Air-Sea Exchange of Volatile Organic Compounds (VOCs): A Missing Link between the Sea Surface Carbon Pool and the Reactive Carbon in the Atmosphere

Dr. Siyuan Wang
（王思源博士）

Atmospheric Chemistry Observations and Modeling
National Center for Atmospheric Research

Volatile organic compounds (VOCs) affect the oxidative capacity of the earth's atmosphere, which largely controls the removal of short-lived climate forcers, such as methane and ozone. The oxidation of VOCs also leads to the formation of organic aerosols, which is highly uncertain but holds the potential to partially offset the warming effect of carbon dioxide (CO2). Airborne observations of VOCs in the vastness of remote troposphere, especially oxygenated VOCs (OVOCs), often remain unexplained by chemistry-climate models. Studies have proposed that the ocean plays a key role in the budget of OVOCs in the atmosphere, especially in remote regions, yet the air-sea exchange of OVOCs remains poorly understood. Ocean is the biggest organic carbon pool on the surface of earth, and dissolved organic materials (DOM) is known to undergo photolysis and producing a wide spectrum of compounds in the seawater, from very long-lived CO2, CO, to short-lived VOCs, even radicals.

In this work, we present an online air-sea exchange framework newly developed for the Community Earth System Model (CESM). The air-sea exchange of a number of species, such as acetaldehyde, acetone, and organohalogens, etc, has been examined using airborne measurements obtained during the recent NASA-funded, multi-year, nearly pole-to-pole airborne campaign, Atomospheric Tomography Mission (ATom). We show that the bottom-up air-sea exchange module greatly improves the model performance in the marine boundary layer, yet in the remote free troposphere a substantial fraction of observations OVOCs still remain unexplained. Our analysis suggests that a significant fraction of the reactive carbon burden in the troposphere is not captured by chemistry-climate models. We hypothesis that there is a missing link between the reactive carbon pool in the atmosphere and the ocean biogeochemistry. The impacts of ocean-derived reactive carbon on the short-lived climate forcers warrants further investigation.

5 October 2018

11:00 a.m.

Room 705, 7/F,
Mong Man Wai Building

EARTH SYSTEM SCIENCE PROGRAMME

Enquires: 3943 9624 essc@cuhk.edu.hk