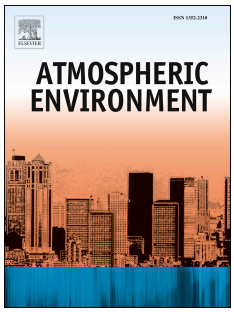
Accepted Manuscript



A modeling study of the influence of sea salt on inorganic aerosol concentration, size distribution, and deposition in the western Pacific Ocean

Li Jiawei, Zhiwei Han, Xiaohong Yao

PII: S1352-2310(18)30413-8

DOI: 10.1016/j.atmosenv.2018.06.030

Reference: AEA 16088

To appear in: *Atmospheric Environment*

Received Date: 2 February 2018

Revised Date: 13 May 2018

Accepted Date: 19 June 2018

Please cite this article as: Jiawei, L., Han, Z., Yao, X., A modeling study of the influence of sea salt on inorganic aerosol concentration, size distribution, and deposition in the western Pacific Ocean, *Atmospheric Environment* (2018), doi: 10.1016/j.atmosenv.2018.06.030.

A modeling study of the influence of sea salt on inorganic aerosol concentration, size distribution, and deposition in the western Pacific Ocean

Li Jiawei[1], Zhiwei Han[1,2], Xiaohong Yao[3]

[1]CAS Key Laboratory of Regional Climate-Environment for Temperate East Asia (RCE-TEA), Institute of Atmospheric Physics, Chinese Academy of Sciences, Beijing 100029, China
[2]University of Chinese Academy of Sciences, Beijing 100049, China
[3]Key Lab of Marine Environmental Science and Ecology, Ministry of Education, Ocean University of China, Qingdao, 266100, China

Correspondence to: Zhiwei Han (hzw@mail.iap.ac.cn)

Abstract. A regional air quality model system (RAQMS) was developed by coupling the treatment of heterogeneous reactions between sea salt aerosols (SSAs) and trace gases and applied to the investigation of aerosol properties and evolutionary features in the western Pacific Ocean in the spring of 2014. Model results for meteorological variables, PM concentrations, and size-resolved water soluble inorganic aerosol (WSIA) concentrations were compared and analyzed with a variety of observations from in situ measurements and the research cruise *Dongfanghong II*. Model validation demonstrated that the model can simulate the spatial-temporal distribution and size distribution of aerosol inorganic components in the marine atmosphere over East Asia, and the inclusion of heterogeneous reactions on SSAs apparently improved the model simulation for WSIA concentration, especially for aerosol size distribution. In the western Pacific Ocean, the non-sea salt SO_4^{2-} and NO_3^- formed on SSAs accounted for up to 30% and 90% of surface SO_4^{2-} and NO_3^- concentrations on average, respectively. The atmospheric depositions of total inorganic sulfur and nitrogen were estimated to be 13184×10^3 kgS/d and 10728×10^3 kgN/d, respectively. Wet deposition was the dominant removal pathway, which accounted for 75% and 68% of sulfur and nitrogen depositions, respectively. The deposition of fine-mode SO_4^{2-} exceeded that of coarse-mode SO_4^{2-}, whereas the deposition of coarse-mode NO_3^- was comparable to that of fine-mode NO_3^-. The non-sea salt SO_4^{2-} and NO_3^- formed on SSAs contributed 16% and 9% of total sulfur and nitrogen