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Monitoring of Wave with sound using Sensor in Sea Environment

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Abstract. Ocean Acoustic Tomography (OAT) is a technique for analysis of the ocean characteristics, which is a fast and accurate monitoring method. The existing Ocean characteristics analysis is done by using the hydrophones, active acoustics. An active acoustics tomography uses the split-beam systems which are capable of detecting organisms but difficult to get the sea environmental properties. This problem can be solved using coastal acoustic tomography. In this paper a novel technique of ocean characerteristics analysis is done by acquiring the ocean acoustics and Temperature. From acquired coastal acoustics signal patterns the ocean environmental characteristics are extracted .The coastal acoustic signals are acquired from the different locations . From the acquired acoustic signals patterns it was able to analysis the ocean characteristics like wave length, wave period, wave speed, wave troughs. Using these characteristics we can identify the wind, tides and tsunami

Key Words: Sound wave, Tomography, Wave Height, wave troughs

1. Introduction

Ocean waves come in many shapes and sizes. They range in length from a fraction of a centimeter for the smallest ripples to half the circumference of Earth for the tides. They are formed by wind, gravitation, earthquakes, and submarine landslides disturbing the water surface. Once formed, and regardless of origin, ocean waves can travel great distances before reaching the coast. The ocean waves arriving at the shore today may have had their beginnings many hours or even days earlier a hemisphere away. Ocean waves have characteristics that can be measured and used to describe each wave. Among the most useful of these are wave height and wavelength. Wave height is the vertical distance between wave crest and wave trough. Wavelength is the horizontal distance between any two successive wave crests.

The technique for underwater environment characterization consists in transmitting acoustic waves and analyzing, at the receiver, the distortions induced by the environment. This technique, called ocean acoustic tomography and introduced in 80s, allows monitoring ocean properties at variable spatial and time scales. Once the feasibility of active acoustic tomography proved, starting in earlier 2000, new constraints are imposed by operational considerations

Ocean Acoustic Tomography (OAT) is to estimate ocean physical parameters (temperature distribution, currents variability, sediment structure) on wide areas using acoustic data analysis . Classical OAT uses a known sound source and in fixed location and, from the inversion of the acoustical pressure or of the travel time of the acoustic pulse received on an hydrophone array, estimates the sound speed field in the area between the source and the receivers; temperature and current field can be then deduced. Important oceanographic processes such as the evolution of seasonal thermo cline , deep water formation and internal tides can be observed by means of acoustic methods.

D. Gaucher, C. Gervaise and G. Jourdain paper provides methodology to study the conditioning of the inverse problem and proves that classical active OAT based on time delays measurements could not be derived into passive OAT without increasing information about the oceanic parameters and optimization of the measurement sets. In this way, we propose to take into account the spatial structure of arrivals or an optimal choice of rays to improve the conditioning performing: this leads to optimal design of experiments for active or passive OAT.

C. Gervaise, E. Bou Mansour, S. Vallez, H. Le Floch, A. Martin, A. Khenchaf, Y. Simard proposed paper, we address passive acoustic tomography using marine mammals vocalizes and more precisely extraction of propagation features from single hydrophone measurement. Extraction procedures are tested on real world data. Accurate estimates of acoustic properties demand the emission of powerful and recurrent signals in the adapted bandwidth and in agreement with the scale of the monitoring.

