**Proof**



**CONTROL ID:** 1798367

**TITLE:** ACIDIFICATION OF THE SHALLOW ARCTIC SEAS AS BIOGEOCHEMICAL CONSEQUENCES OF PERMAFROST DEGRADATION

**ABSTRACT BODY:** There is increasing concern about consequences of ocean acidification from the increasing atmospheric carbon dioxide driven shifts toward lower seawater pH The largest pH changes in this century are anticipated in the surface waters of the Arctic ocean (Orr et al., 2005; Steinacher et al., 2009). Concurrently, aragonite undersaturation might occur locally and become widespread as atmospheric CO2 increases to more than 450ppm (Olafsson et al., 2009). However, the ocean acidification effects induced by increasing Arctic land-shelf export of fluvial and erosional organic carbon (OC) and its oxidation are unknown.

Here we show that massive net redistribution of old OC from thawing permafrost to the East-Siberian Arctic Seas (ESAS) and its consequent remineralization drives acidification over the ESAS which represents the broadest and shallowest shelf of the World Ocean. From top to the bottom the ESAS waters were observed to be undersaturated with respect to aragonite and calcite, and thus potentially corrosive to CaCO3 for the shelf sediments and benthic ecosystems. Our multiyear all-seasonal results (1999-2011) demonstrate how the net ecosystem metabolism of the Siberian shelves, which is the net balance of autotrophic (photosynthesis and net community production) and heterotrophic (respiration and remineralization) processes, is likely to function as the heterotrophic dominated ecosystem.

CO2 outgassing from the East Siberian Arctic Shelf (ESAS) is quantified using multi-year eddy-correlation flux measurements. It is shown that the ESAS is currently a source of atmospheric CO2. A continuing warming adds more terrestrial OC to the Arctic Shelf Seas, which increases pCO2, as the same time as decreased transparency lowers primary production, which reduce consumption of CO2 (and increase acidification effects). This effect results in a positive feedback by outgassing CO2 over the Siberian Shelf , which comprises one half of the entire shelf area.

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**CURRENT SECTION/FOCUS GROUP:** Global Environmental Change (GC)

**CURRENT SESSION:** GC049. Environmental, Socio-Economic and Climatic Changes in Northern Eurasia and their Feedbacks to the Global Earth System

**INDEX TERMS:** 0428 BIOGEOSCIENCES Carbon cycling, 1637 GLOBAL CHANGE Regional climate change, 0475 BIOGEOSCIENCES Permafrost, cryosphere, and high-latitude processes , 4207 OCEANOGRAPHY: GENERAL Arctic and Antarctic oceanography.