

O41.3**Estimating net community production in a macrotidal estuary using high-frequency dissolved oxygen measurements**

Africa Gomez-Castillo, Anouska Pantou, Duncan Purdie

University of Southampton, UK

Abstract

Coastal zones play a major role in Earth's biogeochemical processes by acting as a natural convergence zone for air, sea and land components. In estuarine environments, the concentration of dissolved oxygen (DO) is a key indicator of water quality due to its direct relation with biological and environmental processes. An accurate estimate of the O₂ flux at the air-sea interface can be achieved through the open water diel oxygen method, an integrative technique to calculate primary production from in situ oxygen mass balance through continuous measurements of DO. A year-long high-frequency (15 minute) environmental data time series obtained from a Southampton Water mid-estuary moored data buoy, provided near surface measurements of temperature, salinity, chlorophyll, DO, pH and turbidity throughout 2019. Changes in dissolved oxygen were used to estimate daily integrated gross primary production (GPP), ecosystem respiration (ER) and net community production (NCP), also known as net ecosystem metabolism. An annual mean NCP for Southampton Water of $-0.91 \text{ mmol O}_2 \text{ m}^{-2} \text{ d}^{-1}$ showed a more or less overall balance between GPP and ER, leaning slightly towards a heterotrophic state driven by inputs of external organic matter with O₂ being absorbed and CO₂ released to the atmosphere. However, seasonal productivity events shifted this state for a few days in spring and late summer to net autotrophic conditions, with a longer sustained high productivity period in mid-summer during a high biomass *Mesodinium rubrum* bloom. This change meant that for short periods, the mid estuary ecosystem was a strong CO₂ sink and a source of organic matter and dissolved O₂. The results of this study represent a valuable input to the understanding of key factors influencing seasonal patterns in net community production in estuarine ecosystems and a contribution to air-sea O₂ and CO₂ flux description in coastal zones.

Keywords

Net community production, Dissolved oxygen, Phytoplankton blooms, High-frequency data