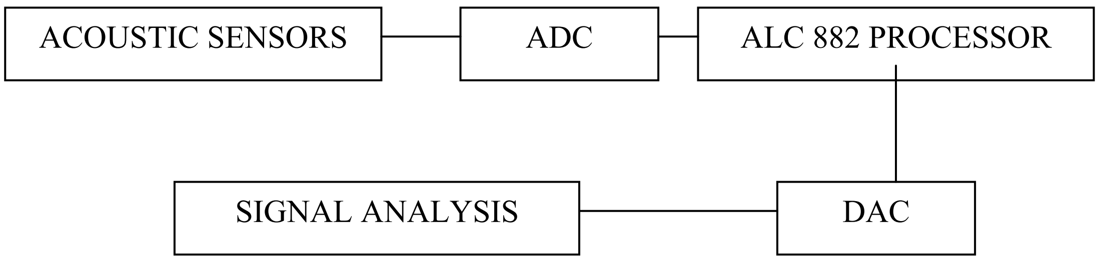
N. Benchekroun, and A. Mansour proposed acoustic tomography is an issue of great importance in many applications. Few algorithms have been dedicated to the passive acoustic tomography of a single input single output (SISO) channel. As matter of fact, most of those algorithms can not be applied in a real situation i.e. for a Multi-Input Multi-Output (MIMO) channel. In this paper, we discussed at first the features of the acoustic channel and signals then we proposed architecture to separate acoustic signals issued from an acoustic realistic channel.

Cornel Ioana, Nicolas Josso, Cédric Gervaise, Jérome Mars, Yann Stéphan Underwater channel is an example of a natural environment potentially characterized by signals generated by various sources : underwater mammals, human activity noise, etc. In order to take advantage of these sources, the concept of passive acoustic tomography has been introduced. According to this concept, the environment parameters could be extracted from the analysis of the received signals.

2. METHODOLOGY

The ocean acoustic signals are recorded using the ALC888 series are high-performance 7.1+2 Channel High Definition Audio Codecs providing ten DAC channels that simultaneously support 7.1 sound playback, plus 2 channels of independent stereo sound output (multiple streaming) through the front panel stereo outputs. The series integrates two stereo ADCs that can support a stereo microphone, and feature Acoustic Echo Cancellation (AEC), Beam Forming (BF), and Noise Suppression (NS) technology. All analog IO are input and output capable, and headphone amplifiers are also integrated at each analog output. All analog IOs can be re-tasked according to user's definitions, or automatically switched depending on the connected device type. After acquiring the acoustic signals it was analyzed by the MATLAB software.

2.1. BLOCK DIAGRAM



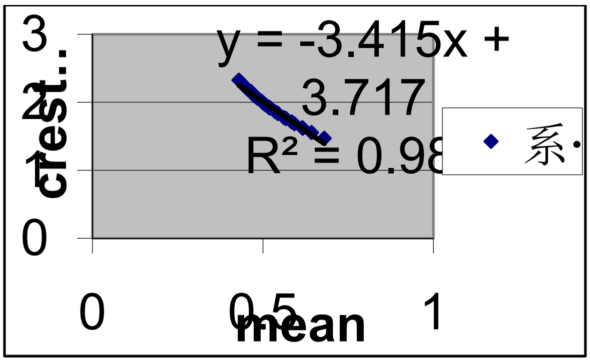
The ALC882 series provide 10 channels of DAC that simultaneously support 7.1 sound playback, plus 2 channels of independent stereo sound output (multiple streaming) through the Front-Out-Left and Front-Out-Right channels. Flexible mixing, mute, and fine gain control functions provide a complete integrated audio solution for next generation multimedia PCs.The DACs (with a highest sampling frequency of 192kHz) and Realtek proprietary hardware content protection are applicable for DVD-Audio, previously only implemented in high-end consumer electronics, and now achieved by PCs with the ALC882 series inside. The ALC882 series also integrate three stereo ADCs that can support a microphone array with Acoustic Echo Cancellation (AEC), Beam Forming (BF), and Noise Suppression (NS) technology simultaneously, significantly improving recording quality for conference calls. With this feature (3 stereo ADCs), the ALC882 series can provide high-quality audio using S/PDIF to output analog data, or for multiple-source recording applications. All analog IO are input and output capable, and headphone amplifiers are also integrated at each analog output. All analog IOs can be re-tasked according to user's definitions, or automatically switched depending on the connected device type.

