Topic 3b - Methane models and measurements

This is just one of the two greenhouse gases that you work on. Let's have a look at the other one, which is the methane. Now, methane is one of those molecules, which, it sounds like it lives in a chemistry lab. Right? It sounds as though it's somewhere else and that people don't see it. And yet, there are all sources of methane all around us. And we can see that there are also these patterns in how methane is moving around. So tell me a little bit about where methane comes from and where it goes to.

So methane has a wider range of sources than CO2. The main source is actually anthropogenic, but comes from agriculture. So we have the enteric fermentation from the cows.

Which is a polite way of saying that cows emit methane.

Exactly. That--

As part of their digestive process.

It's their output. Then we also have the waste, so manure and landfills. And then we have also the production and the transformation of the fossil fuels. So it's a kind of a fugitive emission from the fossil fuel production.

And where does methane go? So it's got a shorter lifetime than carbon dioxide. So where does it go?

Methane has a lifetime of about 12 years. And that's because it reacts with OH. It's basically removed. And the sink is about 90% of the sources. So it's not a component that we have to put in the model in order to be able to detect the growth, the annual growth of methane.

And we hear a lot about carbon dioxide as a greenhouse gas. We don't hear as much about methane. And I always think we should hear more. Tell me why methane is an important greenhouse gas.

So methane is a very, very potent gas. In terms of global warming potential, it's much higher than CO2. But at the same time, because it's short-lived, it's basically transformed into CO2. So you can talk about methane, but also you can talk about CO2 equivalent, because at some point, it will be transformed into CO2. And CO2 is actually the gas that stays there forever, unless it moves to another reservoir because it doesn't react chemically.

And how do you measure? So these are actually representing slight-- both of these are methane distributions. But here, they're at different heights. How would you check? Do you use balloons or the aircraft? How do you measure both methane and CO2 actually in the

atmosphere?

So in the atmosphere, you can use either in-situ measurement, where you sample the air. And then you use spectroscopy to infer the concentration. Or you can do it remotely from space, with satellites. So in-situ measurements are more reliable because they are measured in a controlled environment.

So how would you do that? How do you take an in-situ measurement of methane in the atmosphere?

So usually, you take a sample of air. Or you can use continuous measurements, spectrometers, to actually-- which are intercalibrated with a flask.

And it's a balloon or a plane? How do you get there?

That can be done from a plane. So there are instruments, the same you use on the ground that are put on the plane. And they take the air from higher level. Or you can actually use now what they call air cores, which is a tube that is actually dropped from the stratosphere. And it captures the vertical structure by just sampling air, compressing air, in the tube. And then it has to be analyzed in the laboratory.

So these are very precise measurements. But they need very complex technology that takes time. So if you want near real time data that is actually global, you need satellites. But you need both because you need also a reference that you can use to actually calibrate the satellites with.