[Eruptions on the Sun Set Off 'Solar Tsunamis']

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(Unedited Transcript)

Description:

Two recent eruptions on the sun sent solar tsunamis sweeping across its surface. Physicist David Long reported on the tsunamis in the journal Solar Physics, and he says the waves allowed him to calculate the magnetic field of a "quiet" area on the solar surface, which is 10 times weaker than a fridge magnet.

IRA FLATOW: Welcome back. I'm Ira Flatow. Look at the temperature map of the United States right now, and the whole country is red. It's so hot that my E-ZPass fell off my windshield. It just melted right off there. But that's another story.

Because there's weather in space also. And my next guest says we might be able to fine-tune our space weather forecasts by tracking unusual phenomena, solar tsunamis. That's right. Tsunamis, not just here on earth, but on the sun. And they can ripple through the plasma of the sun at around a million miles per hour. And they're set off by enormous eruptions on the sun's surface.

David Long is a solar physicist at the Mullard Space Science Laboratory, University College London in Surrey in the UK. He joins us by phone. Welcome to "Science Friday."

DAVID LONG: Hi. How are you? Thank you for having me.

IRA FLATOW: What is a tsunami on the sun like?

DAVID LONG: Well. So what happens is you get these huge solar eruptions occurring in active regions. And sometimes we see these great waves of plasma, these bright fronts moving away from the source of the eruption across the sun at really incredible speeds. So you said a million miles an hour. And we see as the solar tsunamis. And what's really interesting to us is that how these tsunamis propagate across the sun can tell us an awful lot about the sun, about the sun's atmosphere, about the magnetic field in the sun's atmosphere, how dense the sun's atmosphere is.

IRA FLATOW: We talk about tsunamis here on earth. How tall can a tsunami wave be on the sun?

DAVID LONG: Well. So the tsunamis that we're looking at are generally about 90 million meters above the photosphere, which is the visible surface of the sun. So they're quite high up in our terms. But on the sun, they're actually quite low down. This is the low atmosphere that we're talking about here.

IRA FLATOW: 90 million meters.

DAVID LONG: Yes.

IRA FLATOW: You're not surfing that wave.

DAVID LONG: No.

IRA FLATOW: And so what can you learn about the weather, the space weather. You were saying that you could learn things about the sun from it. What can you learn?

DAVID LONG: Well. So when we see these tsunamis, it generally means that a blob of plasma has been fired out into space. And these blobs of plasma we call coronal mass ejections, or CMEs. Now, generally if we see one of these tsunamis, it means that the blob of plasma is coming at the telescope, which means that it's very difficult to measure how fast it's going, which is quite important when we want to predict when it might arrive at Earth, for example. So we're hoping that by studying these tsunamis, we might learn a little bit more about these CMEs. We might be able to work out how fast they are moving out into space.

IRA FLATOW: Are these recent discoveries, these tsunamis?

DAVID LONG: Well, actually, they were first observed in 1997, using a spacecraft called Soho. Now, the problem with Soho was the cadence of the instrument. So it took one picture every 20 minutes, which means that it was quite difficult to see these tsunamis. And we were quite lucky to see them in the first place.

More recently, we have a spacecraft called the Solar Dynamics Observatory, or SDO. And this was launched by NASA. It takes an image every 12 seconds. So that really allows us to see these tsunamis. So we're starting to see them more and more. But that's probably a result of the fact that we have better instruments now. We have better telescopes for observing these phenomena.

IRA FLATOW: So it might help you be able to predict a solar storm heading toward the planet, our planet.

DAVID LONG: Yes. Yes, that's the idea.

IRA FLATOW: And do you need any more special instruments for this or what you've got looks pretty good?

DAVID LONG: Well--

IRA FLATOW: I should never ask that of a scientist.

DAVID LONG: [LAUGHS] So the instrument, the SDO spacecraft is really good. And it allows us to see the whole sun in one go. What was really unique about this work was we had a spectroscope. So we had an instrument called the Extreme-Ultraviolet Imaging Spectrometer on a Japanese spacecraft called Hinode. And this allowed us to measure the density of the sun's atmosphere. Now, the EIS uses a very thin slit to measure density, which means that you have to be in the right place at the right time. And in this case, we were. So we were able to get density measurements of the atmosphere. And then as the tsunami passed across the slit, we were able to use the measurement of how fast it was going and the density measurements to then estimate the magnetic field strength in the sun's atmosphere.

IRA FLATOW: And so it's the magnetic field that's important here, too.

DAVID LONG: Yes. So it's really difficult to measure the magnetic field in the sun's atmosphere. It's quite easy to do in active regions, where the magnetic field is very concentrated. It's very strong. And it's quite easy-- it's relatively easy to measure there. What we were looking at was the quiet zone, where everything is quite small. There's a lot of things going on. But it's all very small-scale, and it's very difficult to see, and the magnetic field is very, very small. So it's very difficult to measure.

IRA FLATOW: Before you go, I have one question I have to ask, because we've heard about this, that we're not seeing as much solar activity as we would expect about this time. What's going on there?

DAVID LONG: Well. So the sun has an 11-year cycle of activity. It's come out of a very long minimum. And it's approaching or has reached maximum, which is quite small at the moment. I mean, that's really interesting. We're trying to understand why that is. Why is this maximum so small? And why was the last minimum so long? And that's really a field of active research at the moment.

IRA FLATOW: All right. We'll see what happens if you can configure that out. Thank you. Thank you for taking time to be with us today.

DAVID LONG: No problem. Any time.

IRA FLATOW: David Long, Solar Physicist at the Mullard Space Science Laboratory at the University College London in Surrey, UK.