THE GIS MAPPING TO DETECT TEMPORAL CHANGE ON MARINE ENVIRONMENTS AROUND POWER PLANT – CASE STUDY ON ULJIN NUCLEAR POWER PLANT

Jae-Moon Park [1] and Hong-Joo Yoon[2]

[1]*Department of Spatial Information Engineering, Pukyong National University*
599-1 Daeyeon, Nam-gu, Busan 608-737, Korea; Tel: + 82-51-629-6656; Fax: +82-51-629-6653
E-mail: parkjm56@gmail.com

[2]*Department of Spatial Information Engineering, Pukyong National University*
599-1 Daeyeon, Nam-gu, Busan 608-737, Korea; Tel: + 82-51-629-6656; Fax: +82-51-629-6653
Email: yoonhj@pknu.ac.kr

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ABSTRACT: This study was used *in-situ* data (sea surface temperature: SST, salinity, DO and pH) from 1987 to 2006 for identifying of temporal change of marine environments around power plant. The data was compared temporal changes between before and after operation for identifying on power plant extension. And the area of 1km radius around discharge was set experiment group and the area of 1km radius around reference about southward 5km away from observation site was set control group were compared SST change classified by seasonal. Also, SST data was extracted and intersected areas over seasonal mean SST data in a coastal observation location, Jukbyeon. As a result, a SST difference between experiment group and control group was higher experiment group as spring 1.81℃, summer 1.96℃, fall 1.01℃ and winter 1.76℃. And a seasonal result intersected distribution map interpreted that regardless of season area around discharge of power plant was always higher SST.

I. Introduction

The state of Korean nuclear power plant (NPP) is operating a total of 20 NPP that is the four Kori, the four Wolsong NPP, the six Yeonggwang NPP and the six Uljin from 1978. Nuclear power (NP) comprises 35.5% of gross domestic electricity production in 2007. The advantages of NP are operating in large quantities and not generating green-house gases than fossil fuel. But the disadvantages of NP had the environmental problems such as radioactive contamination and hot waste water etc.

The coast of Korea peninsula has silted up many aquacultures and fisheries. The production of fishery resources will be reduced if sea temperature is rising due to hot waste water discharging from power plants in coast (Kim, 2003). Thus this study is identifying temporal change to marine environments around power plants by hot waste water discharging.

2. Data and methods

The study area is the sea around Uljin NPP in Uljin, Korea (Figure 1). And it contained about 10Km coastline north and south from central discharging site. The data is SST (sea surface temperature), salinity, DO (dissolved oxygen) and pH of marine environments data in KEPCO (Korea electronic power corporation) from 1987 to 2006.

