6/16

Walter Hannah

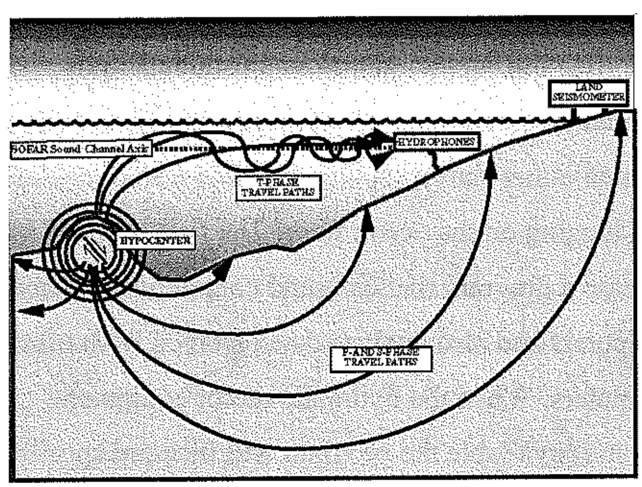
REU Project Proposal

6 / 14 / 04

Introduction

The project I will be working on deals with the development of new underwater acoustic monitoring techniques. One method currently used by PMEL is called a moored hydrophone array. Some downfalls of this approach include noise from the strumming of the hydrophone cable and the delay (non real-time) between when the data is captured and when the data can be processed. The system I will be working on that will solve these problems is a called a QUEphone. This is a hydrophone that sits on the seafloor without a tether and will surface and descend regularly or when a significant seismic or volcanic event occurs to communicate with satellites to send data and track its position. This allows quasi-real time monitoring of an area that would require several (>3) moored hydrophones. Although this device will drift while ascending and descending, it s not expected to drift more than 2 km per cycle.

Scientific Background



Low frequency noise is everywhere in the ocean. Sources of noise include marine mammals, human activities, wind-driven waves, rainfall and seismic events. When earthquakes occur in the ocean crust they produce two basic seismic waves, the primary (P-phase or compression) and secondary (S-phase or shear) waves that travel through the Earth's crust. Tertiary waves (T-phase) are compression waves that travel through the water. Since water has a slower P-phase velocity than the crust, T-phases travel with a slower velocity than primary waves in the

Earth. T-phases are refracted into the ocean sound channel where their rate of energy dissipation is small allowing them to travel greater distances. This makes T-phase very important in the study of seismic and volcanic activity on the ocean floor.

Significance

The importance of understanding seismic activity in the ocean not only includes obtaining information about how the earth is changing, but also helps us predict and prepare for tsunamis that threaten coastal communities. The QUEphone will be especially useful because it will be able to give almost real-time warnings of possible tsunami causing seismic events. This technology can also be utilized to study various marine mammals. Acoustics could be combined with tagging methods to study the movement or migration of various species.

Methods and System Development

Specifically I will be working on programming an embedded system to control the rise and fall of the QUEphone. This will require RS232 communication between the hydraulic motor, Iridium/GPS modem and the main computer. The QUEphone will be equipped with a pressure sensor so the computer will be able to determine the depth and make adjustments to its buoyancy accordingly. This will also be used to know when to either start a satellite transmission or resume data logging on the ocean floor. The first step will be to develop a program that can send commands to other computers and also analyze data received from other computers. When the hydraulic motor equipment becomes available the program will be more specifically tailored to the device. The final step will be field tests to see if the program can accurately and reliably control the buoyancy.