Variability of North Sea pH and CO2 in response to North Atlantic Oscillation forcing

[1] High biological activity causes a distinct seasonality of surface water pH in the North Sea, which is a strong sink for atmospheric CO2 via an effective shelf pump. The intimate connection between the North Sea and the North Atlantic Ocean suggests that the variability of the CO2 system of the North Atlantic Ocean may, in part, be responsible for the observed variability of pH and CO2 in the North Sea. In this work, we demonstrate the role of the North Atlantic Oscillation (NAO), the dominant climate mode for the North Atlantic, in governing this variability. Based on three extensive observational records covering the relevant levels of the NAO index, we provide evidence that the North Sea pH and CO2 system strongly responds to external and internal expressions of the NAO. Under positive NAO, the higher rates of inflow of water from the North Atlantic Ocean and the Baltic outflow lead to a strengthened north-south biogeochemical divide. The limited mixing between the north and south leads to a steeper gradient in pH and partial pressure of CO2 (pCO2) between the two regions in the productive period. This is exacerbated further when coinciding with higher sea surface temperature, which concentrates the net community production in the north through shallower stratification. These effects can be obscured by changing properties of the constituent North Sea water masses, which are also influenced by NAO. Our results highlight the importance of examining interannual trends in the North Sea CO2 system with consideration of the NAO state.

General information
Publication status: Published
Organisations: National Institute of Aquatic Resources, Centre for Ocean Life
Pages: 1584-1592
Publication date: 2013
Peer-reviewed: Yes

Publication information
Journal: Journal of Geophysical Research: Space Physics
Volume: 118
Issue number: 4
ISSN (Print): 2169-9380
Ratings:
Scopus rating (2013): CiteScore 3.38 SJR 3.088 SNIP 1.806
Web of Science (2013): Impact factor 3.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Original language: English
Keywords: Carbon, North Sea, NAO, pH
DOIs:
10.1002/2013JG002306
Source: dtu
Source ID: n:oai:DTIC-ART:swets/430327329::37750
Research output: Contribution to journal › Journal article – Annual report year: 2013 › Research › peer-review