Response to referee #1

We thank the reviewer for careful reading of our manuscript and insightful comments. Following is our response to your comments that were cited in italics.

This is an important paper evaluating the source of nutrients and associated productivity in the East China Sea and should generate wide interest.

Thank you for your evaluation on this study.

There is, however, a major flaw that needs to be fixed: The problem is with the initial nutrient concentration in the Yellow Sea. This is obviously critical as without a reliable starting point the model would go nowhere. The authors used a very high NO3 concentration of about 5uM/L citing a Chinese atlas and the World Ocean Atlas 2005. The latter gave a value lower than 4uM/L while the former gave a value below 2uM/L. It is therefore not clear why the authors chose an initial value higher than both. Further, the World Ocean Atlas did not have any station in the central Yellow Sea so the values were extrapolated. The conclusion is that the Chinese atlas is probably more reliable. As such, the model got off with a poor starting point so the authors need to rerun the model with more realistic NO3 concentration to start with. Otherwise the authors need to explain where the high NO3 originated.

Our initial values of nutrients were interpolated from WOA2005 and Chinese atlas. As you noted, these two data sets give different values and we linearly combined them by specifying a coefficient to each value from two data sets. In the Yellow Sea, the initial values of nutrients were essentially based on Chinese atlas.

Essentially, our model results should not depends closely on initial values. To confirm this, we carried out two additional numerical experiments to examine the sensitivity of our model results to initial conditions after receiving your comments. The first experiment used the values in February from WOA2005 (Figure A1) as initial conditions, while the second experiment used the values in February from Chen (2009JMS) (Figure A2). According to these figures, the initial conditions were significantly different in two experiments.

The nitrate concentrations from two experiments were given in Figures A3 and A4. Although we used completely different initial values, the model results after two years of integration were not much different in two experiments. However, the experiment using initial values from Chen (2009JMS) likely gives a little low nitrate concentration in the Yellow Sea. We therefore decided to change our initial values to those given in Chen (2009JMS).

The following issues were considered as causes responsible for the high concentrations of nitrite in the Yellow Sea in the model results.

1. The position of Changjiang plume water in the model has a northward shift of bias (Fig. A5). This bias is related the usage of climatological wind fields. As a result of northward shift of the plume water, more nutrients were transported into the Yellow Sea.
2. The underwater PAR intensity in the model depends on the satellite SPM concentrations provided by Wang and Jiang (2008). The values we used in this study were probably overestimated in the Changjiang river mouth offshore region and western Yellow Sea. Such overestimation induced a lower underwater PAR intensity and therefore a lower production of phytoplankton. As a result, the consumption of nutrients was underestimated in these areas.

In addition to above problems in the model results, we also want to mention a possible contribution of Yalu River to the nutrient concentration in the Yellow Sea. As shown in Table 1, the Yalu River supplies a large amount of freshwater and nutrients to the Yellow Sea. Its influences on the salinity field can be confirmed in the Chinese atlas (Hydrology) and our calculated results (Fig. A5). However, we did not find its influences in the Chinese atlas (Chemistry) and Chen (2009JMS). Therefore, some field surveys in the north Yellow Sea are necessary in the future to examine the influence of Yalu River on the nutrient concentration.

My other comments are minor:
1. The authors mentioned in the Introduction that the East China Sea receives nutrients from the South China Sea through the Taiwan Strait. It is actually the upwelling of the South China Sea water on the western part of the Kuroshio that supports the major portion of nutrients to the ECS(explained in my 2008 JO paper:Distribution of nutrients in the East China Sea and the South China Sea connection).

We will cite this paper and mention the upwelling of the South China Sea water on the western part of the Kuroshio in the revised manuscript.

2. Under 3.1 the authors stated "For a direct comparison with the observations..." yet there is no comparison given.

We actually want to describe the same features found in both model results and Chen

(2009JMS). However, such writing easily causes misunderstanding and we will change the structure of this part in the revised manuscript by directly comparing with the figures in Chen (2009JMS).

