

Establishment of an Operational Data Management System for Korea Ocean Prediction System

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Abstract

Korea Institute of Ocean Science & Technology (KIOST) started to establish Korea Operational Oceanography System (KOOS) in 2009 to set up an ocean prediction system of Korean waters. An operational data management system was developed concurrently to collect new oceanographic data required for ocean models and provide the forecasting information to users. The system whose main users are ocean researchers, is composed of the data archiving system and the data service system. The data archiving system was set up and started to be operated in 2010. Several physical oceanographic data around Korean peninsula were collected periodically and shared with ocean modellers for data assimilation and model validation. The data service system for the ocean experts was established to distribute observation data and model output files using OPeNDAP (Open-source Project for a Network Data Access Protocol) software and LAS (Live Access Server) software from 2011 to 2013. The KOOS OPeNDAP provides a way for ocean researchers to access oceanographic data anywhere on the internet and extract sub set from the original data set. The KOOS LAS provides on-the-fly visualization and analysis of multi-dimensional scientific data for web users.

1. Introduction

During establishing new Korea ocean prediction system, the operational data management system was developed to manage oceanographic data and information related to the marine forecasting. The development of the data system had been started in 2010 and the first phase was completed on April 2013. The goals of the system are (1) to collect oceanographic data available in Korea waters and provide them to the operational numerical models, (2) to manage observation data and ocean prediction data produced by numerical models, (3) provide data and prediction information to the ocean experts and (4) support on-the-fly visualization and extraction of sub set data from original model output.

