

**Professor Ola M. Johannessen**  
**Nansen Environment and Remote Sensing Center**

"Satellites are, and will probably still be, the most important tool for climate observations."

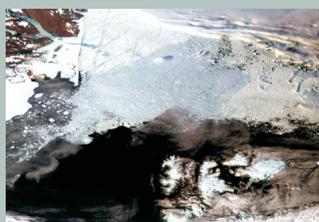


# FOCUS Environment

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Cover photo:

Svalbard area as seen by Envisat.

This 29 August 2006 Envisat MERIS image highlights the area North of Svalbard, Norway, where a very low sea ice concentration can be seen. The image width is about 800 km. Credits: ESA

## Professor Ola M. Johannessen talking with Nordicspace

Going back several decades, Professor Ola M. Johannessen was introduced to oceanographic science before the first earth observation satellite was launched. Since then he has been working with satellite observations and he is still working in this scientific field, following the development of new sensors and observation techniques very closely. Data from the satellites has also been the main source for his research, of course completed with in situ observations and modelling.

After a period dealing with fjord and coastal research, he later switched to research dealing with oceans and ice while working at the McGill University, Canada, in the late sixties. After several years abroad he returned to Bergen in 1974. Since then - Bergen has been his base, the whole world his working place, and ocean and ice his main scientific areas.

An interest for weather and sea from the early days as a young yachtsman has brought Ola M. Johannessen to a position as one of Europe's leading scientists within the field of oceanography and sea ice. From his research he was one of the first to warn people about the decreasing ice coverage in

Arctic, an observation that would not have been possible without the earth observation satellites. The use of satellites is a matter very close to his heart— he assesses that this is the most important tool for science and society for large-scale observations of the climate, learn more about it, and monitor its evolution.

“Within my field”, says Johannessen, “the microwave satellites are the main source for information, they are not dependent of a clear sky, day or night and have given us a continual stream of data from 1978, including the development of new and better sensors”.

The most valuable sensors for Johannessen's use are the altimetry and passive microwave sensors, placed in polar orbits. The best known are the European Envisat and the American IceSat. Altimeter-satellites like Topex Poseidon and Jason are also valuable,

but they do not polar orbit so they cannot give information from the high latitudes, while IceSat does not give continuous information from the sensor.

It was data from passive microwave sensors that caused Ola M. Johannessen and the Nansen Centre in 1995 to raise the alarm about shrinking ice coverage in the Arctic in a paper in *Nature*, something which unfortunately has continued in an accelerating scale ever since. In 2004 he and his colleagues published a paper in *Tellus* where they for the first time predicted that the ice will disappear during the summer in the Arctic Ocean before the end of this Century.

The inland ice of Greenland is another field Johannessen has been working with. Based on altimeter data from ERS and Envisat satellites it was found that the ice sheet over 1500 metres increased with around four centimetres every year during the 1992-2005 period, but one knows that the melting is relatively strong near the margin of the ice sheet. Calculations thus indicate a melting of around 100 Giga tons ice per year from the margin of the ice sheet. That provides an increase of the ocean global sea level of 0.3 mm a year. The global ocean sea level

increases with 3 mm yearly, 0.8 mm of this occurs due to melting of all other of the Earth's glaciers, the rest occurs from the ocean's expansion caused by increasing ocean's temperature due to global warming. If we assume that Greenland's ice sheet melts at the same rate as now, it will take about 20,000 years until the whole ice sheet is gone, resulting in a global sea level rise of 7 m. Johannessen says “that many overstate the importance of the melting of the Greenland ice sheet. Of course, all the ice may eventually melt sometime, but that will not happen in the foreseeable future”.

Another issue regarding the melting of the ice sheet is the increasing flow of freshwater from it. That may influence the Gulf Stream and in the worst case, reduce it. That was some of the background for a new expedition to the coast of Greenland in September-October last year, an expedition Johannessen was the

leader of. “The further evolution of the situation of the Greenland ice sheet and the drifting ice in the Arctic Ocean will have immense influence on the climate in our region, and also for rest of the world. This is something we will focus on to a great extent in the future, both at the Nansen Centre and part of the international climate research community”, he says.

Another interesting phenomenon Ola M. Johannessen has detected on one of the expeditions to the Arctic ice edge is the reasons for the high production of biological production along the ice edge. During an expedition north of Svalbard in 1977 they detected the upwelling of deeper water along the edge of the drifting polar ice. The phenomenon is well-known along the coastline, but for the first time detected along the ice edge of this expedition. Such upwelling in the summer time, with abundance of light, 24 hours a day, provides very high biological productivity along the ice edge.

*You were the initiator of founding the Nansen Centre in Bergen. Have the expectations been fulfilled?*

Yes, I think so. From the small staff twenty years ago, we are now about sixty persons from 14 nations including 15 PhD students. The participating in the different types of scientific projects, production of scientific papers and delivering of facts for the society from the centre during these years make us reasonable satisfied with the progress.

*Nansen Centre has expanded in Russia and in the Far East. What have these countries in common with Norway that can provide common ground for cooperation between the institutes?*

For Russia it is a simple answer since Russia has great experience within the same fields as Norway in the Arctic; they have a well-developed ice research community, and they give us possibilities to participate in research programmes in the Russian areas benefiting both countries and the international community. China and India have in addition to the large ocean areas, and interests connected to the higher latitudes through teleconnection of climate processes affecting the climate in our regions and vice versa.

