Interfacial Chemistry of SO_2 with Sea Surface Microlayer as An Alternative Source of Oxygenated Volatile Organic Compounds in the Marine Boundary Layer

Sasho Gligorovski

Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, China

Author list (excluding presenting author)

Yiqun Wang, Ruqian Miao, Qi Chen

Abstract

Sea surface microlayer (SML) is defined as the most upper layer of the ocean surface water and represents one of the largest active interfaces on earth which provides a unique medium for interface chemical processing. In this study, we promote a new concept showing that chemical interaction between gaseous SO_2 and authentic SML collected from 10 different locations in South China Sea leads to the formation of a number of volatile organic compounds (VOCs), especially oxygenated VOCs (OVOCs) which could be an important but overlooked source of airborne pollutants in marine boundary layer (MBL). For this purpose, we performed real-time measurements of the VOCs formed in dark and under light irradiation (300 nm < λ < 700 nm) by a Secondary Electrospray Ionization High-Resolution Mass Spectrometry (SESI-HRMS) coupled to a reactor. A strong enhancement in VOCs production was observed upon SO_2 oxidation chemistry at authentic SML samples under actinic illumination. Namely 33 common product compounds were identified in dark, whereas 144 common product compounds were identified in light, among all ten sampling sites. We implemented daytime marine sources of selected VOCs species into a nested-grid chemical transport model to evaluate the potential contribution of SO_2 oxidation on SML to sea-surface VOC concentrations based on the observed production rates of these species in light irradiation experiments. The model data showed that surface concentration of OVOCs increased by about 200%, especially in the Bohai Sea and Yellow Sea where the wind speeds were low highlighting the importance of the reaction between SO_2 and sea surface microlayer.

Early Career Scientist

NO, I am not an early career scientist.