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*Supplement of*

**Synthesis of observed air–sea CO<sub>2</sub> exchange fluxes in the river-dominated East China Sea and improved estimates of annual and seasonal net mean fluxes**

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## Supplementary Online Materials

### 1. The distribution of the field underway $p\text{CO}_2$ in summer

Nine summer cruises for direct underway  $p\text{CO}_{2w}$  with hydrographic measurements were carried out in the East China Sea (ECS) shelf (25-32 °N and 120-128 °E) between 2003 and 2011 on board R/V *Ocean Researcher-I*.

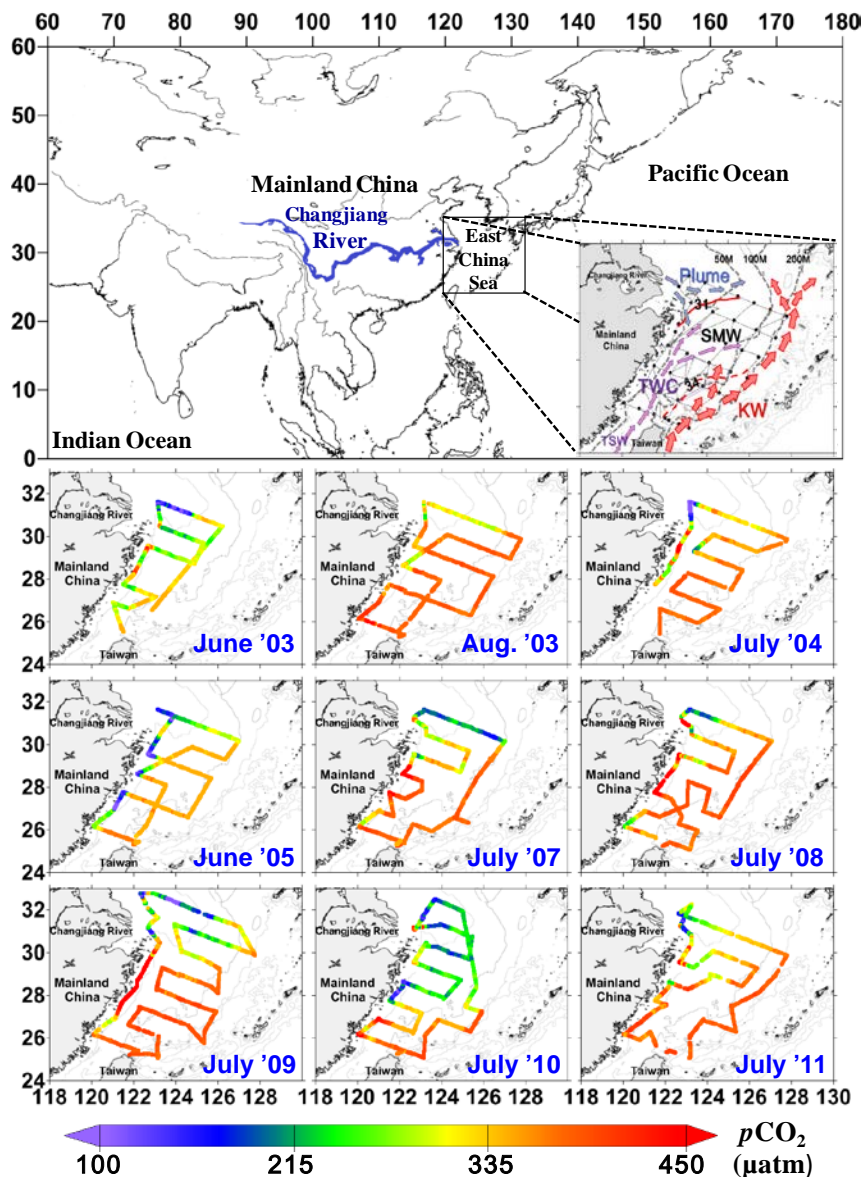


Fig. S1. Maps of the study areas in the ECS showing surface  $p\text{CO}_2$  distribution and cruise track with circulation system collected in summer between 2003 and 2011.

## 2. Model output reliability

The empirical algorithm for calculating  $p\text{CO}_{2w}$  as a function of SST and CRD successfully simulated the annual cycles of  $p\text{CO}_{2w}$ ,  $\delta p\text{CO}_2$  and the  $\text{CO}_2$  flux, which are in excellent agreement with observations (Fig. S2). Overall speaking, the modeled  $p\text{CO}_{2w}$  linearly correlate well with the observed areal mean as shown in Fig. S2. It indicates the performance of the empirical algorithm applied to the model domains (S and B) and cruise survey area of the ECS is well confirmed. Further, the model uncertainty estimated by the mean  $p\text{CO}_2$  deviation between the model results and observations from January to November was small about  $-0.7 \pm 13.9 \mu\text{atm}$ .

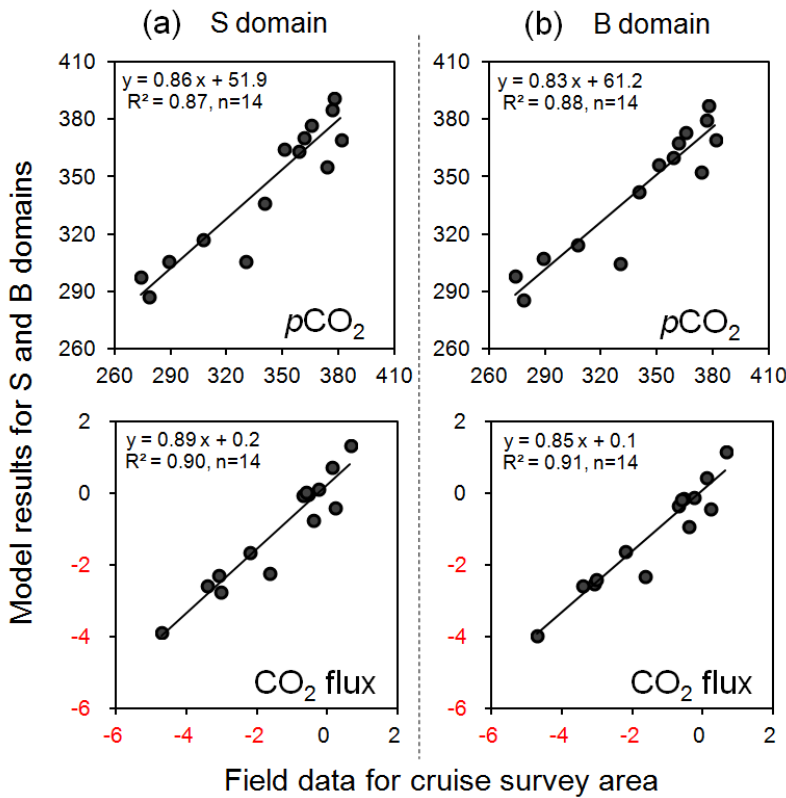


Fig. S2 Upper panels: Relationships between modeled areal mean  $p\text{CO}_{2w}$  and mean values from field observations and their linear regression results for regions (a) S and (b) B; Lower panels: the same plots except for sea-to-air  $\text{CO}_2$  fluxes.