

6th Global summit on Climate Change

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Climate change can lead to global anoxia and mass extinctions by disrupting oxygen production in oceans

A lot have been said about negative consequences of the global warming. However, the worst kind of catastrophe that could affect most of the living being on Earth may have been overlooked. We consider the effect of global warming on the coupled plankton-oxygen dynamics in the ocean. The net oxygen production by phytoplankton is known to depend on the water temperature and hence can be disrupted by warming. We address this issue theoretically by considering a family of novel mathematical models of the plankton-oxygen system. We show that sustainable oxygen production by phytoplankton is only possible if the net oxygen production rate is within a certain intermediate range (i.e. not too low and not too high). This appears to be in agreement with some available field data. We show that a sufficiently large increase in the water temperature is likely to push the system out of the safe range, which may result in a global oxygen depletion, which would likely result in mass mortality of animals and humans. We then discuss the temporal scale at which the oxygen depletion can occur and show that this catastrophe can be especially dangerous because it can be preceded by long periods of apparently stable, “safe” dynamics, which then experiences a fast transition to extinction. We also show that a similar type of ecological catastrophe may have happened in the past, in particular resulting in some of the mass extinction events in Earth paleo-history.

Biography

Sergei Petrovskii graduated as a Theoretical Physicist in 1983 from Moscow Engineering Physics Institute. He got his PhD in Applied Mathematics and Theoretical Physics from the same institution in 1990. He worked as a case sensitive in Shirshov Institute of Oceanology (Moscow) in 1991-2006. He moved to the UK and got a faculty position in the University of Leicester in 2006. From 2012, he holds a post of a chair in Applied Mathematics. He published four books and more than 100 papers in peer-reviewed journals. He is the Editor-in-Chief of Ecological Complexity (Elsevier) and on the case sensitive of two other journals. He is also the Founder and Scientific Coordinator of the MPDE conference series (Models in Population Dynamics and Ecology).

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