*Increasingly more and new satellite sensors are launched, which ones do you have the most exceptions for?*

One of the new satellites we have great expectations for is GOCE (Gravity Field and Steady-State Ocean Circulation). The satellite will provide possibilities to calculate ocean current for the world oceans. The satellite I personally have the greatest exceptions for is Cryosat II altimeter satellite that will be launched in 2010. This satellite is enormously important for our research regarding the present situation and evolution on Greenland ice sheet and the ice cover in the Arctic Ocean. With new and better methods for detecting the ice surfaces, we will have better possibilities calculating the mass of ice in the Arctic region. The altimetry data from the satellite will be fundamental for our calculation of ice thickness of the sea ice, and for detection of the evolution of the height of the ice sheet on Greenland.

*Does Norway have the position within the field of ocean and ice research that the geographical position indicates?*

After so many years in this research field, I am very disappointed of the lack of money from the Norwegian Government to interpret the data from the Earth observation satellites. Norway participates in ESA's Earth Observation Programme with nearly 70 mill. NOK/year. However the amount of funds that is available to interpret this data from Norwegian Space Centre is only about 9,5 mill. NOK/year. For comparison, my community proposed 14 millions NOK per years twenty years ago. Without our centre's participating in international programmes we would not have had possibilities to have an institute like the Nansen centre today. I will say it is a scandal to use so little for data analysis when the nation spends so much money in the ESA-infrastructure program. To me it is incomprehensible that the politicians do not see this, in this time with climate in focus, the very valuable source for knowledge that the satellite sensors provide both for local, regional and global problems.

*Can the scientists play a more active*

*role in influencing the politicians and the rest of the society?*

Undoubtedly, we should and we are taking part in proposing scientific program both to the Norwegian Space Centre and the Research Council of Norway and we feel that it is their responsibility to influence the different ministries and politicians – but so far little luck. Our “job” should be to work with data and scientific problems to the benefit of the society, so my message to the Norwegian Government is:” Open your eyes and see how useful satellite observations are, then consider to give

the Norwegian satellite earth observation community a significant increase in funding, 30-40 mill. NOK/year will do it – ACTION”.

Ola M. Johannessen has no to intentions of resting on his laurels. Lately, he has been active in working with a merger of Bergen's different institutes within climate and environment to a common centre, the Nansen-Bjerknes Centre for Climate and Ocean Research. In addition, he has been elected, as one of the four members of the ESA's Science Policy's senior advisory body group for ESA's Director-General, Jean-Jacques Dordain.

We will undoubtedly hear more about ocean, ice and climate from Professor Ola M. Johannessen in the future as well.

### Prof. Ola M. Johannessen

**Nansen Environmental and Remote Sensing Center / Geophysical Institute, University of Bergen, Norway**

Ola M. Johannessen (OMJ) is at present the Founding Director of the Nansen Environmental and Remote Sensing Center (NERSC).

Since graduating from the University of Bergen (UoB) in 1965, with the degree Cand. Real. in oceanography, he has held different faculty and research positions at the University of Sao Paulo in Brazil, McGill University in Canada and the NATO Research Center in Italy, before returning to the University of Bergen in 1974 as a tenured Assistant Professor before he was promoted to a tenured Associate Professor in 1975 and to a tenured Professor in 1987

OMJ is presently involved in the following scientific fields: Global warming detection and prediction of the Arctic climate system, including sea ice, Greenland ice sheet and deep water formation and its impact on the thermohaline circulation; CO<sub>2</sub> uptake and CO<sub>2</sub> injection in the ocean, global change studies of marine ecosystems, marine pollution, harmful algae blooms, radioactive spreading in the ocean, Indian and Southern Ocean circulation studies and socio-economic impact studies of global change.

Through his career OMJ has been the author and co-author of 473 publications of which 7 are books and 138 are in referee journals, books and proceedings (e.g. 8 in Science – 1 in Nature). OMJ has been the supervisor for 30 Master and PhD students. Presently he supervise several PhD students at the different Nansen Centres in Norway, Russia, India and China. OMJ was a contributing author to the Third Assessment IPCC Report and has been an IPCC expert reviewer for the Fourth IPCC Assessment report.

He has received 8 awards for his research and leadership. He was the Laureate of the EU Descartes Prize in Earth Science in 2005 for leading the project: Climate and Environmental Change in the Arctic (CECA). Furthermore he received the Fridtjof Nansen Medal for Outstanding Research in 2007 which is an official Norwegian decoration.

In 1986 OMJ took the initiative to start the Nansen Environmental and Remote Sensing Center (NERSC) ([www.nersc.no](http://www.nersc.no)) in Bergen, and later contributed to establishing similar institutes in Russia, India and China At present the Nansen Group, with OMJ as the leader, consists of these four institutes, employing 150 persons including 45 PhD candidates.

OMJ is elected full member of the International Academy of Astronautics, the European Academy of Science and Arts, Finnish Academy of Science and Letters, the Norwegian Academy of Technical Sciences and the Norwegian Academy of Science and Letters.