



Coastal environment monitoring using HF radar system in the Yantai waters, China

Cheng TANG¹, Xiangyang ZHENG², Xin LIU¹, Qianguo XING¹, Yanfang LI¹, Tao ZOU¹, Hua ZHANG¹, Ping SHI¹, Robert MAYERLE², Jan HARFF³

¹ Yantai Institute of Coastal Zone Research, Chinese Academy of Sciences, China (ctang@yic.ac.cn)

² Research and Technology Centre, Kiel University, Germany

³ Institute of Marine and Coastal Sciences, University of Szczecin, Poland

1. Introduction

The coast of Yantai waters have been tremendously changed in the last 30 years due to increasing aquaculture business, coastal tourism and other industries, which subjected to serious problems related to coastal erosion, seawater intrusion, and pollution. A sustainable coastal zone management is required by the government to assess the vulnerability and potential of the coastal zone utilization. For this purpose the effectiveness of innovative remote sensing techniques is needed for the long term coastal environment monitoring, among which the HF radar systems can measure surface currents and waves directional spectrum up to more than 100 km offshore, is now a well accepted technology around the world (Fig.1).

2. Radar settings

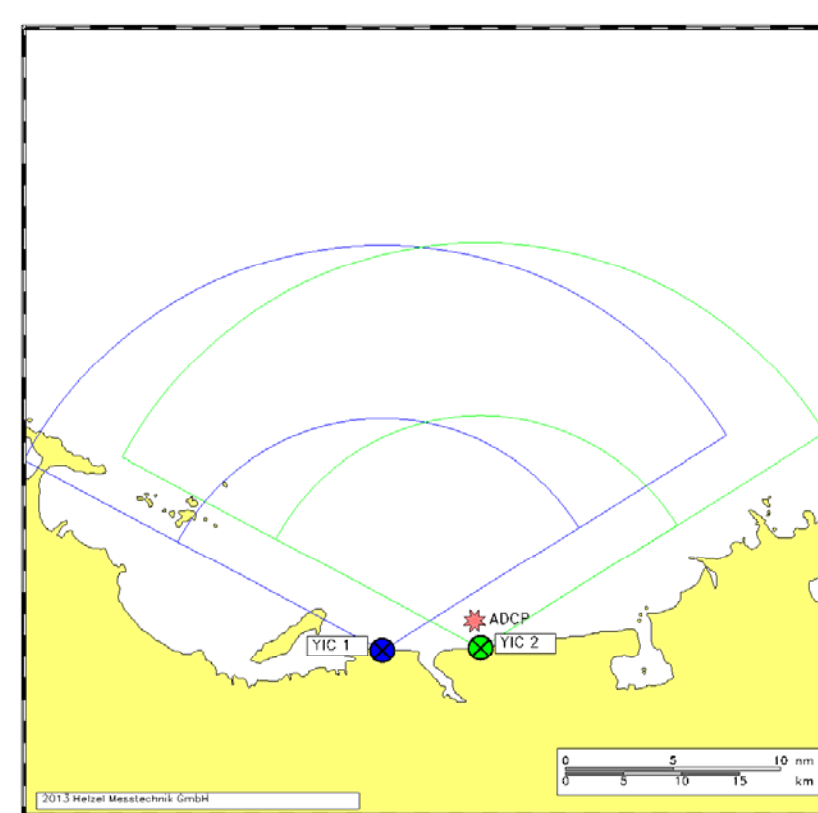


Fig.1 Left: The installed transmit antenna in site 1, Right: the plotted range of HF radar installed in Yantai coast

The WERA system is a shore based remote sensing system using the over the horizon technology to monitor ocean surface currents, waves and wind parameters. The system installed on Yantai coast operating at frequency 26.25 MHz designed to obtain range about 40 km. The radar operates with a mean power of up to 35 w and uses FMcw modulation. The WERA HF radar system has been install in the Yantai coast in August, 2013, the measuring grid off the coast of Yantai can be seen in Fig.2 for 130*80 spacing. The main interest in the Yantai coast is to monitoring the hydrodynamic environment change and its potential impact to coastal aquaculture business.

