Anglais

"What do we know exactly about Climate change? What will its impact be on the planet?
Over the past fifty years, scientists have accumulated a certain amount of knowledge about how marine ecosystems work and react to climate modifications.

It is now fundamental to more fully understand the current changes, and to try to predict what might happen over the next half-century.

Tackling this major issue is the goal of researchers from more than 20 nations, who have pooled their forces together through the EUR-OCEANS project, supported by the European Commission."

It is a fact that global change is occurring and that it will be amplified over the following decades. CO2 emissions in the atmosphere are rising and this is partly due to man. This has an immediate impact on the surface waters of the ocean which absorb 9 billion tons of carbon dioxide per year.

Many effects on the Earth's ecosystems still remain a mystery, so what is the consequence in the increase of CO2 absorption by the oceans.

Oceans have a complex chemistry. Take a look at a seawater sample taken from the West of Europe, Brittany for example.

So let's look at the same sample so this twofold increase of CO2 pressure is expected to occur between 2050 and 2100.

When CO2 increases, oceans become more acidic. However, the magnitude of this acidification seems small. So, is it relevant?

James Orr : *' We know that CO2 is increasing in the atmosphere…. We know this has a direct effect on the chemistry of the ocean because when CO2 reacts with water it makes an acid, and this reaction also causes other changes in ocean chemistry such as a decrease in carbonate ion concentration.'*

Carbonate ion concentration is an essential parameter.
Several marine organisms combine carbonate ions with calcium ions dissolved in the seawater to make their calcareous exoskeleton. This process is known as calcification.

This is how for example crustaceans and shellfish protect themselves or how certain algae build their external skeleton.
This is also the way, how after centuries, monumental biological structures such as the huge Australian coral barrier reef came to be, all through the labour of tiny marine organisms.

Unfortunately, coral reefs have been under threat for a long time now, mainly because of man though the expansion of cities, proliferation of industries and waste and pollution.

Nevertheless, in the last 20 years or so, a new danger has appeared as a direct

consequence of global warming : coral bleaching.

Jean Pierre Gattuso: *' For corals, the most recent important threat is the rising of atmospheric CO2. It is believed that coral calcification has already decreased by 10% since 1860 and that that decrease could still go on until the end of this century to reach up to 30% by 2100'.*

Coral reefs might be threatened by ocean acidification. But there are also other organisms vulnerable to chemical changes in the oceans. Let's take the coccolithophores for example.

At certain periods of the year, particularly in Spring in the North Atlantic, these microalgae are able to multiply thanks to the positive and combined effects of light, temperature and nutrients.

Could the changes in the chemical parameters of the ocean have an impact on this phenomenon?"

Jean Pierre Gattuso : '*You can see that at normal CO2 pressure, coccolithophores are totally normal, with the coccolithes in the periphery of the cell while when the partial pressure is increased, there are missing coccolithes and the remaining ones are damaged. Their ornamentation is irregular and malformed.What we see in the screen and appears whitish here, is the light reflected by the calcium carbonate during the bloom period of these microalgae.*
If CO2 increases, we think that the development of these blooms will become more difficult. Their extension will be reduced, and thus the amount of calcium carbonate that will be exported to the deep ocean will also be smaller. And this might have feedback consequences on the climate!'

Another fact in the ocean's chemistry is that CO2 dilutes more easily in cold seawater than in warm. Hence in the polar regions, the effect of ocean acidification is swifter and stronger.

Let's have a look at the seas located at the poles of our Planet and let's focus on a tiny snail only a mere few millimetres long: the Pteropods

James Orr : ' *These organisms lie at the base of the food chain, they are eaten by many zooplankton, many other small organisms in the ocean, but they are also eaten by many commercially important fish such as cod, mackerel, herring and even juvenile salmon in the North Pacific. And additionally they are even eaten by whales, so in some years they are so important in the southern ocean that they outnumber the krill."*

However, this little winged snail has a fragile calcereous external shell that contributes to its protection and buoyancy. If the seawater becomes corrosive, we can imagine that these organisms will have a very hard time surviving.

James Orr : '*So if you are really talking about a healthy organism, one of the measures now been used are the numbers of the pteropods. If they go away, we can say that the health of the ocean is certainly being degraded'.*

'*If we use numerical models to try to understand how these changes will occur in the future, we can already see that in about 20 years, the first waters, the colder waters on the planet among them in the Weddel Sea, in Antarctica, will already become*

corrosive to aragonite one of the key calcium carbonate minerals that organisms use; pteropods for example. And within 50 to 100 years we expect the entire Southern Ocean to become corrosive to aragonite'.

So today, there is no doubt that the ocean acidification trend will continue. Some organisms might find survival really difficult. If they become extinct. We don't know what the effects will be on the balance of their ecosystem.

Also, calcification of marine organisms will decrease. Will these organisms be able to adapt in time to these changes?

Jean Pierre Gattuso : '*CO2 does not have frontiers, it is emitted by one country but it is spread into the whole atmosphere. Hence, it is really necessary to have protocols for reducing the emissions as soon as possible, because CO2 have already greatly increased'.*

James Orr : '*On the average, on the planet right now 4 Kg of CO2 per person per day is going into the ocean. Each of us is responsible for that. Among us who live in the more developed countries are responsible for even much more than that.*
So it's a big problem and it's getting worse all the time. So we have to try and do something about it we can't wait any longer. The longer we wait the more difficult it become to trying to resolve this problem'.