3. Why nutrient fluxes reach a minimum in March, not in June when minimum volume flux occurs need to be explained.

Shortly speaking, this is because the nutrient concentrations in the inflow and outflow waters are different. The volume transport of inflow water (Vol_+), the mean concentration (C_+) in the inflow water, the volume transport of outflow water (Vol_-), and the mean concentration (C_-) in the outflow water can be defined as follows,

$$Vol_+ = \sum u_+, \quad C_+ = \frac{\sum u_+ \cdot C}{\sum u_+}, \quad Vol_- = \sum u_-, \; C_- = \frac{\sum u_- \cdot C}{\sum u_-}$$

where u_+ and u_- denotes inflow and outflow volume at the grids along 200m isobath. As an example, the inflow and outflow volume transports and the mean concentrations of nitrate in the inflow and outflow waters on each month are presented in Figure A6. According to Figure A6a, the inflow volume transport is always larger than the outflow volume transport through a year. However, the mean nitrate concentration in the inflow water is smaller (larger) than that in the outflow water from September to next March (from April to September). Therefore, the seasonal variation in onshore nutrient transport is different from that in onshore volume transport.

Table A1. Averaged runoff and nutrients concentration in three rivers

River name	runoff(m^3 y^{-1})	nitrate(μM)	phosphate(μM)	Silicate(μM)
Changjiang	905.6×10^9	32.9	95.0	0.57
Yalujiang	28.7×10^9	309.8	168.4	0.29
Huanghe	19.9×10^9	78.5	85.4	0.95