Ocean waves are also described in terms of wave period. This is the time required for two successive crests to pass a fixed point. From the acoustic ocean signals, it may be easier and more accurate to record how long it takes ten waves to pass and then divide by ten to obtain the average period. An ocean wave is also characterized by wave speed, or the distance it travels divided by the time it takes to travel that distance. Having already determined the time it takes the above wind generated wave to travel a distance of one wavelength (the wave period), determine the wave speed by dividing the wavelength by the wave period. From the Acquired acoustic signals the wave speed are calculated. Tides can be thought of as a global-scale ocean wave generated by gravitational attraction of the Moon and Sun. High tide is the crest of the wave and low tide the trough. Where two high tides occur each day, the wave period is about 12.5 hours. If the wavelength is about 20,000 km (half The circumference of Earth), determine the wave speed as above and record all three wave characteristics and circle the generating factor in the table.

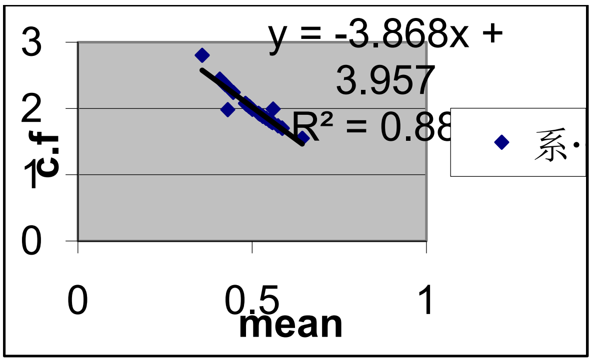
Tsunamis, sometimes erroneously called tidal waves, are ocean waves generated by earthquakes and submarine landslides. They have a period of about 0.5 hour and a wavelength of about 200 km. Again, determine the wave speed as above and record all three characteristics and circle the generating factor in the table. Although the speed of a tsunami is influenced by its interaction with the ocean bottom, using the speed you calculated, it would take about (one hour) (ten hours) (1 day) for a tsunami triggered by a coastal earthquake in Alaska to travel to Hawaii (a distance of 4,000 km). From what you have learned about the factors that generate ocean waves, why is the term “tidal wave” not an accurate term when referring to a tsunami.

2.2. Results and Discussion

In this paper we used coastal acoustic tomography, using acoustic signals as the source to estimate the sea properties like wave height, temperature and sound. The results are achieved from this is mean value and crest factor changes at different locations as monitoring of waves.



POSITION 1



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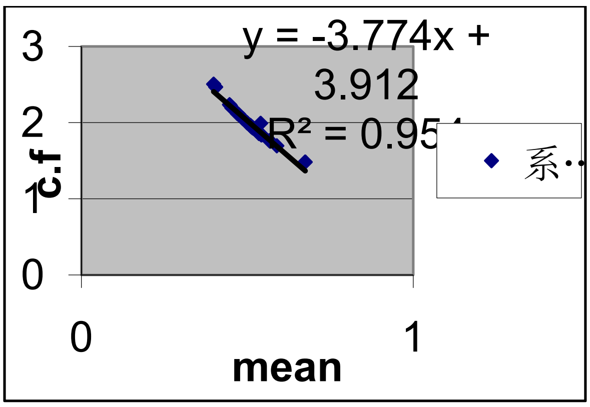

POSITION 3

we use a technique Ocean Acoustic Tomography (OAT), using acoustic sources like sound and temperature. We use that sound as a source and estimate the environmental properties of the ocean. The result achieved in ocean acoustic tomography variation in mean value as the mean value changes for the different wave heights.

2.3. SUMMARY AND CONCLUSIONS

This paper discusses an approach to reconstruct the true environment parameters in the presence of internal wave perturbations. The approach exploits a variety of information sources including direct local sound speed measurements, an oceanographic model of the sound speed field, and a full field acoustic propagation model as well as full field measurements. Through iteratively implementing the inversion procedure, the environmental uncertainty can be reduced and the true environment parameters can be reconstructed more precisely. The approach is applied to a realistic shallow water scenario. The results further demonstrate the validity of the active tomography.

3. ACKNOWLEDGMENT

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