Geophysical Research Abstracts
Vol. 13, EGU2011-2830-1, 2011
EGU General Assembly 2011

Error estimations of dry deposition velocities of air pollutants using 4-m depth temperature under common assumptions

Yung-Yao Lan (1), Ben-Jei Tsuang (1), Noel Keenlyside (2), and Sheng Fong Lin (3)

(1) Department of Environmental Engineering, National Chung Hsing University, Taichung 40227, Taiwan (yylan887@gmail.com), (2) Leibniz-Institut fuer Meereswissenschaften Duesternbrooker Weg 20, D-24105 Kiel, Germany, (3) Green Energy & Environment Laboratories, Industrial Technology Research Institute, Hsinchu 31040 Taiwan

It is well known that skin sea surface temperature (SSST) is different from bulk sea surface temperature (BSST) by a few tenths of a degree Celsius. However, the extent of the error associated with dry deposition (or uptake) estimation by using BSST is not well known. This study tries to conduct such an evaluation using the on-board observation data over the South China Sea in the summers of 2004 and 2006. It was found that when a warm layer occurred, the deposition velocities using BSST were underestimated within the range of 0.8 – 4.3 %, and the absorbed sea surface heat flux was overestimated by 21 W m-2. In contrast, under cool-skin only conditions, the deposition velocities using BSST were overestimated within the range of 0.5 – 2.0 %, varying with pollutants and the absorbed sea surface heat flux was underestimated also by 21 W m-2. Scale analysis shows that for a slightly soluble gas (e.g., NO2, NO and CO), the error in the solubility estimation using BSST is the major source of the error in dry deposition estimation. For highly soluble gas (e.g., SO2), the error in the estimation of turbulent heat fluxes and, consequently, aerodynamic resistance and gas-phase film resistance using BSST is the major source of the total error. In contrast, for medium soluble gas (e.g., O3 and CO2) both the errors from the estimations of the solubility and aerodynamic resistance are important. In addition, deposition estimations by using various assumptions are discussed. The largest uncertainty is from the parameterizations for chemical enhancement factors, followed by various parameterizations for gas-transfer velocity, followed by neutral-atmosphere assumption, followed by using BSST as SST, and then followed by constant pH value assumption.

Keywords: South China Sea; deposition resistance; Henry constant; chemical enhancement factor; dry deposition; warm layer; cool skin