3. Measurement

The radar is continuously transmitting very low rf power no gating or pulsing sequences are used to provide best signal to noise performance. The output of significant wave height and surface current can be gained by system calculating(Fig.3, Fig.4)

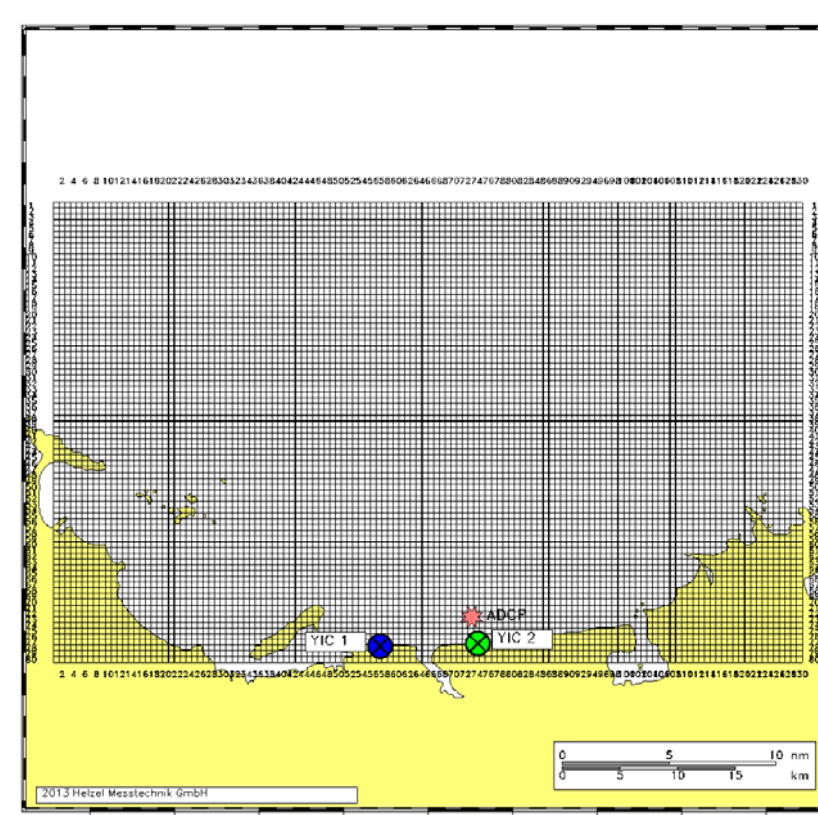


Fig.2 The measured grid in the Yantai waters by WERA system

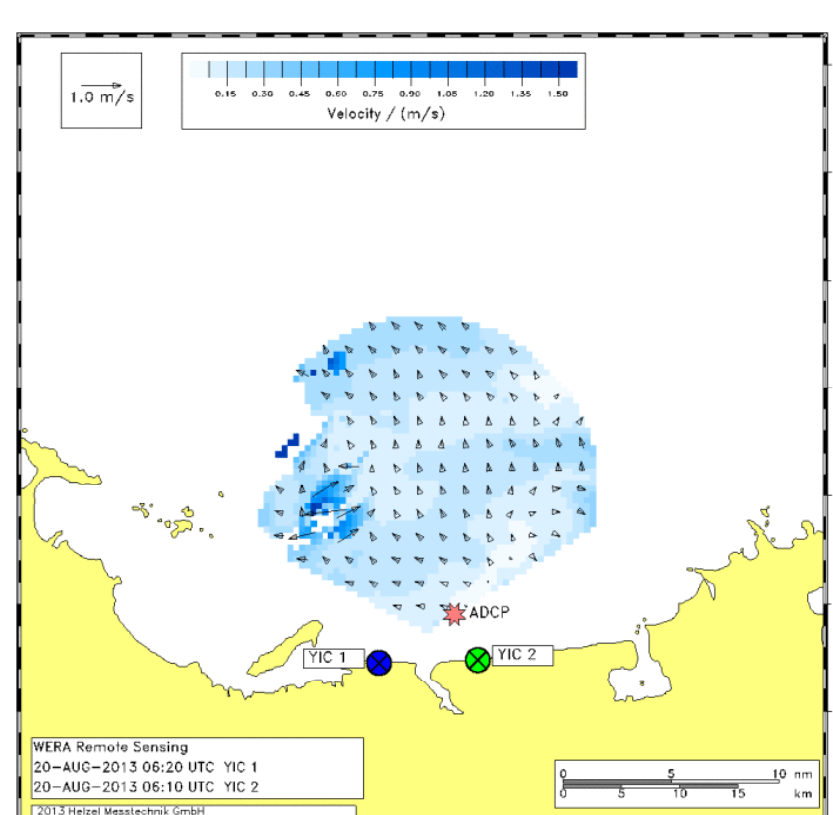


Fig.3 A surface current field(arrows) measured at the Yantai by WERA

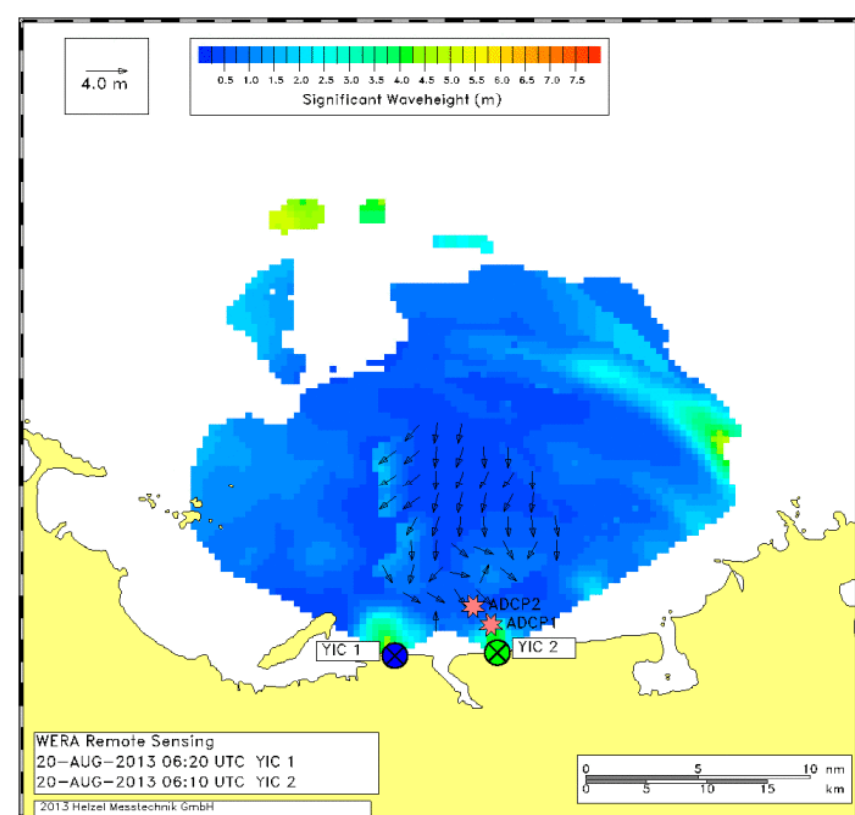


Fig.4 Map of significant wave height averaged at 30 minutes, the arrow on top shows the wind directions