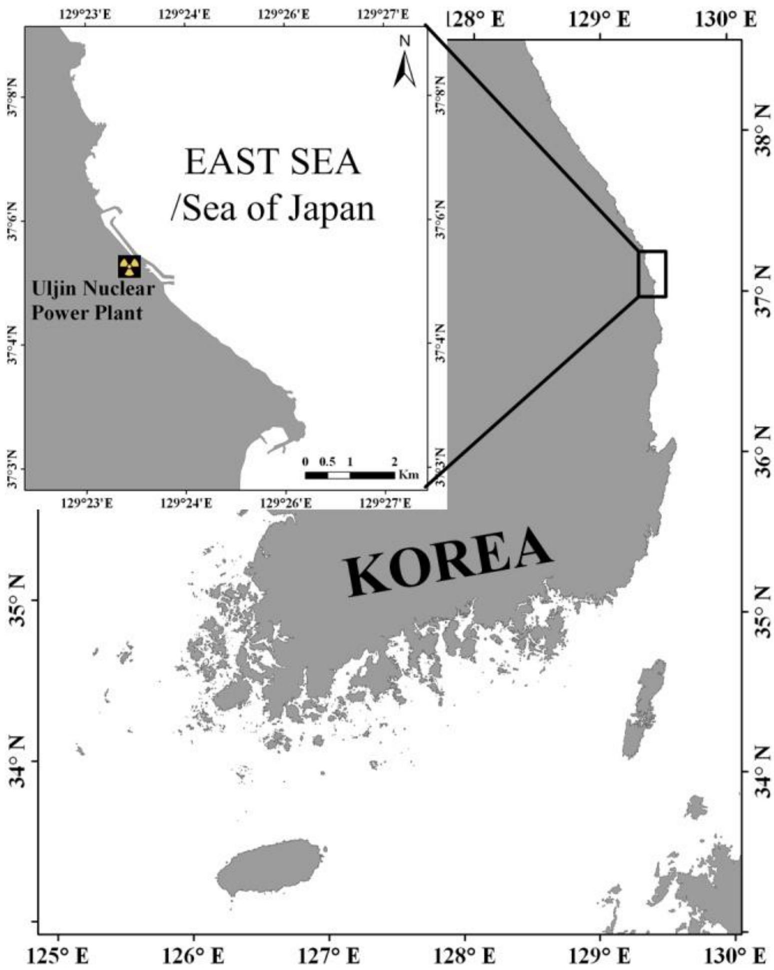

Figure 1. Study area.

In this study, the observed data for 20 years was transformed spatial data such as point data. Point data was made by WGS-84 UTM #52 coordinate. Thematic maps were made classified by year and season. Study procedure is such as Figure 2.

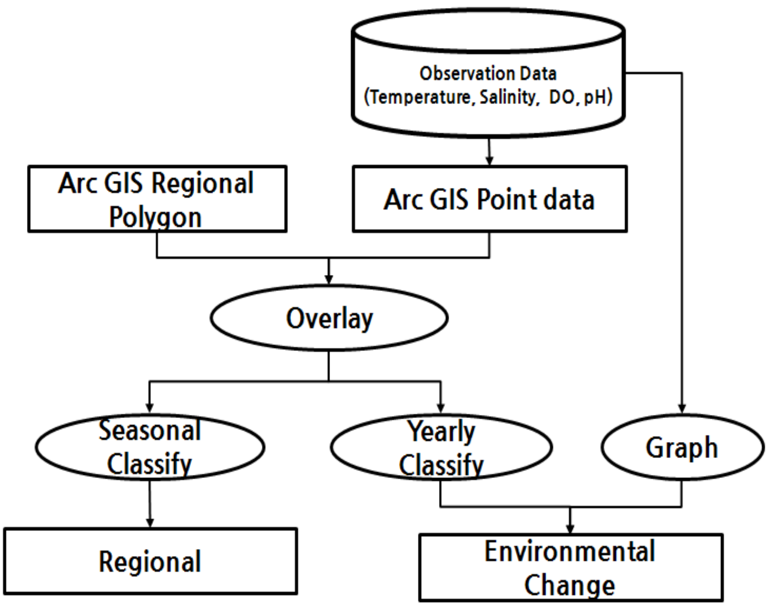

Figure 2. Flow chart for study.

3. Results

3.1 Comparison between experimental site and reference site

The experimental site was set a sea (within a 1Km radius) around discharging site to identify hot waste water effect nearby discharging site of power plant. And the reference site was set a sea (within a 1Km radius) around location about 5Km away from discharging site. Observing stations of SST and DO were such as figure 3. The number of SST station was spring 366, summer 385, fall 347 and winter 317 in experimental site and spring 119, summer 110, fall 109 and winter 113 in reference site. The number of DO station was spring 61, summer 60, fall 60 and winter 59 in experimental site and spring 23, summer 23, fall 23 and winter 22 in reference site. SST was higher in summer and fall and lower in spring and fall. A distribution of SST was from 7.9 to 34℃ in experimental site and from 8.2 to 28.9℃ in reference site. A standard deviation of SST was 2.75℃ in experimental site and 1.6℃ in reference site. Therefore SST distribution of a sea around experimental site was larger than a sea around reference site and experimental site was about 5℃ higher than reference site at maximum SST.