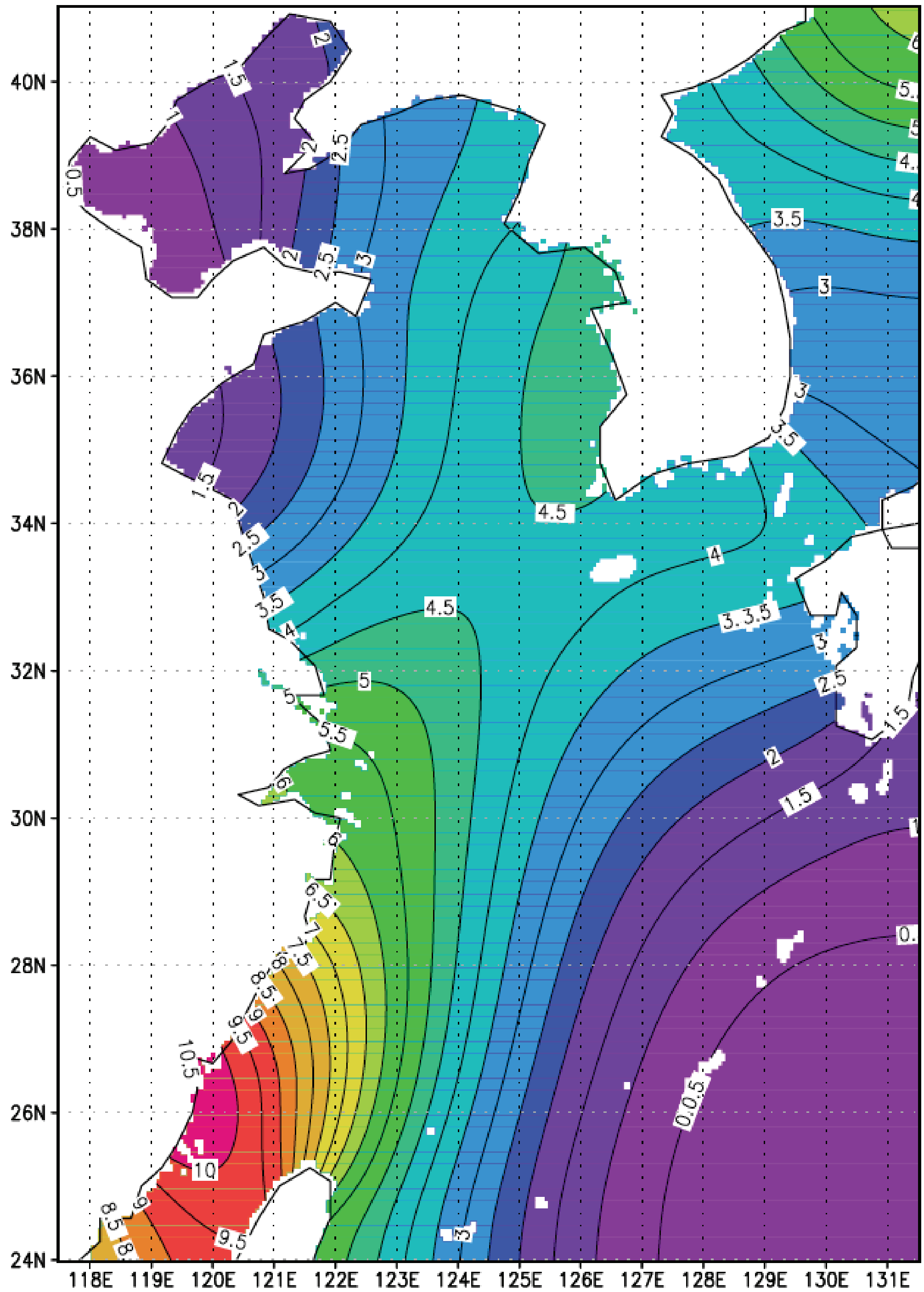

Figure A1. Horizontal distribution of initial surface nitrate (mmol m^{-3}) from WOA2005.