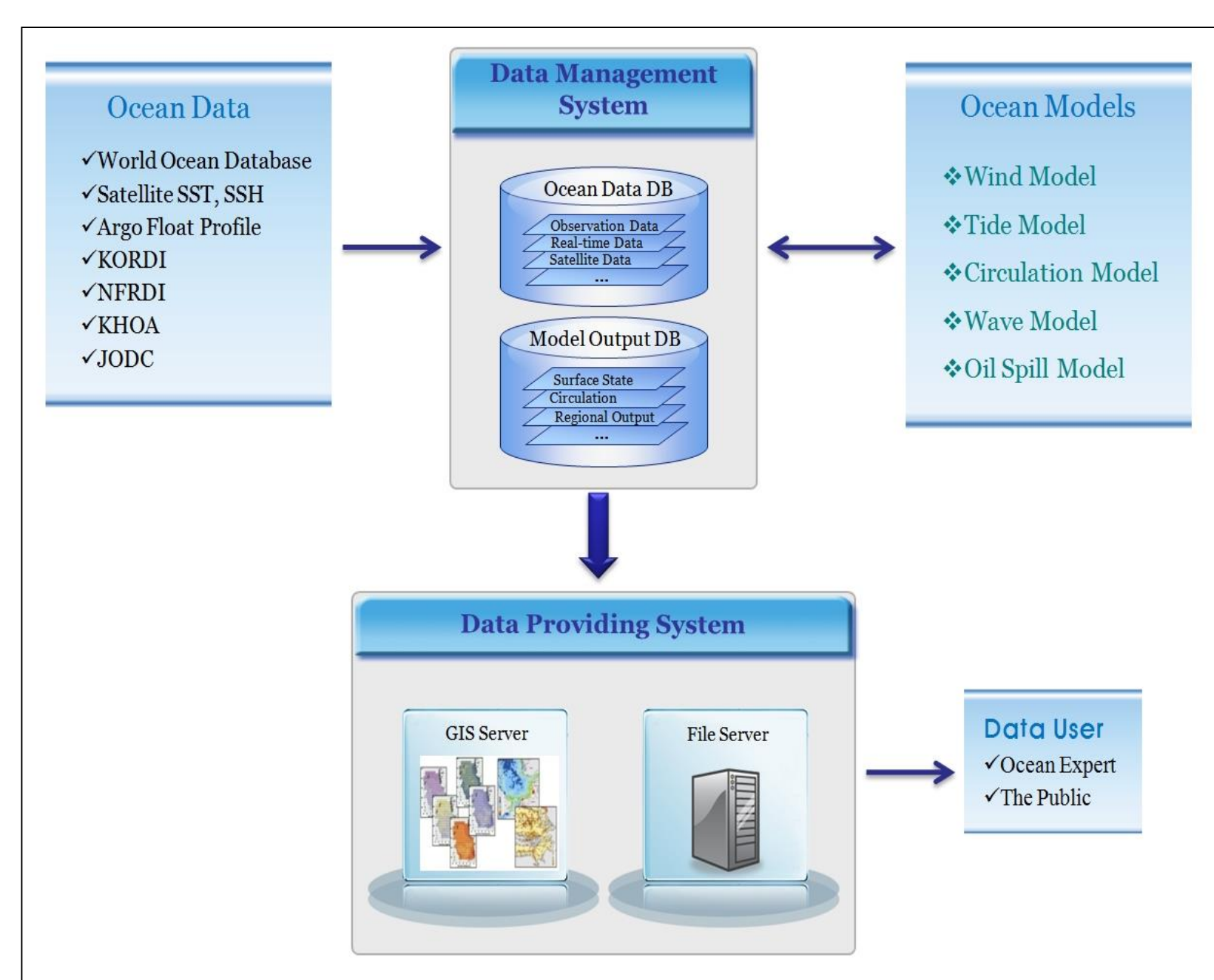


Fig 1. Structure of the operational data management system for KOOS

2. Data Archive System

According to the request of ocean model researchers, several physical oceanographic data were collected and distributed through the KOOS data services. We started to collect data in the Yellow Sea, the East China Sea and the East Sea (Japan Sea) to provide them to the ocean researchers who are developing ocean prediction systems and data assimilation systems.

Almost temperature and salinity (TS) data available in the public domain and TS data produced by the Korean organizations were gathered periodically. The northern limit and the southern limit of the data collection area are 20°N and 55°N, and the western limit and the eastern limit are 110°E and 150°E, respectively. To archive TS profile data, ARGO data and World Ocean Database (WOD) data have been collected every week since 2010. The quality control software for TS profile data was developed using C language with QC criteria suggested by the ARGO program and the GTSP (Global Temperature-Salinity Profile Program). It was applied to the collected TS profile data and QC flags were added to the profile data when the data were not meet QC criteria. The ARGO data were collected from ARGO GDAC USA (Global Data Assembly Center USA) and GDAC France in the format of netCDF and the profile data in the north west Pacific area were extracted from the original files. By the end of April 2013, the total number of vertical profile data collected from the ARGO GDAC was 45,989 deployed by 7 organizations of Korea, Japan, China, Australia and Canada. WOD data set was published in 1998 (WOD98), 2001 (WOD01), 2005 (WOD05), and 2009 (WOD09). Newly collected data are updated every 3 months and distributed through the WOD web site. Many historical TS profile data observed by CTD, OSD, BT, and PFL were retrieved from World Ocean Database 2009 and newly updated data are checked and collected every month. The total number of gathered data from WOD was 1,584,267.

To archive SST (Sea Surface Temperature) data and SSH (Sea Surface Height) data obtained by Satellite, AMSR-E SST, NCDC (National Climate Data Center) SST and AVISO SSH data were collected every week. We started to archive global 1/4° gridded AMSR-E SST data of level 3 on June 17, 2010, but data service was stopped on October 3, 2011 due to malfunction of satellite antenna. Since October 4, 2011, NCDC SST data set produced by optimum interpolation using AVHRR data have been collected from FTP service of NCDC. AVISO global 1/4° gridded SSH data is started to be collected from May 27, 2011. After we collect satellite data, we extract regional SST data and SSH data around Korean peninsula from the original global data sets and save them in the format of netCDF. We also produce the image files using extracted file and provide them through FTP.

Table 1. List of data items archived for KOOS

| Data | Source | Period | Remark |
|------------------------|--------------|---------------|-------------------------------|
| ARGO | US GDAC | Every week | |
| World Ocean Database | US NODC, WDC | Every month | WOD 2009 |
| World Ocean Atlas | US NODC, WDC | Once | WOA 2009 |
| Real-time Data of KHOA | KHOA | Every week | |
| AMSR-E SST | NSIDC | Every week | By 3 rd Oct 2011 |
| NCDC OI SST | NCDC | Every week | From 4 th Oct 2011 |
| AVISO SSH | AVISO | Every week | |
| UM Model Output | KMA | Every 3 hours | |
| Ocean Buoy Data of KMA | KMA | Every hour | |
| AWS Data of KMA | KMA | Every minute | |

