

Corals provide evidence of changes to oceanic currents through Global Warming

January 4, 2011 | Andri Bryner

Topics: Ecosystems | Biodiversity

Examination of deep sea corals reveals that there have been drastic changes to oceanic currents in the western North Atlantic since the 1970s. The influence of the cold water Labrador Current, which is in periodic interchange with the warm Gulf Stream, has been decreasing continually since the 1970s. Occurring at the same time as Global Warming this phenomenon is unique in the past 2000 years. These results are reported by researchers from the University of Basel and Eawag in the current edition of the scientific journal «PNAS».

One of the oldest known weather systems in the world is the North Atlantic Oscillation (NAO), the periodic variation of atmospheric pressure difference between the Azores and Iceland. It dictates not only whether the winters in Europe will be cold and dry or wet and warm, but also influences the oceanic currents in the North Atlantic. On the continental shelf off Nova Scotia, the NAO seems to control the interaction between different water masses. During positive phases, the oceanography of the north-west American continental shelf is dictated by a relatively warm water mass at 10 degrees Celsius which is salty and nutrient-rich, originating from the Gulf Stream. If the NAO is in a negative phase, the Labrador Current is dominant, a relatively cold water mass at 6 degrees Celsius, which is relatively nutrient-poor scarce and originates from sub-polar regions.

Using new geochemical methods, an international team of researchers including the biogeochemists Prof. Moritz Lehmann (University of Basel) and Dr. Carsten Schubert (Eawag – Swiss Federal Institute of Aquatic Science and Technology) were able to prove that a drastic change to a «warm water mode» occurred in the western North Atlantic in the early 1970s. This change, the timing of which coincides with and may be directly related to Global Warming, is unique in the last 2000 years.

Corals record climate data

The researchers made use of the fact that water masses carry different nitrogen isotopic signatures (different ratios of the stable nitrogen isotopes ^{15}N und ^{14}N) depending on their origins. These signals are then recorded in the biomass of deep sea corals hundreds of metres below the surface that feed on sinking organic particles from above. The deep sea corals thus allow a reconstruction of the oceanic current ratios over the last few decades. An exact dating of the individual samples is possible due to the corals' production of easily identifiable annual growth rings. The researchers were able to show a clear reduction in the $^{15}\text{N}/^{14}\text{N}$ ratio since 1970 which indicates that the role of the cold Labrador Current, with a higher $^{15}\text{N}/^{14}\text{N}$ ratio is becoming less important.

Possible alternative bio-ecological or geochemical causes for such a change in the stable isotope ratio were able to be excluded by the researchers using component-specific nitrogen analyses of the corals. Depending on the food chain structure, changes occur in the $^{15}\text{N}/^{14}\text{N}$ ratio of specific amino acids in the corals' individual annual growth rings. The nitrogen isotope signatures of the amino acids show that the food chain effect did not play a significant role at least since the 1970s.

Global Warming with consequences

Isotopic analysis of fossil deep sea corals from the same region confirms that the nitrogen isotope ratios and thus the oceanic current situation have remained practically unchanged over the past 2000

years. This indicates that the oceanographic change in oceanic currents of this scale, which has been occurring since the 1970s, is a unique occurrence within the past 2000 years.

The researchers suspect there is a direct connection between the changes in the oceanic currents in the North Atlantic and Global Warming primarily caused by human activities.

Contact



Andri Bryner

Media officer

Tel. +41 58 765 5104

andri.bryner@eawag.ch

<https://www.eawag.ch/en/info/portal/news/news-archive/archive-detail/corals-provide-evidence-of-changes-to-oceanic-currents-through-global-warming>