4. Data Validation

For validation, 2 ADCPs were placed within the field of view of the radars(Fig.5). The correlation between the ADCP data and WERA current/wave were excellent(Fig.6, Fig.7) . Some mismatches during the measurement were caused due to power failure and anthropogenic interference.



Fig.5 Left: The ADCP before deployment, Right: ADCP put in the water with diver help

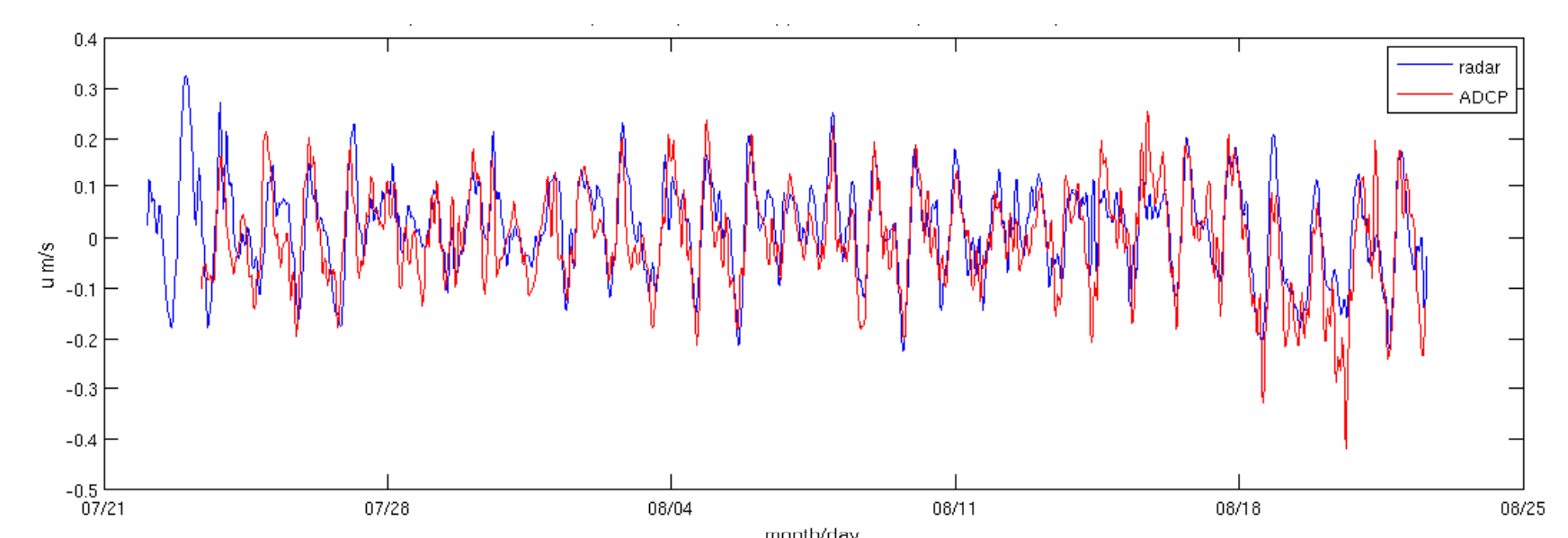


Fig.6 The comparison of surface current velocity (east component) between ADCP measurement and WERA system, coefficient index up to 0.8349

