Geophysical Research Abstracts
Vol. 19, EGU2017-14031, 2017
EGU General Assembly 2017

Variability of dissolved oxygen over the last millennium and the 21st century in CESM

Angélique Hameau (1,2), Fortunat Joos (1,2), Juliette Mignot (3), Kathrin Keller (1,2)

(1) University of Bern, Climate and Environmental Physics, Bern, Switzerland (hameau@climate.unibe.ch), (2) Oeschger Centre for Climate Change Research, (3) LOCEAN Laboratory, Sorbonne Universités, Paris, France

The earth system models simulate a depletion of the oxygen content in the ocean under global warming conditions (Cocco et al. 2012, Frölicher et al. 2009). The response to external forcing and mechanism underlying this evolution are not completely understood. Physical and biogeochemical processes are involved and tangled up to each other leading to a decrease of the global mean concentration of O_2 in the ocean with the increase of the ocean temperature. This result is supported by experimental and observational studies in Atlantic and Pacific oceans (Stramma et al. 2008, Brandt et al. 2010).
Here, we study the evolution of dissolved oxygen in a climate simulation of the Community Earth System Model (CESM) covering the last millennium and the 21st century. This long period allows us to identify the natural variability of the climate in this system, and therefore analyse the time of emergence (ToE) of the anthropogenic signal under the RCP8.5 scenario. Based on Keller et al. 2014, the time of emergence is defined as the point in time when the trend signal reaches twice the standard deviation of the signal during the preindustrial period (1000 years). The ToE of oxygen and of temperature present an offset. We show that the anthropogenic emissions are seen in a first hand by the oxygen and only then by the temperature.
We also look at the OMZ response. The oxygen minimum zones result from a combination of weak ventilation and sustained respiration by the microorgamisms. With a global decrease of the oceanic oxygen content, the OMZ may therefore expand impacting the environment of marine species. But this statement is questioned by Deutsch et al 2014, who relates the variations of Pacific OMZ to the variations of the tropical Walker circulation. The CESM climate model predicts an expansion of the oxygen low zones and the emergence of new ones over the last century. Magnitude and timescales of these responses will be discussed and compared to natural variability.