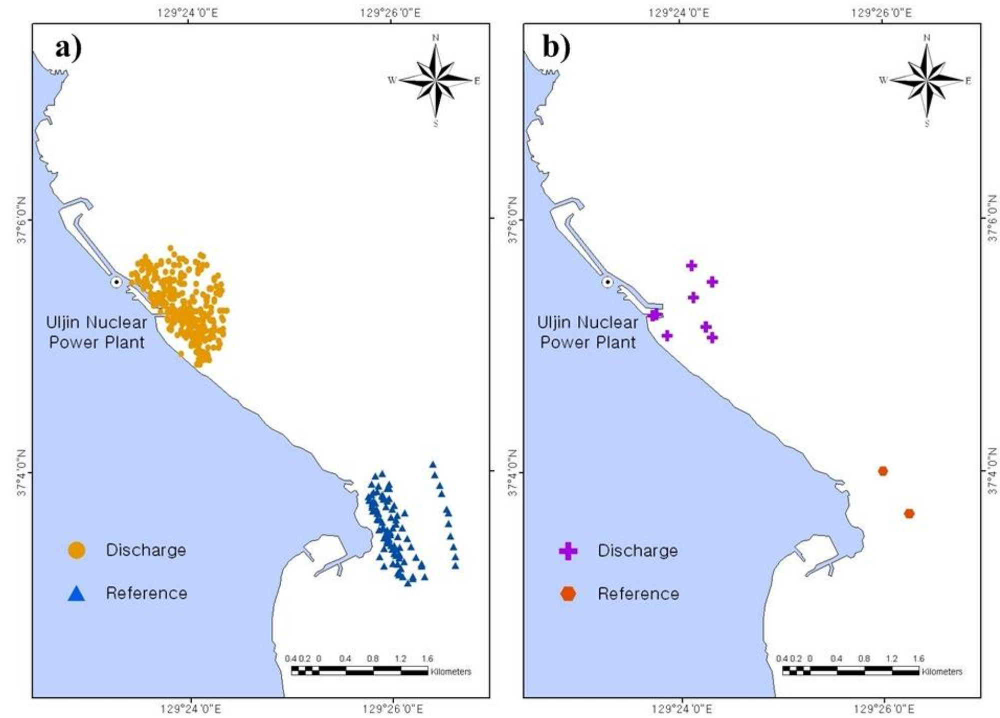

Figure 3. Comparison between experimental site and reference site (a) SST and (b) DO.

A mean SST was higher in experimental site and higher classified by seasonal in spring 1.81℃, summer 1.96℃, fall 1.01℃ and winter 1.76℃. DO was the highest at both areas in winter. Seasonal mean DO of experimental site was spring 8.6 mg/L, summer 7.6 mg/L, fall 7.5 mg/L and winter 8.8 mg/L and reference site was spring 8.9 mg/L, summer 7.2 mg/L, fall 7.7 mg/L and winter 9.1 mg/L. The minimum DO of both areas was averagely difference of approximately 0.4 mg/L, but the maximum was shown big difference as 1.2 mg/L.

