Topic 1a - Why satellites?

So Alain, we're here outside the EUMETSAT sat building with the stunning pond and satellites in the background. Tell me about your role in this organisation.

So you see EUMETSAT is a sort of ship. You see the sea, and I'm the captain of the ship. And what the ship is about is interaction between scientists, engineers, and users. This is the melting pot of EUMETSAT.

So when it comes to what the satellites are doing, you're responsible for making sure that this operation works smoothly?

Yes. I think it's complex, because we develop new systems. So we prepare for the future. But we also apply the current system. And here we need to deliver around the clock products, information to users. And we improve this information with science, new science, new algorithms. And that's what we do on a day to day. Polling the spacecraft is a prerequisite to get information from them, but then a lot remains to be done-- acquire the data, process, validate, calibrate, and also interface with the users to see if they are happy.

So that's a huge amount of work behind the scenes just to get these data.

Yes, absolutely. And if you visit the control room, you'd see a few people. But behind, you have a lot of people working, developing products, information. And then when something is new, everybody comes to put it to line. And this is quite exciting for everybody. And this is where the scientist and engineer work well together.

When we look up at the sky-- not so much on a nice sunny day like today-- but we look up and we see clouds moving around and that's what we think of as weather. But the ocean is also dynamic. It's moving around.

Yes, absolutely. And if you look at history, we did not know much about the dynamics of the ocean. For instance, world ocean circulation experiment was just about knowing about the other edge of the currents. But now, and this is thanks to satellites, we are developing operational oceanographics-- forecasting the ocean in three dimensions, in four dimensions. And this is quite new.

Meteorologists were almost convinced it was as simple as the atmosphere. But it was very, very different, because the scales are much smaller. You know when you have a storm with a diameter of 1,500 kilometres, the equivalent in the ocean is an eddy which is 20 kilometres large. So you need sampling, much more observation, and the only way is satellites, because you cannot have a buoy every 10 kilometre.

Tell me about the Copernicus system briefly.

Copernicus is a large programme, addressing a lot of topics. We're focusing on atmosphere and ocean at EUMETSAT. We have delegation to operate as the Sentinel mission which monitor the atmosphere and the ocean. And Sentinel 3 is the main one, but Jason 3's also a Copernicus mission and sometimes

it's forgotten. For us, we are also contributing to Copernicus with our own mission, because the main objective for us is to achieve the best possible synergy-- not for us, but for the users-- between the Copernicus dedicated mission, so Sentinel 3 and Jason 3, and our mission.

Like I said, because there are a lot of ocean parameters which we can retrieve for our own mission. For instance, sea surface temperature, but also with MeteoSat. We measure the solar energy which is available to the ocean, which is only available from the geostationary orbit. And we also observe winds, ocean surface winds, from the MetOp satellites with the radar.

So all the challenges to make this thing data stream available to the users. And they will use everything. If you take for instance the off-shore industry, they are interested in marine meteorology. They needs to know about the winds, but also in the currents.

So this takes a long time, the developments of these satellites. It's a very careful process, isn't it?

It's a careful and difficult process because, of course, you think about the satellite, but you need to integrate the satellite with the ground segment to test everything. Because when you're in orbit, it's too late. You don't repair a satellite. So you need to be fully ready. So it requires a lot of preparedness reviews, testing, validation, rehearsal. And that's something which is not in people's mind, but it's terribly important to have efficient and operational systems.

But it's important, isn't it? Even though it's difficult looking at the ocean using satellites, it's an important to do.

Yes, because the ocean is terribly important. First of all, everybody knows it's 70% of the surface of the globe. But if you look at climate, it uptakes 50% of our CO2 and also most of the heat. So it's clearly the moderator of the climate and the climate change. So we need to understand-- if you don't understand the ocean, you have no chance to understand climate and then more so for climate change.

But if you look also at heat waves today, it has to do with the ocean, because the ocean is a memory of the earth system. So when the ocean is warm, it remains warm because there is a lot of thermal inertia in the ocean. And it influences the atmosphere on the long run for weeks, months, and days. And you have also El Nino.

So you see, the ocean is a very important element on the planet. As I told you, it's very difficult to observe, not only because of the scales that you need to resolve, but also because the ocean is opaque. So in the atmosphere, you can do sounding from space, from ground. But with the ocean, it's very difficult. You can do it with floats, not very frequently.

So satellites are very important, but it's a challenge, because you observe the surface. And you need to infer information in the depths of the ocean from what you get from the surface. And this is where the modelling comes into the picture. And this is a big challenge. But it works. And the next challenge will be what we call the bio-ocean, because we have ocean colour. We have the carbon cycle in the ocean. We start to have observations from space.

We can mix them with the dynamics of the ocean, and then we can even think of looking at the climate of the ocean, which is extremely important for fish stocks, for instance. We see the ocean as influencing the climate, but the ocean will have its own climate.

So tell me about what's coming online this summer.

This summer we have two new birds in orbit. So you know Jason 3 and Sentinel 3. And these are ocean satellites. So since 1st of July, Jason 3 data is flowing to the users. It means that after a few months of calibration, commissioning, we found out and the scientists found that the data is good enough to go to the users. We are still the most accurate products to validate, and this will happen in November.

So that's for Jason 3. And for Sentinel 3, it's very recent. We took over the satellite operations from ESA. It was on the 13th of July. And now we will ramp up the production of products and, again, deliver data very soon. So it means we have two ocean satellites going together, which is quite unique.

For everything that we are doing by launching satellite and observing our planet is really in support of many policies. Today we're mostly speaking about the marine area, but it is true that all the other services looking in the land management, in the emergency situation in support of civil protection-- another point that is quite important is the border surveillance.

We are looking also into aspects of climate change. So really, a lot of policies that are very important.

For centuries humans have looked at the ocean and we've touched it and floated on it and now we're starting to look at it using satellites from a long way away. Tell me about how satellites are contributing to our picture of the oceans.

Well, let's say 20 or 25 years ago, we tried using satellites for what they do very well, is to monitor the surface of the ocean very quickly and to provide us with a beautiful picture of what is the surface of the ocean. Quickly in distance, we can cover everything. So it took one century. It was different circumstance to have these kind of maps.

So we had something which was impressive for us, for oceanographers. And then start the second part, which is to go into these three dimension-- to ingest all these data, this satellite data, into what we call a model, which is a cube, a 3D cube of the ocean. We ingest the satellite data on this face. We put what we have in situ-- the buoys and the drifting buoys-- and then we are able to translate this satellite and buoys information into a completely consistent depiction of the ocean with the currents, with the ice, with the acidity, with the salinity, consistent in space and time.

And then we push the model forward and we have a forecast for the coming days and weeks.

How close are you to the ideal ocean model now? How far along the journey are we?

So what I was explaining is true. This is what we do every day. So it is really the situation. We are forecasting the ocean every day thanks to the satellite data, thanks to the collaboration we have with EUMETSAT, who supplies the data. With the institute data we have in real time, we forecast the ocean. How accurate it is? Well, we go at sea or people going at sea, the scientists with the research campaigns, and they compare what we forecast and what they have.

And it's not so bad. And the proof of it is that 50% of our users are scientists. So they trust what we forecast. And so there is this mix of real oceanographers going at sea, observing the oceans, and this digital oceanographers that are simulating the ocean. And these two communities are getting along very well. We are the same community, which is the beauty of this operation, the mission of the earth..