the water content of soil for its

9

00:00:36,500 --> 00:00:40,520

Earth-observing SMAP mission, which stands for "Soil Moisture Active Passive."

10

00:00:40,540 --> 00:00:44,530

The "active passive" part really refers to the instrument,

11

00:00:44,550 --> 00:00:48,540

so the active portion is a microwave radar,

12

00:00:48,560 --> 00:00:52,540

and the passive portion is a microwave radiometer that we built here at Goddard Space Flight Center.

13

00:00:56,630 --> 00:01:00,610

Every molecule naturally gives off or absorbs microwave energy

14

00:01:00,630 --> 00:01:04,610

to maintain a balance with its surroundings. The amount given off

15

00:01:04,630 --> 00:01:08,620

by the soil depend on its temperature and its water content. The molecules in the soil

16

00:01:08,640 --> 00:01:12,630

with the water, they're bouncing around off of each other and emitting microwaves.

17

00:01:12,650 --> 00:01:16,640

The dry soil lets out a lot of these microwaves and the wetter soil lets out

18

00:01:16,660 --> 00:01:20,640

fewer of these microwaves. The challenge is that the neighboring bands

19

00:01:20,660 --> 00:01:24,640

have radars and communications systems

20

00:01:24,660 --> 00:01:28,650

and those transmissions can unintentionally leak into our spectrum.

21

00:01:28,670 --> 00:01:32,650

So we had to develop dedicated technology for SMAP

22

00:01:32,670 --> 00:01:36,670

to try to separate out the

23

00:01:36,690 --> 00:01:40,670

natural signals from the earth and the human-made signals

24

00:01:40,690 --> 00:01:44,690

that we don't want. The signals that we want

25

00:01:44,710 --> 00:01:48,730

the SMAP radiometer to listen to, they vary slowly in time.

26  
00:01:48,750 --> 00:01:52,740  
they are very broadband. And in fact what they are is,

27  
00:01:52,760 --> 00:01:56,780  
it sounds like - if you were to hook up a radio receiver and listen to it

28  
00:01:56,800 --> 00:02:00,980  
yourself, it would sound like noise, it would sound like static.

29  
00:02:01,000 --> 00:02:04,990  
So we look for signals that don't look like static and that's what we want to throw away

30  
00:02:05,010 --> 00:02:09,180  
and keep the static for ourselves.

31  
00:02:09,200 --> 00:02:13,200  
So the team here at Goddard developed specialized hardware and software.

32  
00:02:13,220 --> 00:02:17,230  
It separates out the signals that the radiometer receives in time and frequency

33  
00:02:17,250 --> 00:02:21,230  
and for every spot on the ground,

34  
00:02:21,250 --> 00:02:25,240  
looks for outliers and if it sees those, it just removes them from the measurement.

35  
00:02:25,260 --> 00:02:29,240  
Throws away the bad, keeps the good, and produces the data

36  
00:02:29,260 --> 00:02:33,250  
to give us good measurements of soil moisture here today