

#### **Topic 4a - Phytoplankton and Climate**

Ewa, you and I-- we're both ocean colour scientists. And you've got a really exciting new role in helping bring data from Sentinel-3 to our community. But you've been working with lots of other instruments over your career, haven't you? Can you tell me something about those instruments?

Oh, certainly. I worked actually on one of the first instruments-- ocean colour and temperature scanner that are coming from the Japanese space agency. There, I was a post-doc investigating data from this instrument. And this is, in fact, the first time that I had come across ocean colour.

So I started to work with the Japanese instrument. Then I moved to NASA, where I worked with seaWiFS as well as two model sensors on the aqua and terra platforms. These were excellent instruments. And actually they are providing data till now. Furthermore, VIIRS just being a little bit involved with this instrument in its conception early stages. Then in Europe, it was MERIS. MERIS on the envisat platform-- another excellent instrument and the precursor of what I'm working now with, with Sentinel-3 ocean and land colour instrument, one of the Copernicus Earth observation satellite series.

So there's this long legacy of different ocean colour instruments. And you've been involved in those throughout your career. How has what we learned from those instruments helped us to build this instrument-- OLCI on Sentinel-3.

Yeah, OLCI on Sentinel-3 carries really a lot of heritage. We started at the end of 1970's in 1978 with the launch of the first ocean colour instrument CZCS yes. With this instrument we for the first time demonstrated that concentrations of this tiny algae in the waters can be actually detected from space. We did not know this before.

It's a complete change in paradigm-- amazing.

It was a complete change of paradigm. And also we at that point when we realise how important these tiny phytoplankton in the oceans are to the global climate and to the life on Earth in general. So ever since various space agencies started launching different ocean colour instrument through the Japanese instruments to American and European as well, not mentioning Chinese, Korean, and others all very much interested in different applications of this data.

Here, we came to a Sentinel-3, which is a series of instruments within the Copernicus Earth observation programme. This programme is especially exciting because it is an operational programme. So it is for the first time in Europe that we will have this totally operational, continuous, sustained delivery of ocean colour data. And the heritage is based on a very similar and extremely successful instrument on the envisat platform from the European Space Agency called MERIS.

So MERIS was a really cool instrument. I was using it during my PhD. And I really enjoyed looking at all the different images and trying to find blooms like this when I was looking at the coast of southern Africa. Have you got some data from OLCI that you can show me?

Yes, yes, certainly. Actually, with the Sentinel-3A launched in February of this year and already right now we are disseminating this wonderful data to our Sentinel-3 validation expert users who help us with validation and calibration of things.

They're testing it before you can send it out to everybody.

Exactly-- before we announce the data delivery to everybody, to the general public. And you can see just based on the feedback from the S3VT and what we see ourselves is really excellent, a wonderful quality, nice sharp features, 300-metre resolution globally. Here, it is what the community needs and what the users need for the data.

I can go further here. For example here, these are just simple RGB composites. But you can see this wonderful cocolithophore blooms, which are the special type of algae very important for climate. And their blooms occur already right now. This is the time of June.

Here's some cyanobacteria bacteria in the Baltic Sea. Some of these cyanobacteria develop toxic properties, especially those in the Baltic Sea. It could be harmful to the sea life as well as to humans. So it is excellent data and already many applications that we can envision and they are planned already.

Furthermore, for example here you can see these wonderful plumes of the sediments coming off river runoff and land runoff in general. This is the Northwest of Borneo. And this data is so important for the coastal management.

It's not just biology. It's also sediments and things in the water too. You can really see here how that enhanced spatial resolution is important. To get into these areas, you need that higher resolution at 300 metres, don't you? It's impressive. It's amazing.

Yes, we are coming really close to the coast. And we've got the required detail for a variety of applications here. And here, this beautiful image of the Great Barrier Reef you can see wonderful, wonderful structures of the day in the water a little bit of coral reef, as well as a little bit of sediments coming off land too-- so totally beautiful data and nice results already.

So these are amazing images. And this is pretty much just the ocean colour as you might see if you looked with your eyes if you were a satellite. But we can also derive products from this, can't we? And we're starting to do that now already for algae?

Of course. We are already deriving products too. Our major product is chlorophyll A concentration. This is a very early result. This is a global composite as you can see here. It is a preliminary result. Of course, we are still in the calibration and validation phase. However, you can see these wonderful structures of chlorophyll concentrations-- chlorophyll being the photosynthetic pigment of phytoplankton.

So you can already see this nice differentiation of different chlorophyll levels around the globe. The data is already wonderful. And this is a single image of course-- single, probably monthly coverage. However, what we are hoping for is multidecadal coverage like this example from the SeaWiFS instrument. Here, with Sentinel-3 OLCI we are hoping for a, b, c, and d instruments-- so really

adapted to truly operational applications, as well as climate. So a variety of users can really go down and start using this data with full reliability that it will continue for decades to come.

So this is really strongly continuing that legacy we spoke about earlier. It's quite amazing to see that that's going to continue now decades, maybe 60 years into the future.

Yes, certainly, thanks to the European Commission Earth Observation Copernicus Programme. Yes, this is what we are hoping for. And of course, with the EUMETSAT and the European and global ocean colour community, we are extremely excited with this data.