DETECTION OF SEA SURFACE TEMPERATURE (SST) AND SALINITY USING THERMAL INFRARED DATA OF AVHRR AND MODIS IN THE GULF OF BOHAI SEA OF CHINA

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Abstract - This paper presents the detection of sea surface temperature (SST) and salinity in the Gulf of Bohai Sea of China using thermal infrared (TIR) data of Advanced Very High Resolution Radiometer (AVHRR) and Moderate Resolution Imaging Spectroradiometer (MODIS). Both AVHRR and MODIS imageries are evaluated as main data sources for monitoring SST as a measure of upwelling’s dynamic. The relationship between SST and salinity in the area is also discussed during 1997-2000 derived from AVHRR data and then examined using MODIS data of 2000. The obtained results indicated that both AVHRR and MODIS are useful to detect SST and salinity in the study area.

Keywords – TIR data, SST, salinity, AVHRR, MODIS.
1. Introduction

Satellite remote sensing provides an adequate synoptic and repetitive overview of environmental parameters in oceanography, especially in coastal and sea areas where SST monitoring allows a precise description of upwelling’s dynamic [1]-[2]. Passive thermal infrared remote sensing such as onboard NOAA AVHRR and MODIS is one of the techniques used for Earth surface observations from space. Recently, this technique remains one of the most efficient means of monitoring oceanic changes at sea level and meets real time needs.

SST measurement using AVHRR thermal infrared (TIR) band data is now an operational reality [3]. Since 2000, the TIR data of MODIS-Terra can also be used to examine SST observations. However, the error factors in the SST estimation are not limited to the atmospheric effects. Sea surface effects were surveyed to suggest that it should be an error factor in the SST estimation [3]. These effects include salinity of sea water and wind speed, affecting the emission of the sea surface. Since such effects lead to a temperature difference between the sea surface skin and water below the sea surface [4], salinity is considered as one major error factor of the SST estimation in this study. In addition, the relationship between SST and salinity in the area is discussed during 1997-2000 derived from AVHRR data and then examined using MODIS data of 2000. Further studies are still needed to refine the method using more MODIS and MERIS data collections in the near future.

2. Study Area and Satellite Data

2.1 Study Area

The Gulf of Bohai Sea is the only inner sea in China with the total area of 95 000 km². From 1997 to 2000, more than 30 times of “red tide” phenomena had been occurred in Bohai Sea. Among them, two of the largest were respectively formed on 22nd September 1998 with the “red tide” area of about 4990 km² and on 13th July 1999 with the “red tide” area of about 6280 km². During July and September 2000, eight “red tide” phenomena occurred again in Bohai Sea with the area of about 2470 km². Even though many factors may result in these “red tide”