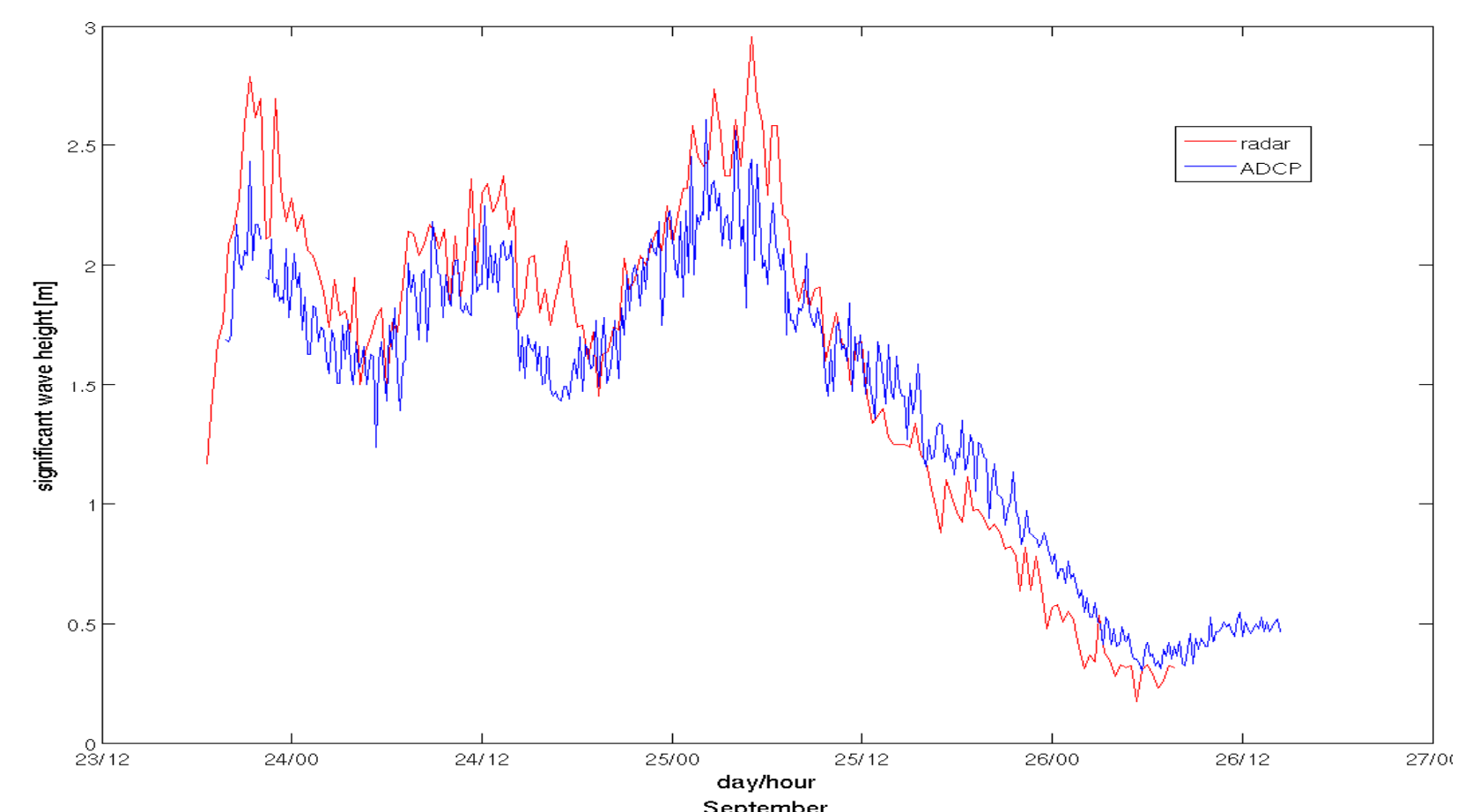


Fig.7 The comparison of significant wave height between ADCP measurement and WERA system,

5. Conclusions

The HF radar system is a powerful instrument which can provide reliable information for the desired coastal waters. The data collected in the Yantai waters show a good correlation with what have been measured from ADCP in the survey area. Some physical, oceanographic and additional technical parameters need to be taken into account to the system specific application.