Topic 4a - Overview of Atmospheric transport

Welcome to week four, and this week is long range pollution transport. Anything that gets emitted into the atmosphere, whether it's natural or man-made, gets transported, and it can go surprisingly long distances. So this week we'll be looking, for example, at the transport of volcanic ash and the emissions from forest fires and dust storms.

We have to be aware and want to understand how the different gases in the atmosphere can have very different sources, how they can interact and react in somewhere else, and that consequence can come back over our heads and be very important in our own lives.

So something could happen somewhere else, nothing to do with us at all, and then it arrives?

Absolutely. Absolutely. I mean, the ozone depletion story was a good example. So creating CFC, chlorofluorocarbons, putting very small amounts into the atmosphere, tiny amounts, transporting it all the way to the poles, where you have incredibly different atmosphere, different clouds, different chemistry. Suddenly, you create something that destroys ozone much faster than, actually, anyone had ever imagined at the time. It was a real discovery from observations.

There are such strong patterns. Even this one diagram shows things from ships, emissions from wetlands, lots of different pollutants, and there's such-- it's here and not here. But then they do get mixed in it. They travel around.

Well, they are transported and transformed, and so pollution from Asia goes to North America west coast. Pollution from Europe goes into the Arctic, and we can see smog in Spitsbergen similar to that in London nowadays when the event-- so things going up from here. Russia also is a large industry, which the wind systems takes it into the Arctic. So pristine regions, and when we have no ice here, we're going to go more shipping because it's cheaper to go from Europe to Asia via this route. Although, in this projection it doesn't look like, that, but it is actually quicker than going through the Red Sea. So we were very concerned about pristine regions being impacted by shipping. And here you can see shipping emissions, which we're observing from space. That's actually oxides of nitrogen again.

And this really highlights the reason why you need both chemistry and weather models together. It's not good enough to understand the chemistry without the weather.

Well, basically it's such in the stratosphere or in the troposphere, is that the dynamics are creating the air mass chemical vessel. The conditions for the chemistry, which are temperature and pressure, are being contr-- in large part, and any surface for heterogeneous reactions is being controlled by the dynamics. And if you change the dynamics, you'll change the chemistry. The chemistry, long-term, can impact on the dynamics by changing surface temperature, for example, and changing as a result of that, flows in the atmosphere and

around the atmosphere. So this is why we need to measure both the meteorology and the chemical composition.