Topic 1b - Part 1: Copernicus, CAMS and Global Networks - The importance of collaboration

Copernicus actually started in '98 from brilliant ideas of visionary people. And now, after 20 years, we have these capacities flying on one side because we have satellites flying. And on the other hand, we have also services. So this is providing information.

And one of these is actually this atmospheric service, where we monitor the atmosphere. It's not just about satellites. It's about putting together observations from satellites, but also from in situ components. And on that basis, information is provided.

ECMWF is actually the entity that we have entrusted to run this service for us. And they are generating these products for large communities of users. And these products are not generated with a top-down decision, but are largely based on user requirements. So there has been a long user requirements process in order to identify which are the products that these user communities are really needing.

This is a team job. And what you have at CAMS-- there's all these international and national networks of hundreds of thousands of people working together as a team to understand this chemical soup. Tell me a little bit about what the parts of that team are and how it works together.

Yes. First of all, the measurements of atmosphere composition are extremely rare. There are two exceptions. One exception is the countries where air quality is really regulated-- about 50 countries in the world, so most of the developed world. And the other exception are field campaigns, where scientists use balloons, aircraft, et cetera to look into a specific situation, but only for a few days or weeks.

Apart from that, atmosphere composition observations are very rare, and that's why upcoming satellite observation of atmosphere composition are so beneficial. They are probably less accurate than the in situ measurements, but they have the potential for large coverage.

So because they are so rare, they're also expensive to get. In the world, there needs to be some collaboration so that these rare observations are shared and used as much as possible. And part of the work in CAMS is to liaise with different networks or the space agencies that operate networks so that we can get access to the data.

And in return, we can provide them with the products, the elaborated products that we generate. Also, we can inform data producers when their data may be going wrong. That is, when we see that our model versus the observation shows a deviation which is much larger than normal, it may be that there is something specific, a specific event. But it also may be that the instrument has a problem. And there are many cases where we can find very early that something is going wrong with observations. So we are not only users of observations; we are also helping to strengthen the quality of the observation networks.

So there's lots of opportunity for people to take this data and use it for whatever they need to use it for. It's a very flexible system like that.

Yes.

There's a lot of data in this system, and there are more satellites coming online. But you can't measure everything. Tell me a little bit about what you can and can't measure.

Yes. Doing models is about making compromise. So we cannot represent accurately everything that's going on in the atmosphere. We have tens of thousands of species. And also, the models that should cover the globe cannot have a 1-centimeter resolution, which is maybe what you need if you think of the gradients of the pollutants in the atmosphere.

So we make lots of compromise. So we try to represent the way chemistry works in the atmosphere in a more compact way because our driving principle is that we need to deliver the forecast within a couple hours, not more. Otherwise, when we deliver the forecast, it would no longer be a forecast and it would no longer be useful for our users.

So in what we do, we fit all we can in terms of acquiring observations as high resolution as we can, as complex as we can for representing the processes, but always with the principle that it fits within our window.

Some of the new information coming from the atmospheric monitoring services can be really helpful in complementing the in situ data that we have with remote sensing information. Member states must meet certain requirements under the European Union's air quality directives. There is a lot of data and information out there that we don't see through the official information channels. And this is why initiatives such as the CAMS atmospheric monitoring service can be very helpful in complementing the official data that see, and which we can package and shape to inform decision-makers about the problem of air quality.

It's a flight simulator for the atmosphere. You've got this model. You've put a lot of scientific research into building it, and you're continuing to improve it. But basically, you can press the button using the data you've got, and you can rerun the atmosphere or predict into the future for a short period of time. What are the benefits to society? You've got this amazing capability. What's the benefit to society?

Everybody's familiar with a weather forecast, but there's nothing to change about the weather. If a storm is coming, there's nothing to do to stop the storm. What you can do is to protect and to reduce the potential for disasters.

In the case of air quality, it's different because emissions by human activity are a key factor into the episode. So forecasting has an additional potential in terms of air quality. Because if

you have conditions which are very stable, very stagnant, the model forecast will say that accumulation is a high risk, and decision-makers, mayors locally, can decide, for instance, to reduce traffic or to ask industry to reduce their emissions. So there is an additional possibility in terms of air quality, which is actually to falsify our forecast and change the emissions so that an episode that was forecast is not as bad as it could have been.

Also, for the people, people can see that there is a bad episode. Traffic is a component to these episodes. They can decide voluntarily to take public transports. So yeah, the nice thing about air quality is that you can do something about it.

There's this lovely idea, though, which is that if you're in a city and your forecasts say that something is going to happen in five days' time-- I mean, whatever pollution you emit, it's going to sit on top of you. And that's going to happen. And so you can decide in advance maybe not to let everyone drive their cars. You can decide not to put pollution into the atmosphere and actually change. You said you can't change the weather forecast, but you could change the atmospheric composition forecast.

And also, you can understand, for instance, if there is a big fire which is raging, say, 500 kilometers away, if the flow brings the exhaust from the fire to your place, you can take all the local measures you want. You will not like the levels of pollutants. So it's also a way to understand whether a certain emission reduction policy will be effective on a specific day. On some days, it is not effective to ban car traffic. On some days, it is extremely effective, and the models actually can tell us about that.