

## **Methane distributions and sea-to-air fluxes in the South China Sea and the West Philippines Sea**

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### **Abstract content**

We collected 700 water samples in the South China Sea (SCS) and 300 water samples in the West Philippines Sea (WPS), during 8 cruises from August 2003 to July 2007 in order to determine methane (CH<sub>4</sub>) distributions from surface to depths of 4250 m.

The surface CH<sub>4</sub> concentrations were above atmospheric equilibrium, both in the SCS and the WPS, with an average concentration of 4.5±3.6 and 3.0±1.2 nM, respectively. The sea-to-air fluxes were computed, showing that the SCS emits CH<sub>4</sub> at a rate of 8.6 μmol m<sup>-2</sup> d<sup>-1</sup> and the WPS at a rate of 4.9 μmol m<sup>-2</sup> d<sup>-1</sup>. In the SCS, the CH<sub>4</sub> emissions were higher over the continental shelf (11.0 μmol m<sup>-2</sup> d<sup>-1</sup>) than over the deep ocean (6.1 μmol m<sup>-2</sup> d<sup>-1</sup>), owing to higher productivity and closer coupling with the sediments in the continental shelf. The SCS emitted 30.1\*10<sup>6</sup> mol d<sup>-1</sup> CH<sub>4</sub> to the atmosphere and exported 1.88\*10<sup>6</sup> mol d<sup>-1</sup> CH<sub>4</sub> to the WPS during the wet season.

Both the concentrations of CH<sub>4</sub> and chlorophyll *a* were higher in the 200m surface layer of the WPS, however, not correlated unlike recent reports suggesting the occurrence of CH<sub>4</sub> production in surface oxic waters directly related to phytoplankton activity. CH<sub>4</sub> concentrations generally decrease with depth below the euphotic zone but remain constant below 1,000 m, both in the SCS and the WPS. Some high CH<sub>4</sub> values were observed at mid-depths in the SCS, and were most likely attributed to the anoxic generation of CH<sub>4</sub> or the release of CH<sub>4</sub> from sediments, gas hydrates or gas seepage.

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