

# Development and Application of Teaching Materials for Ocean using JOISS

Mirinae Kim, KESTI (South Korea), [malji527@kesti.co.kr](mailto:malji527@kesti.co.kr)  
 Taeydoon Song, KESTI (South Korea), [ty-song@kesti.co.kr](mailto:ty-song@kesti.co.kr)  
 Minyoung Kim, KESTI (South Korea), [myk0907@kesti.co.kr](mailto:myk0907@kesti.co.kr)

High school students in Korea are learning about the ocean phenomenon in subjects such as 'Integrated Science', 'Science Inquiry Experiment', 'Earth Science I', 'Earth Science II'. The maritime curriculum is a small part of each subject and although there are some textbooks with practices using serial oceanographic observation from NIFS(National Institute of Fisheries Science) or Argos around Korea, it is difficult to find the use of various other marine observation data. Recently, it has been a trend to provide teaching-learning methods for students to collect and analyze data. Collecting and processing scientific data are also a necessary capability for students in the fourth industrial revolution. Therefore, the teaching materials for Ocean, which allow students to use their own observed data, will make it easier for students to increase their understanding and interest. JOISS(<http://joiss.kr>) is a portal that collects and provides marine research data in Korea, and students will be able to easily access the data that fit the subject of the class at JOISS.

This study aims to introduce the contents of teaching materials for the curriculum using the marine data provided by JOISS and analyze the results of applying them. 16 teachers in the Earth Science Education & Learning Community reviewed each subject, extracted the contents related to the ocean and divided into 5 parts: marine physics, marine chemistry, marine biology, marine geology/geophysics and marine weather. The teaching materials were developed by selecting themes suitable for each part and reviewing the JOISS data for the themes. Finally, we developed teaching materials for a total of 31 themes: 11 marine physics, 7 marine chemistry, 5 marine biology, 3 marine geology/geophysics and 5 marine weather. The contents of the materials consist of 1) outline, 2) open thinking, 3) using JOISS, 4) inquiry activities, 5) result report and 6) reference. In the case of climate change among the various themes, students can download the water temperature and salinity data around Korea for 30 years from JOISS and draw a time series graph with trend line to interpret data. And JOISS supports it by serving the education application.



Figure 1: Teaching materials for Ocean (coastal upwelling)

