Distribution and Air-Sea Exchange Fluxes of CO_2 in the East China Sea

C.-M. Tseng[1]*, G.-C. Gong[2], K.-K. Liu[3]

[1]* National Center for Ocean Research, National Taiwan University, Taiwan, ROC; ph. 886-2-23636450-309; fax 886-2-23644049; e-mail:cmtseng@ncor.ntu.edu.tw;

[2.] Institute of Marine Environmental Chemistry and Ecology, National Taiwan Ocean University, Keelung, Taiwan ph. 886-2-24622192 Email: gcgong@mail.ntou.edu.tw

[3] Institute of Hydrological Sciences, National Central University, Jungli, Taiwan, ROC; ph. 886-3-4222874; fax 886-3-4222894; e-mail: kkliu@cc.ncu.edu.tw)

This is the first report of pCO_2 distribution in the East China Sea (ECS) obtained by underway survey, which was undertaken on 4 cruises between June 2003 and July 2004. Sea surface pCO_2 distribution, for instance, in June 2003 showed significant spatial and temporal variation, ranging from 109 to 435 µatm with an average of 297±57 (n=1078). Low pCO_2 levels were found in low salinity coastal waters off Mainland China. High nutrient loadings from Changjiang and Mingjiang Rivers appeared to be the most important factor contributing to the drawdown of the coastal seawater pCO_2 values biogeochemically. Air pCO2 levels remained fairly constant with an average of 366±2 µatm. The pCO_2 concentration gradient (i.e. delta pCO_2 = pCO_2 water - pCO_2 air) ranged from −258 µatm to 67 µatm with an average of −69 ± 57 µatm. Most samples (90% of total) were undersaturated relative to the atmospheric CO_2 concentration in June, 2003. Air-sea CO_2 invasion flux was estimated to be 1.6±1.0 mol m^{-2} y^{-1}, based on Winninkhof's (1992) empirical equation. Overall, there will be an annual CO_2 uptake of 0.02 Gt C by the ECS, if ECS area is taken to be 1.25 x 10^{12} m^2. The result is quite similar to the value of 0.03 Gt C/yr estimated by Peng et al. (1999) based on the data collected in the spring. It further indicates that the shelf regions could be significant CO_2 sinks. To have a better understanding and quantification of the ECS as a sink of CO_2, more investigations are needed for all other seasons of the year to obtain a representative estimate.