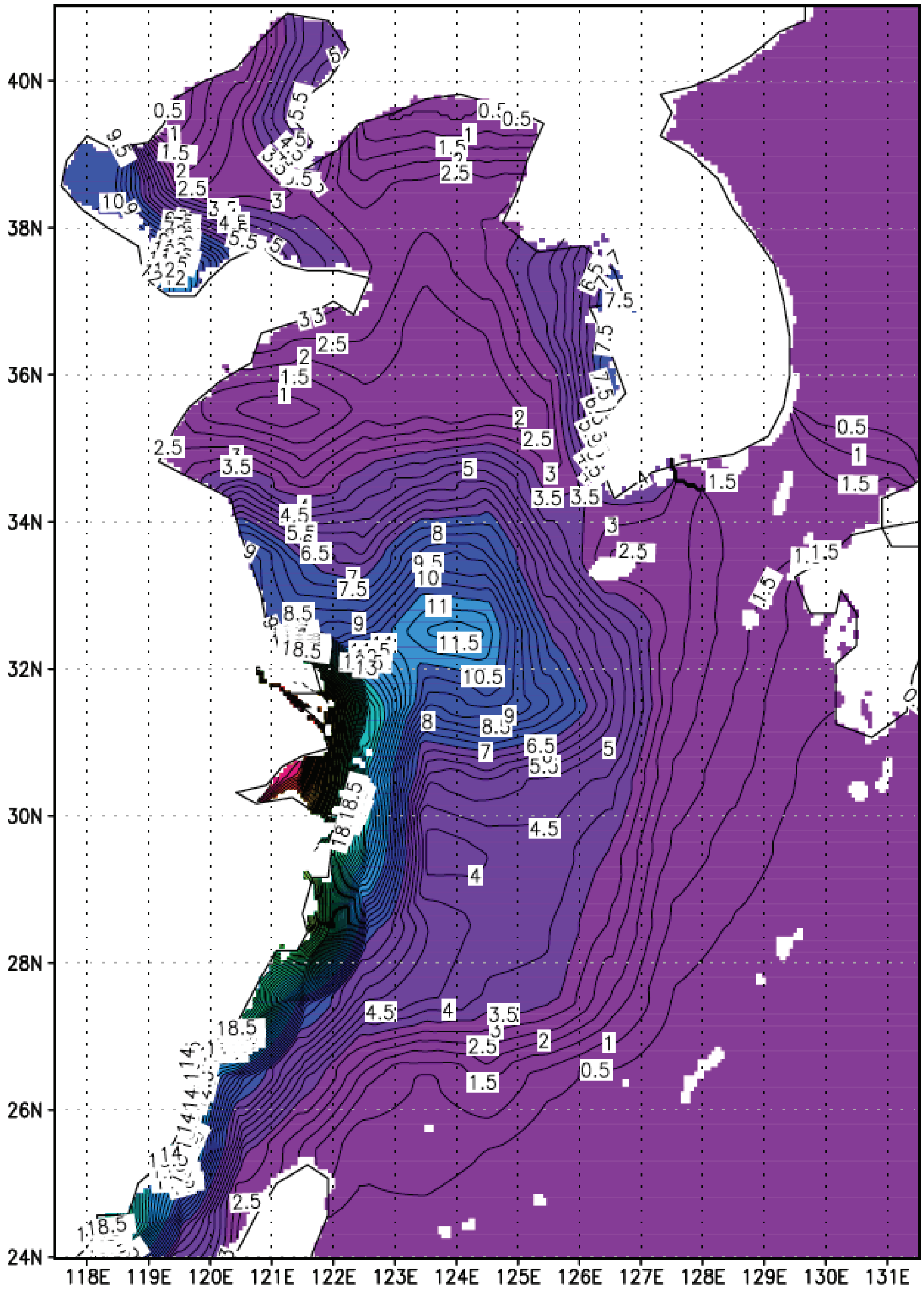

Figure A2. Horizontal distribution of initial surface nitrate (mmol m^{-3}) based on Chen (2009JMS).