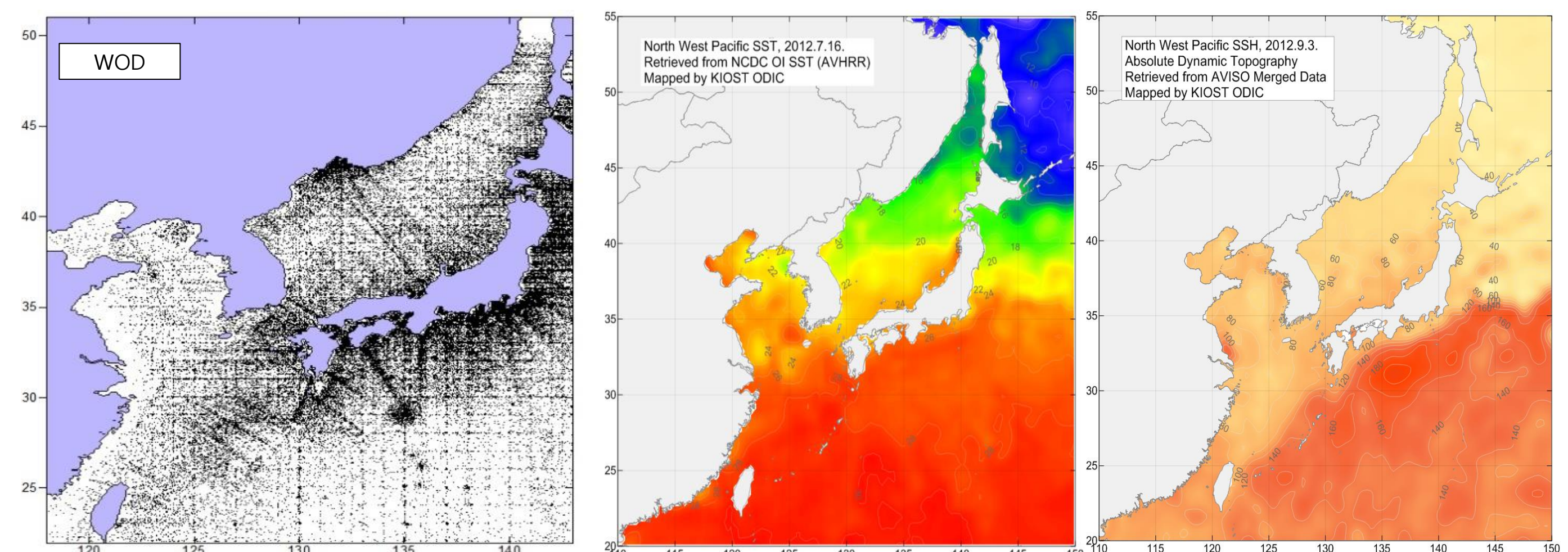


Fig 2. Archived TS data from WOD

Fig 3. Archived satellite data : SST & SSH

Table 2. Number of archived data

| Data | Data Format | No. of Data | Date |
|------------------------|-------------|-------------|-------------------|
| ARGO | netCDF | 45,989 | 11.01.01~13.05.03 |
| World Ocean Database | ASCII | 1,584,267 | 11.05.26~13.04.25 |
| Real-time Data of KHOA | Excel | 564 | 10.04.02~12.12.31 |
| AMSR-E SST | HDF | 1,416 | 10.06.17~11.10.03 |
| NCDC OI SST | netCDF | 1,033 | 11.10.04~13.05.04 |
| AVISO SSH | netCDF | 1,734 | 11.05.21~13.05.08 |
| UM Model Output | glib2 | 389,758 | 11.01.01~13.05.09 |
| Ocean Buoy Data of KMA | ASCII | 177,394 | 10.12.15~13.05.10 |
| AWS Data of KMA | ASCII | 1,324,300 | 10.11.11~13.05.10 |

3. Data Service System for the Ocean Experts

The data service system for the ocean experts was established to distribute observation data and model output files. It consists of 3 file services using OPeNDAP, LAS and FTP. The OPeNDAP permits remote connection to the data file through various data manipulating software like Ferret, Matlab, IDL, etc. KOOS OPeNDAP service was set up to provide netCDF output files of KOOS and started its service in 2011. The Live Access Server is a highly configurable web server designed to provide access to geo-referenced scientific data. LAS enables the web user to visualize ocean data with on-the-fly graphics, to request custom subsets of variables and to compare variables. We set up KOOS LAS to provide various graphic images of several model output data produced by Korea ocean prediction system. It offers unified access interface for multiple types of data and powerful graphic functions for section maps, depth profiles, hovmoller plots, line plots, time-series plots, and scatter plots. It also can produce animation images and KML files for the Google Earth. KOOS LAS supports the modelers and data users on their work to analyze the model output data.