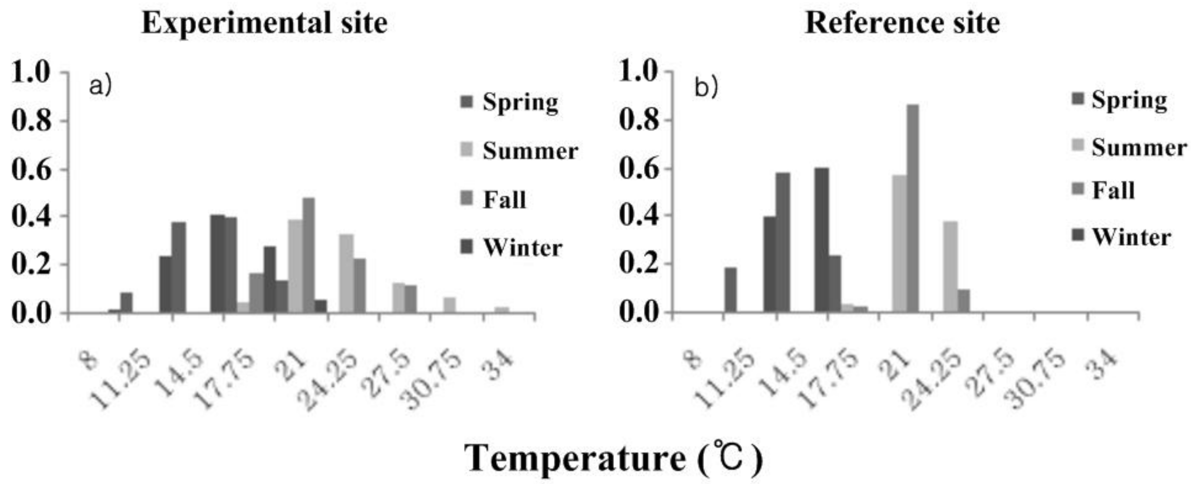

Figure 4. Distribution ratio of SST classified by seasonal (a) experimental site and (b) reference site.

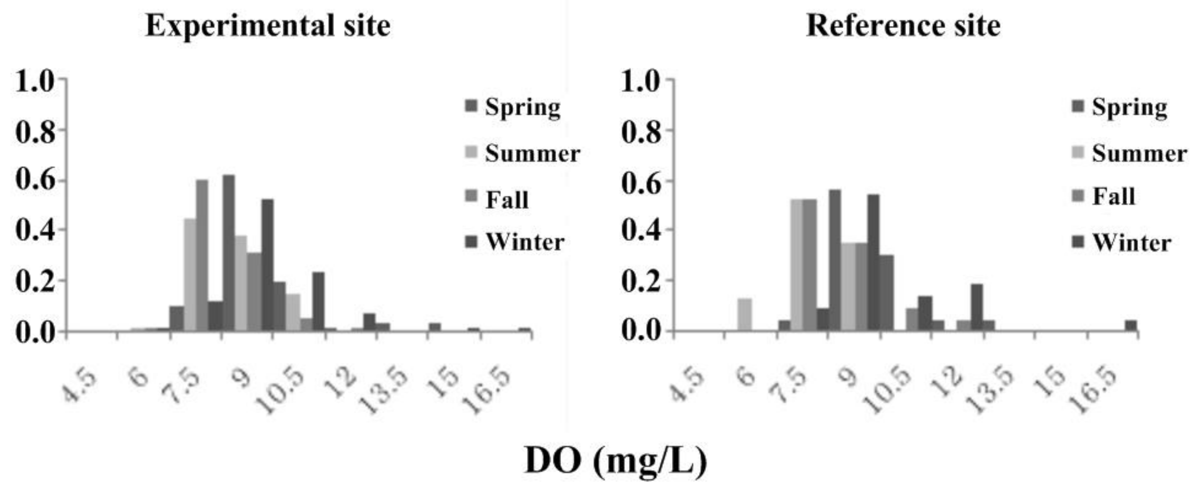

Figure 5. Distribution ratio of DO classified by seasonal (a) experimental site and (b) reference site.

3.2 Seasonal analysis for SST distribution

To identify hot waste water impact on SST, observing data was calculated seasonal mean of SST from 1987 to 2006 in Jukbyeon nearby Uljin NPP (Table 1). A data was Coastal Oceanographic Observation Data of Korea Oceanographic Data Center (KODC). It made decision a higher sea than seasonal mean SST of Jukbyeon as where impacted on hot waste water. And seasonal mean SST data of study area over seasonal mean SST of Jukbyeon is shown Figure 6.

Seasonally, spring has shown approximately 75% over mean SST of Jukbyeon and distributed under discharging site. Summer has occurred smaller than spring, but similarly distributed. Fall has shown approximately 33% over mean SST of Jukbyeon unlike spring and summer, but similarly distributed like spring and summer. Winter has shown totally like fall. Finally, to identifying over mean SST of Jukbyeon, intersected among distribution of four seasons such as Figure 7.