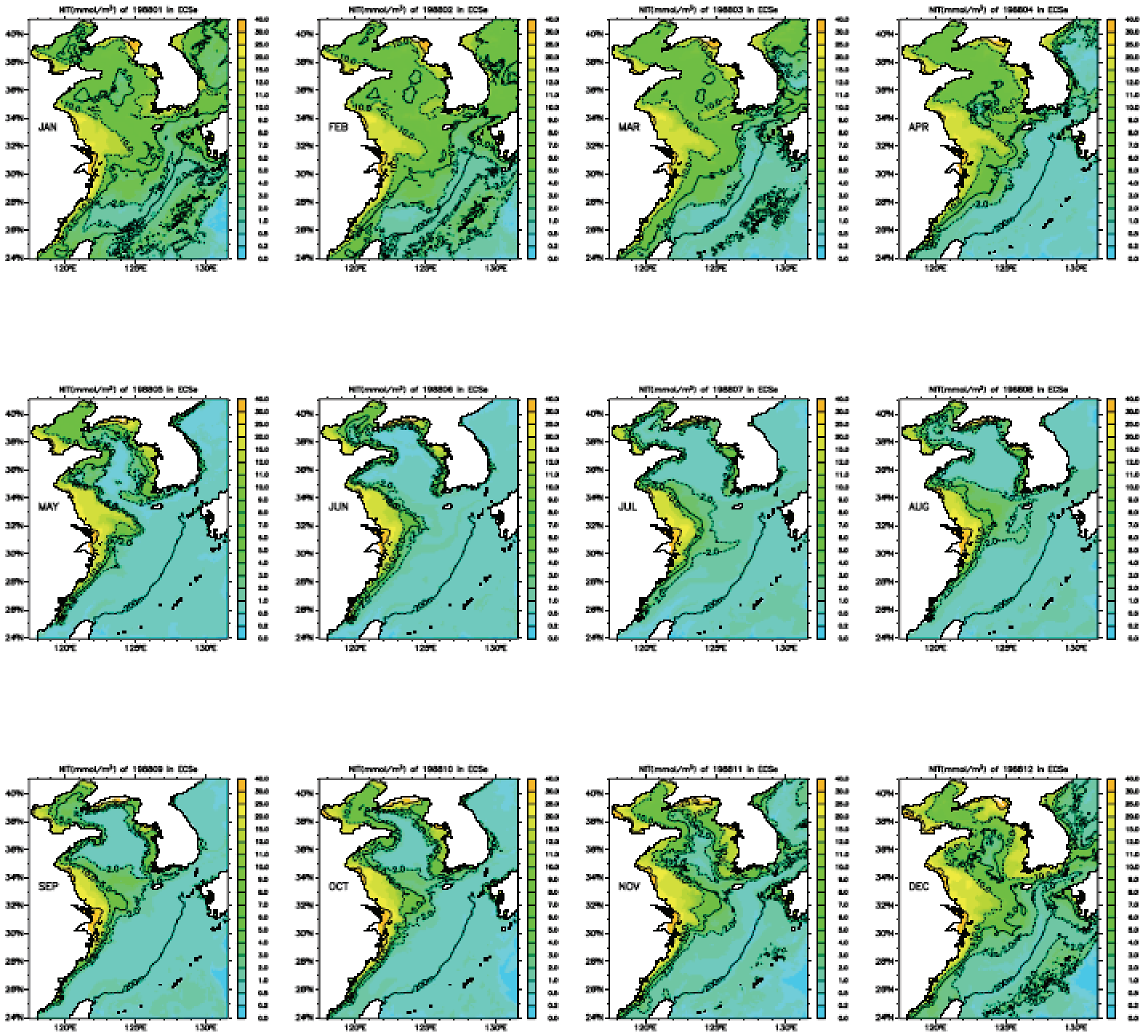

Figure A3. Simulated horizontal distribution of monthly surface nitrate (mmol m^{-3}) with the initial nutrients condition from WOA2005.