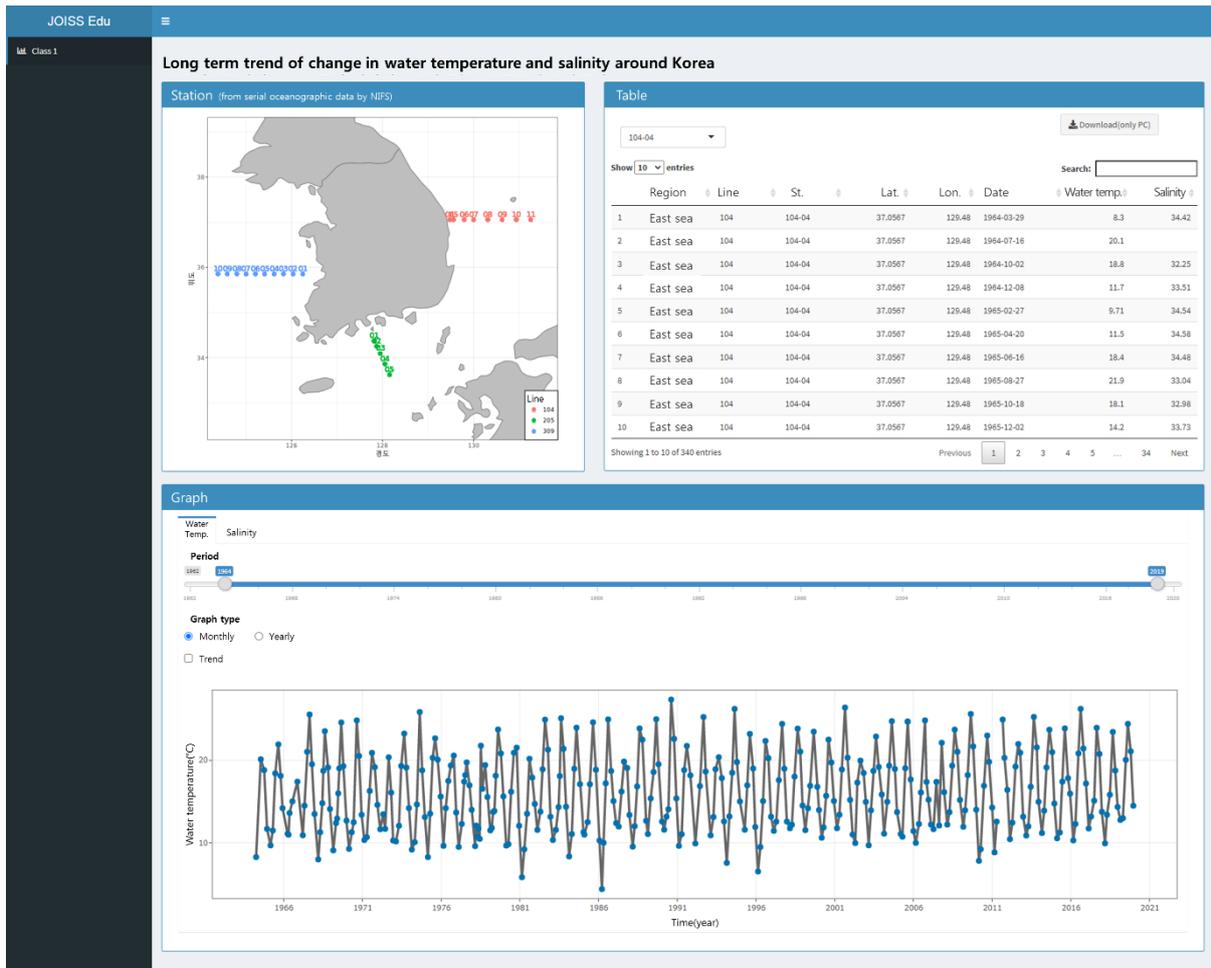


Figure 2: JOISS Education App. (Long term trend of change in water temperature and salinity)

The developed materials have been distributed to every middle and high schools located in Incheon, and has been provided at JOISS for students and teachers. As a result, 36 schools and 568 students joined JOISS and are using these materials. The developed teaching materials for ocean are applied in several schools and seminars, and some of the developed contents are published in various reference book for teachers. As schools can switch to online classes because of the COVID-19 pandemic, the number of classes that use the teaching materials and the education application in JOISS is increasing. Therefore, it is expected that teaching materials for ocean using JOISS will be used in various ways in schools.

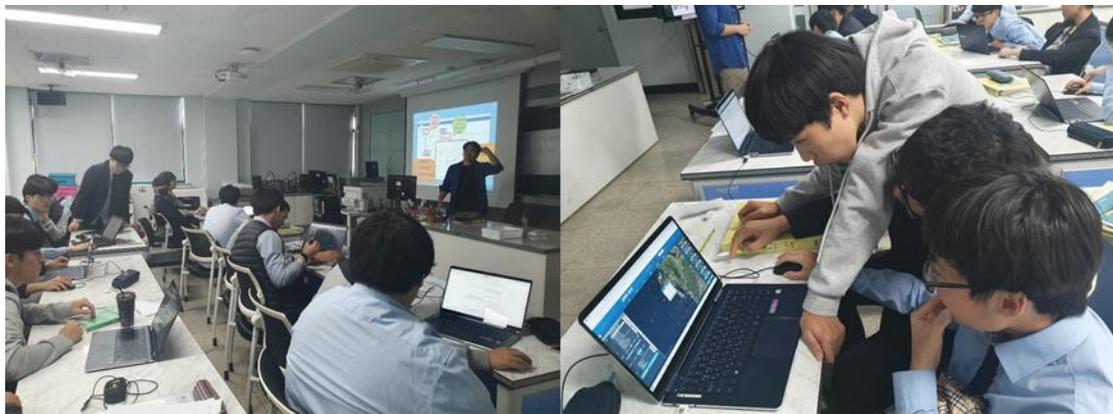


Figure 2: A case of class using the developed teaching materials