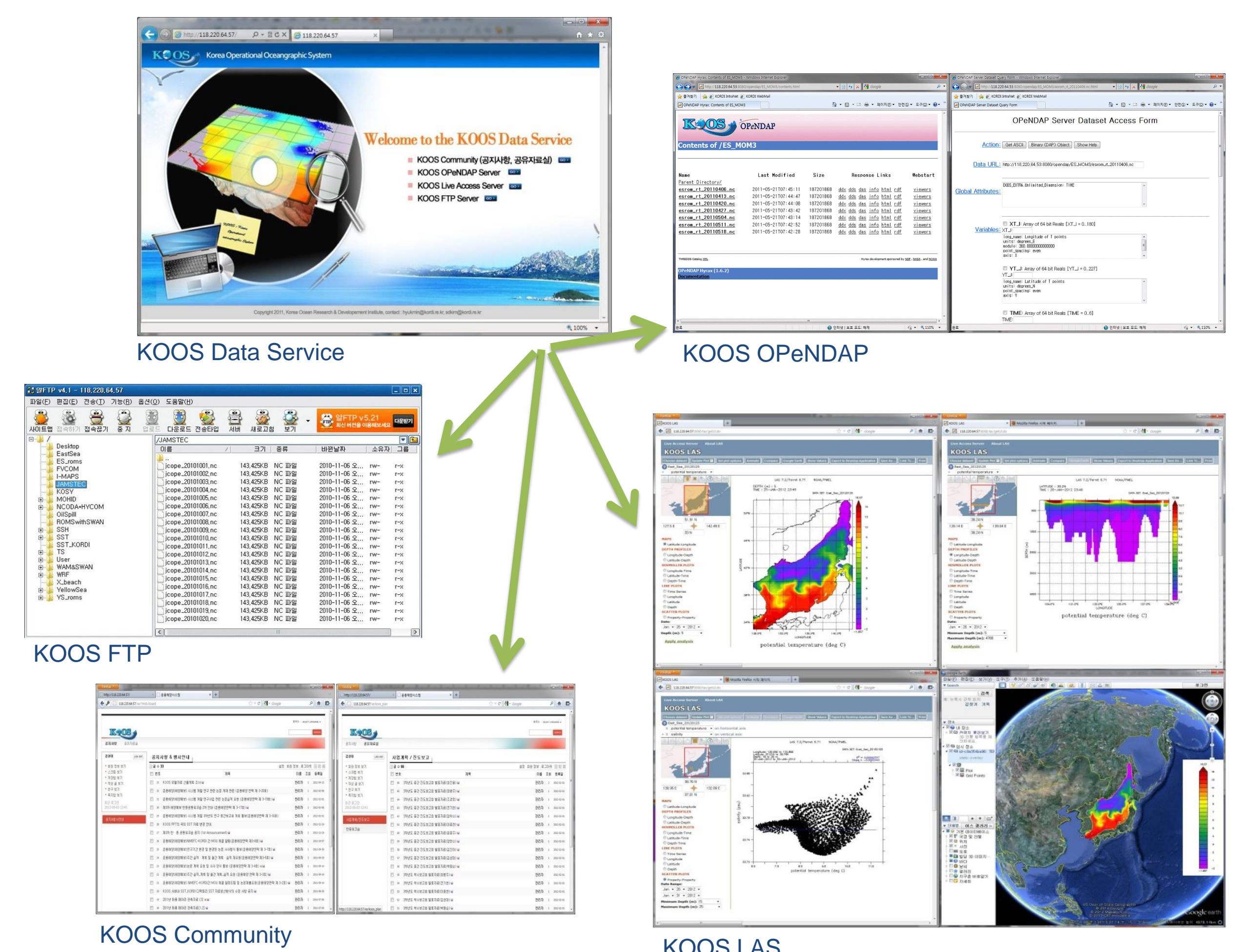


Fig 4. KOOS Data Service

4. Conclusion Remark

The operational data management system of KOOS was developed from 2010 to 2013 and it has been operated to support the Korea ocean prediction system. The second phase development of the data management system will be started from this October to improve quality control functions and data service functions.

Acknowledgments

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