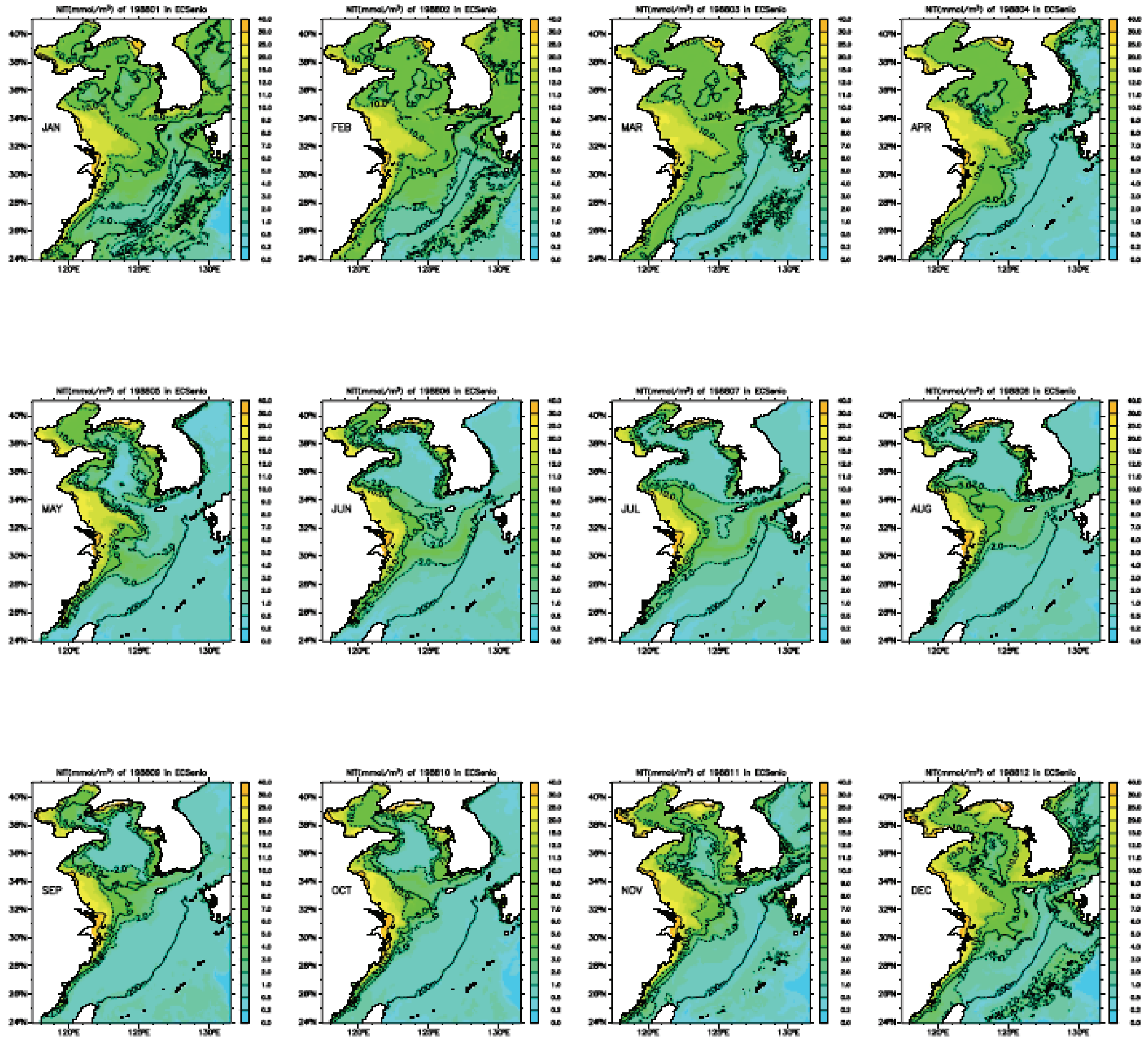

Figure A4. Simulated horizontal distribution of monthly surface nitrate (mmol m^{-3}) with the initial nutrients condition from Chen (2009JMS).

