Methane Dynamics in the Belgian Coastal Zone

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Introduction

Methane (CH₄) is the second most important greenhouse gas (GHG) after CO₂, accounting for 32% of the anthropogenic global radiative forcing by well-mixed GHGs in 2011 relative to 1750. Yet, there remains an important uncertainty on estimates of the sources and sinks of CH₄. The open ocean is a very modest source of CH₄ to the atmosphere compared to other natural and anthropogenic CH₄ emissions. Coastal regions are more intense sources of CH₄ to the atmosphere than open oceanic waters. The high CH₄ concentrations in surface waters of continental shelves are due to direct CH₄ inputs from estuaries and from sediments where methanogenesis is sustained by high organic matter sedimentation. Natural gas seeps from continental shelves contribute additionally.

Study Area

The Belgian coastal zone (BCZ) is a coastal area with multiple possible sources of CH₄ such as from rivers and gassy sediments. The BCZ is also a site of important organic matter sedimentation and accumulation unlike the rest of the North Sea.

Datasets

We report a dataset of CH₄ concentrations in surface waters of the Belgian coastal zone (BCZ) in spring, summer and fall 2010 and 2011. Measurements were carried out by gas chromatography in the frame of the BELSPO BECOUNOUR-II project. Data were recovered, quality checked and formatted uniformly in the frame of the BELSPO project “4 decades of Belgian marine monitoring” (4Demon).

Conclusions

Very high CH₄ concentrations (up to 1,100 nmol L⁻¹) were observed in surface waters of the BCZ compared to open oceanic conditions (<5 nmol L⁻¹) due to release of CH₄ from sediments (in-situ production and leakage from gasy sediments) and the well-mixed water column that allows an efficient transfer of CH₄ from bottom waters to surface waters.

Our data suggest that further warming of surface waters could increase CH₄ emissions and provide a positive feedback on warming climate. This feedback will be expected to be acute in shallow gassy areas such as the BCZ since they are natural hotspots of CH₄ emission, and the well-mixed water column will allow an efficient propagation of additional heat to the sediment that will be buffered by seasonal thermal stratification in deeper seep areas. The increase of temperature will stimulate the biogenic CH₄ production, as well as, decrease Henry’s constant promoting bubbling from sediments.

Further reading

Borges AV, W Champenois, N Gypen, B DeLille, J Harlay (2016) Massive marine methane emissions from near-shore shallow coastal areas, Scientific Reports, 6:27908, doi:10.1038/srep27908
http://www.nature.com/articles/srep27908