Development of hydrodynamic and eutrophication model in the west coast of Korea

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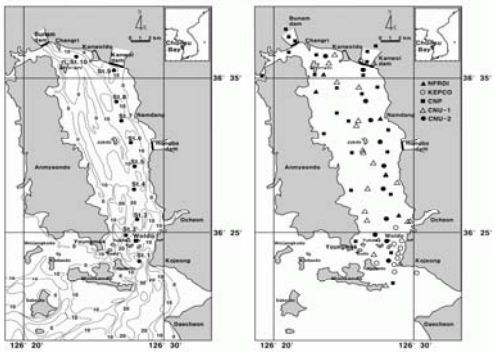
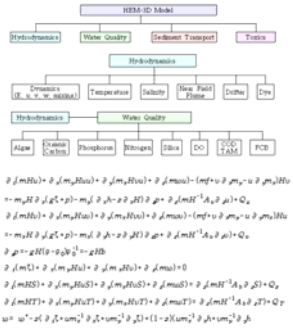
Introduction

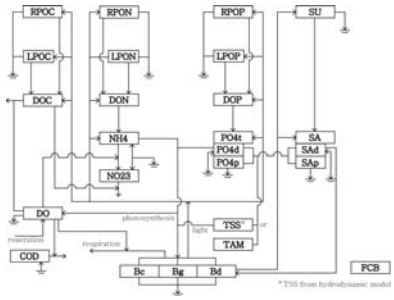
This study focused on the development of hydrodynamic and eutrophication model in Chunsu bay, west coast of Korea. To investigate the characteristics of water quality distribution and variability in the study area, Monthly hydrographic survey were carried out at 10 stations, collecting temperature, salinity and water quality parameters for the period of 2001-2002. In addition, simultaneously time series records of water quality parameters had been collected by realtime monitoring system with 10-minute sampling interval. The observational results show the characteristic patterns of dissolved oxygen (DO) and formation of hypoxia in the bottom water in the vicinity of the embankment and aquaculture fishfarm in summer. A 3-dimensional hydrodynamic and water quality model was performed to reproduce the distribution of water quality parameters in the study area using HEM-3D with real oceanographic forcing.

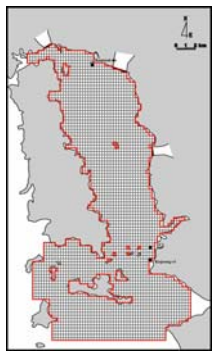


Bathymetry of the Chunsu Bay and sampling stations

Hydrodynamic–Eutrophication Model



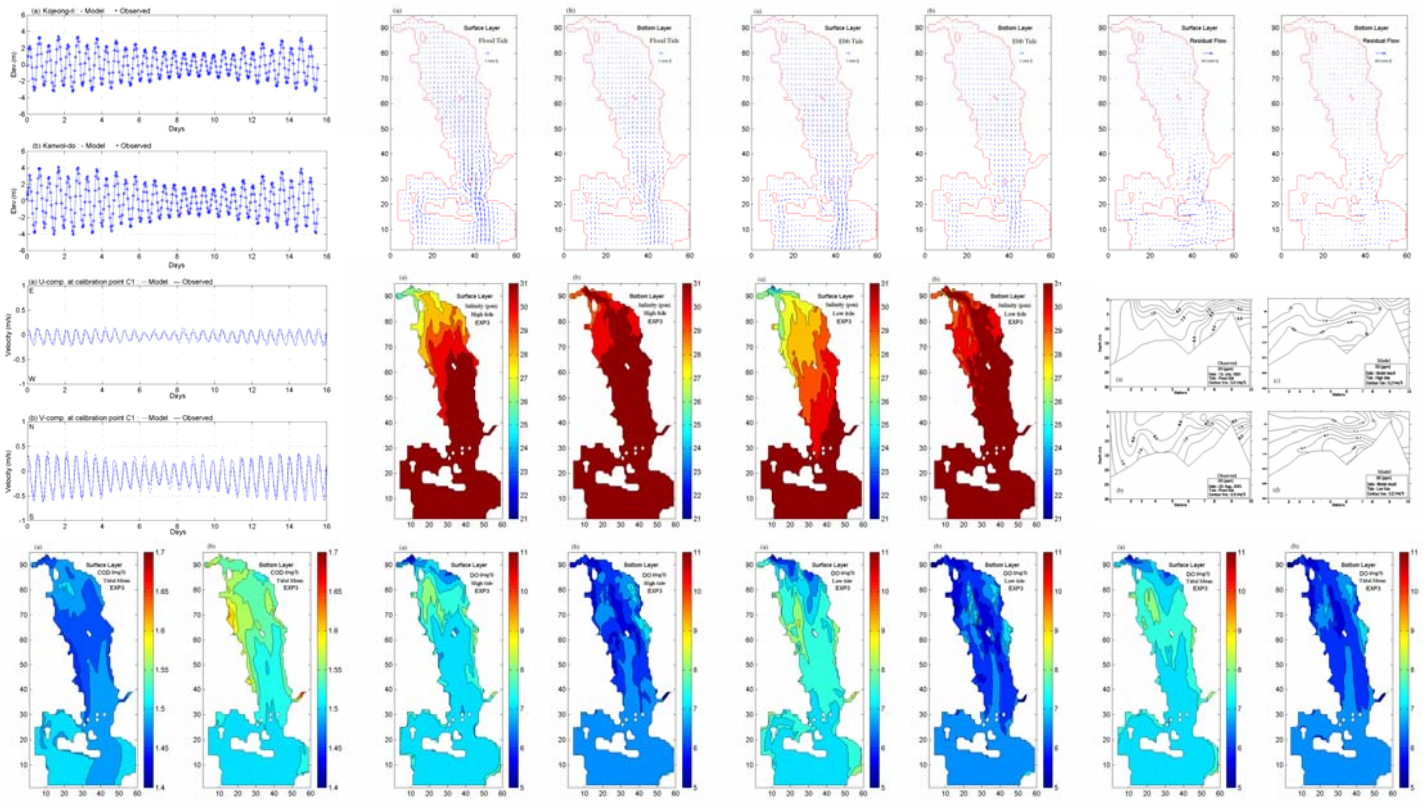




The Cartesian grid system

Results

The hydrodynamic model results were in good agreement with observation data. the model could reproduce tidal elevation and current with more than 90% accuracy for four major tidal constituents. The Eulerian tidal residuals show that a lot of eddy structures developed around islands and inner parts of the study area due to the complex coastline and irregular bottom topography. The water quality model was successful in reproducing the distribution of water quality parameters in the study area. The horizontal distribution of salinity show that low salinity water extends southward to the bay mouth at low tide, while the area is limited to the northern part of the bay at high tide. The lowest salinity water resides the adjacent area to the embankment due to the low speed of flow pattern with less than 0.1 m/s. The horizontal distribution of DO show that the vicinity of the embankment and aquaculture fishfarm were characterized as low DO concentration, less than 5.0 mg/l, while high concentration, greater than 7 mg/l, at the central part of the bay. The sensitivity analysis was performed using the calibrated model to study the control process for hypoxia in the study area. It shows the DO consumption by SOD is more effective to change the water quality than that due to chemical oxygen demand (COD) of fresh water discharges. However, More detailed model study will be needed to understand the physical and biogeochemical processes of water quality variables in the study area. Among those, the influence of the fresh water runoff, pollutants loading from aquaculture fishfarm and bottom sediment flux will be main focus to develop the water quality prediction model.



References

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