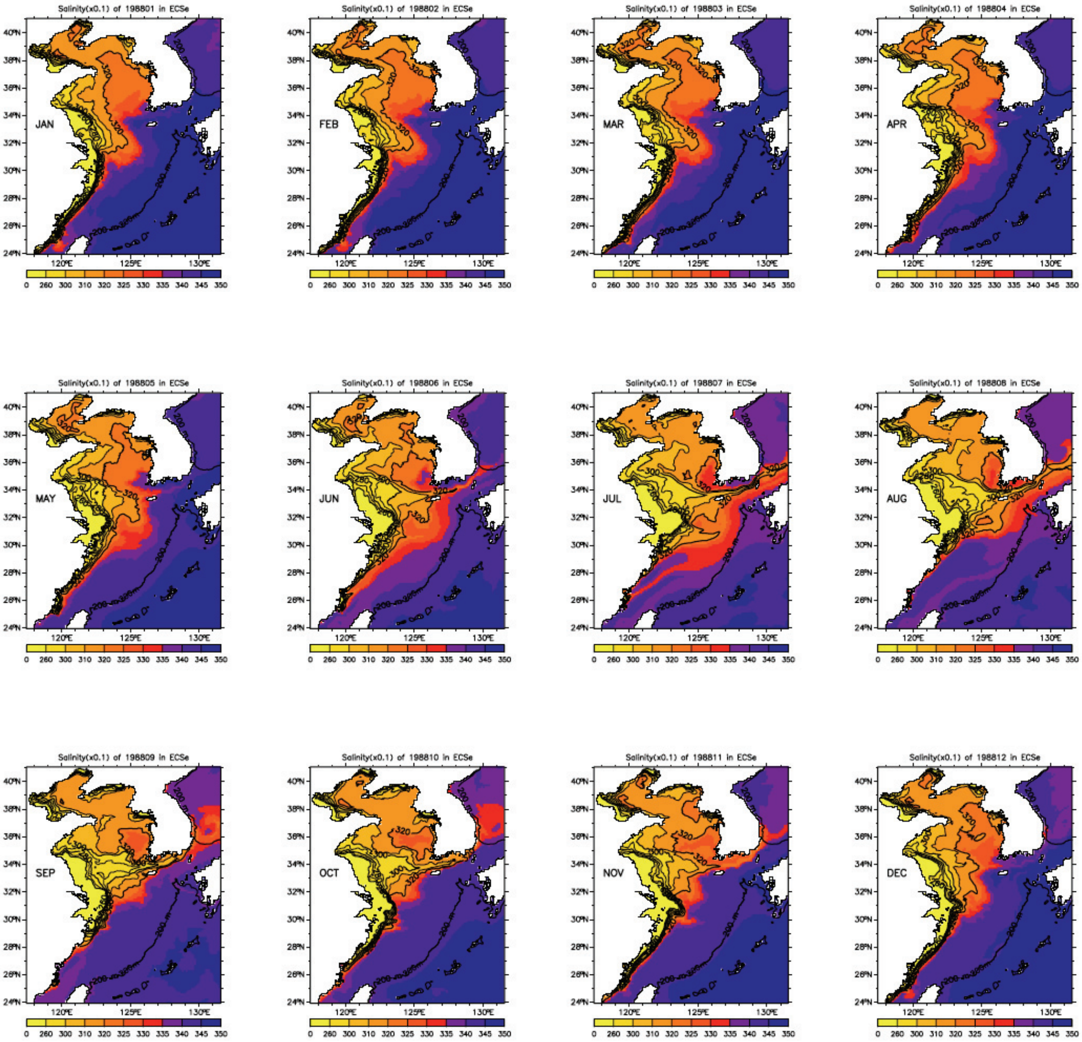

Figure A5. Simulated horizontal distribution of monthly surface salinity.

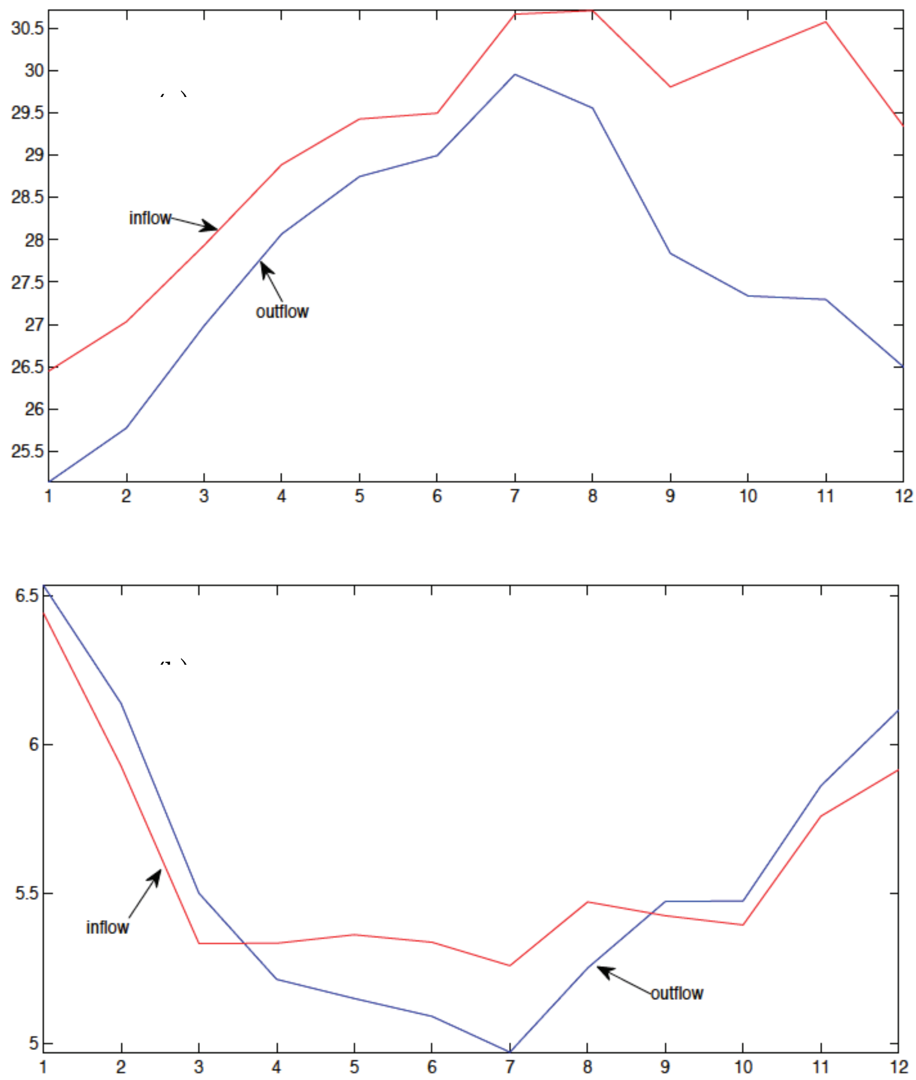

Figure A6. (a) monthly inflow and outflow volume transports (Sv) cross 200m isobath. (b) monthly mean nitrate concentration (mmol m^{-3}) in the water carried out by the inflow and outflow volume transports.