Table 1. Mean SST in Jukbyeon

Season	Spring	Summer	Fall	Winter
Mean SST (℃)	11.96	19.36	19.21	11.35

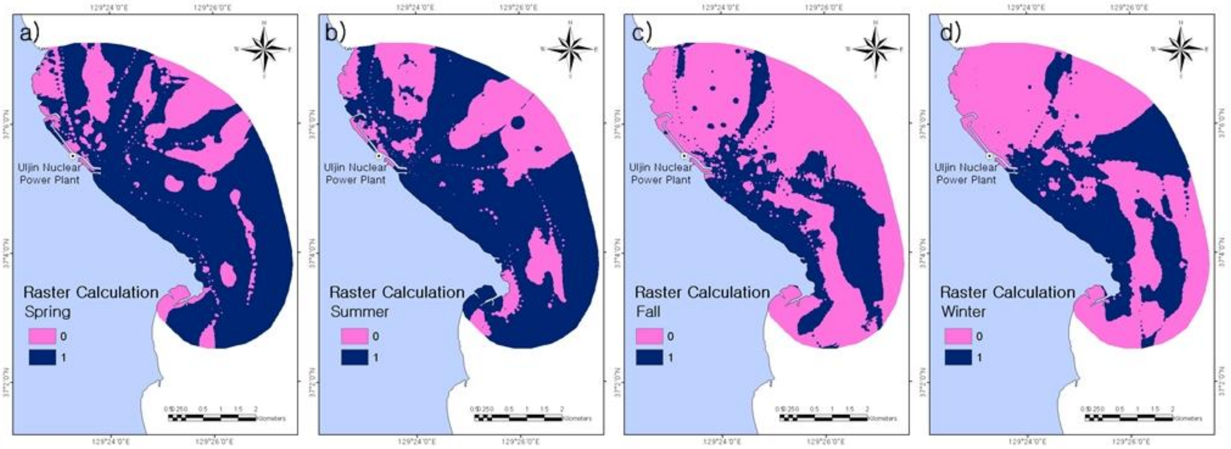

Figure 6. Seasonal map using the value over mean SST of Jukbyeon (a) spring, (b) summer, (c) fall and (d) winter.

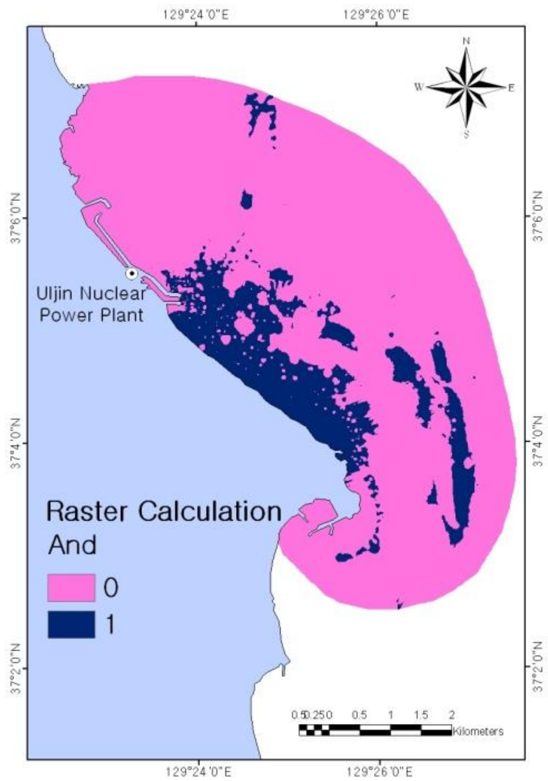

Figure 7. The map of intersection for seasonal maps of SST.

4. Conclusion

In this study, observed marine environments data during 20 years from 1987 to 2006 was used to identify marine environments change around Uljin NPP and to compare between experimental site and reference site and to GIS mapping for seasonal change distribution.

The seasonal change distribution of SST was occurred higher around discharging site than mean SST. And SST of seasonal experimental site was occurred higher 2.75 ℃ than reference site. Therefore SST around NPP was shown higher than other locations.

DO concentration of discharging site was spring 8.6 mg/L, summer 7.6 mg/L, fall 7.5 mg/L and winter 8.8 mg/L. The difference of mean with experimental and reference site was a small in winter and a big in spring.

Therefore marine environments around NPP were affected by discharged hot waste water from NPP. And it is to identify sustainedly impact on salinity and DO value due to rising SST.

Acknowledgement

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