**Boundary Conditions:**

**Upstream Boundary Condition at eight outlets:**

In our manuscript, we have considered the large spatial-temporal variance of DIC and TA at the eight outlets. Firstly, We collected the data observed in PRE in four season during 2006 to 2007. Then we used the method presented in Guo et al. (2008) to get the DIC-S and TA-S relationship in the west four outlets and east four outlets, respectively.

we selected surface data while the observing station is inside the 20m isobath to be used in the method. As the reviewer suggested, we detailed our boundary condition during cruise period at eight outlets as follow:

Table S1: Effective value of DIC and TA

|  |  |  |
| --- | --- | --- |
| **Time Period** | **West Four Outlets** | **East Four Outlets** |
| **7/24 2006 to  8/30 2006** | TA = 24.385\*Salinity+1244.771 | TA = 33.486\*Salinity+1080.942 |
| DIC = 14.995\* Salinity+1382.098 | DIC = 21.691\* Salinity+1278.058 |
| **12/15 2006 to  1/17 2007** | TA = 5.109\*Salinity+2026.555 | TA = 6.057\*Salinity+2016.834 |
| DIC = -5.155\*Salinity+2165.417 | DIC = -8.621\*Salinity+2144.092 |
| **4/ 1 2007 to  4/30 2007** | TA = 20.692\*Salinity+1660.503 | TA = 21.8\*Salinity+1598.856 |
| DIC = 2.761\*Salinity+1847.268 | DIC =3.712\*Salinity+1830.115 |
| **11/10 2007 to  12/ 5 2007** | TA = 17.083\*Salinity+1715.874 | TA = 23.389\*Salinity+1530.755 |
| DIC = 2.101\*Salinity+1870.239 | DIC = 2.084\*Salinity+1735.044 |

The monthly upstream boundary condition is interpolated according to Supporting Information Table S1.

**Open sea Boundary Condition:**

In our manuscript, open boundary condition is set according to the mean value of the observing station nearest the Southern Open Sea Boundary. We chose those station because they are mainly affected by the open sea biogeochemical processes and can represent DIC and TA of open sea. The open sea boundary condition during cruise period at eight outlets as follow:

Table S2: Open sea boundary condition of DIC and TA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Time Period** | **Surface Layer** | | **Bottom Layer** | |
| **7/24 2006 to  8/30 2006** | **TA** | 2258.6 | **TA** | 2239.1 |
| **DIC** | 1951.4 | **DIC** | 2043.1 |
| **12/15 2006 to  1/17 2007** | **TA** | 2234.2 | **TA** | 2215.1 |
| **DIC** | 1957.0 | **DIC** | 1943.0 |
| **4/ 1 2007 to  4/30 2007** | **TA** | 2167.5 | **TA** | 2186.1 |
| **DIC** | 1917.5 | **DIC** | 1974.5 |
| **11/10 2007 to  12/ 5 2007** | **TA** | 2239.4 | **TA** | 2234.5 |
| **DIC** | 1944.9 | **DIC** | 2023.5 |