Low Frequency Acoustsics (RAFOS) and Profiling Floats

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LONG-TERM GOALS

It is the long-term goal of this work to add a low-frequency acoustics capability to profiling floats. This capability takes the form of RAFOS tracking, wherein the float is equipped with a RAFOS receiver that processes signals transmitted from moored, low-frequency acoustic sources. This technology has been in existence for many years, but it is new to profiling floats.

OBJECTIVES

The objective of this work is to add a generalized RAFOS capability to profiling floats. The RAFOS technique has been in existence for many years, generally used on RAFOS-dedicated floats that receive signals transmitted at a frequency of 260 hz from moored acoustic sources. Such floats have been used in a number of oceanographic experiments worldwide. However, this technique has not been widely used with profiling floats. The objective here is to add this capability to a few Argo-type floats so that the floats can be tracked continuously during their drift phase. Presently, most Argo-type floats collect positions suitable for velocity calculations only every 10 days or so, when they surface and collect their CTD profiles. The addition of RAFOS will allow the float to be tracked at arbitrarily short intervals, such as 3-4 times a day when necessary. The other objective of this work is to examine the range of optimal parameters that can be used for RAFOS tracking. Traditional RAFOS floats listen for signals 80 seconds long at 260 hz, 3 or 4 times per day. These parameters are necessitated by the relatively small storage capacity and processing capability of traditional RAFOS floats. With profiling floats, a great deal of on-board processing capability exists, and, using the Iridium communications system, signal processing parameters on the float can be changed in real time. We plan to explore the use of variations in processing parameters (ie, length of the signal window, frequency of listening, etc) using Iridium and profiling floats.

APPROACH

In order to carry out this work, 2 profiling floats equipped with RAFOS capability have been built and tested at UW and were deployed in the western N. Atlantic during the summer of 2006. The floats were deployed in an acoustic source array that is maintained by WHOI and several European nations. The floats use the Iridium communications system, so that a large quantity of engineering data can be uploaded at regular intervals at very low cost.

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WORK COMPLETED

Funds for this work were received from ONR in mid-2003. The floats were built in 2005; the delay was caused by the need to fully develop and test the Iridium communications system. The Iridium work has been completed and we have now deployed over 50 Argo floats that employ this technology. We have given the technology to Webb Research Corp. and it is now commercially available. The RAFOS capability was added to 2 Iridium floats so that, through the use of 2-way communications, the RAFOS data could be easily downloaded at intervals chosen by the user. Initially we collected data at one-day or two-day intervals; once we were sure that the system was working well, we changed this parameter to the standard 10-day sampling used by Argo. As conditions warrant, we can change this back to higher frequency sampling whenever we choose.

RESULTS

Two Iridium-RAFOS floats were deployed in the western N. Atlantic during the summer of 2006. One is performing well and is routinely hearing acoustic transmissions from 5 sound sources (see the trajectory and high-resolution profile data shown in Figure 1). The sources are being heard at ranges from 600 to 2000 km. The second float reported data intermittently for a few days, and it was quickly judged that there was a problem with it. Since it was deployed near Bermuda, it was simple to recover the float; this was done in late July of 2006. The float was returned to UW in Seattle, where the problem was found to be simply a loose electrical connection inside the float, probably developed during shipping to Bermuda. This problem was fixed and the float will be redeployed at Bermuda soon. The results from these RAFOS profiling floats will be presented at a national meeting and in a paper that will be submitted to J*ournal of Atmospheric and Oceanic Technology* in 2007.

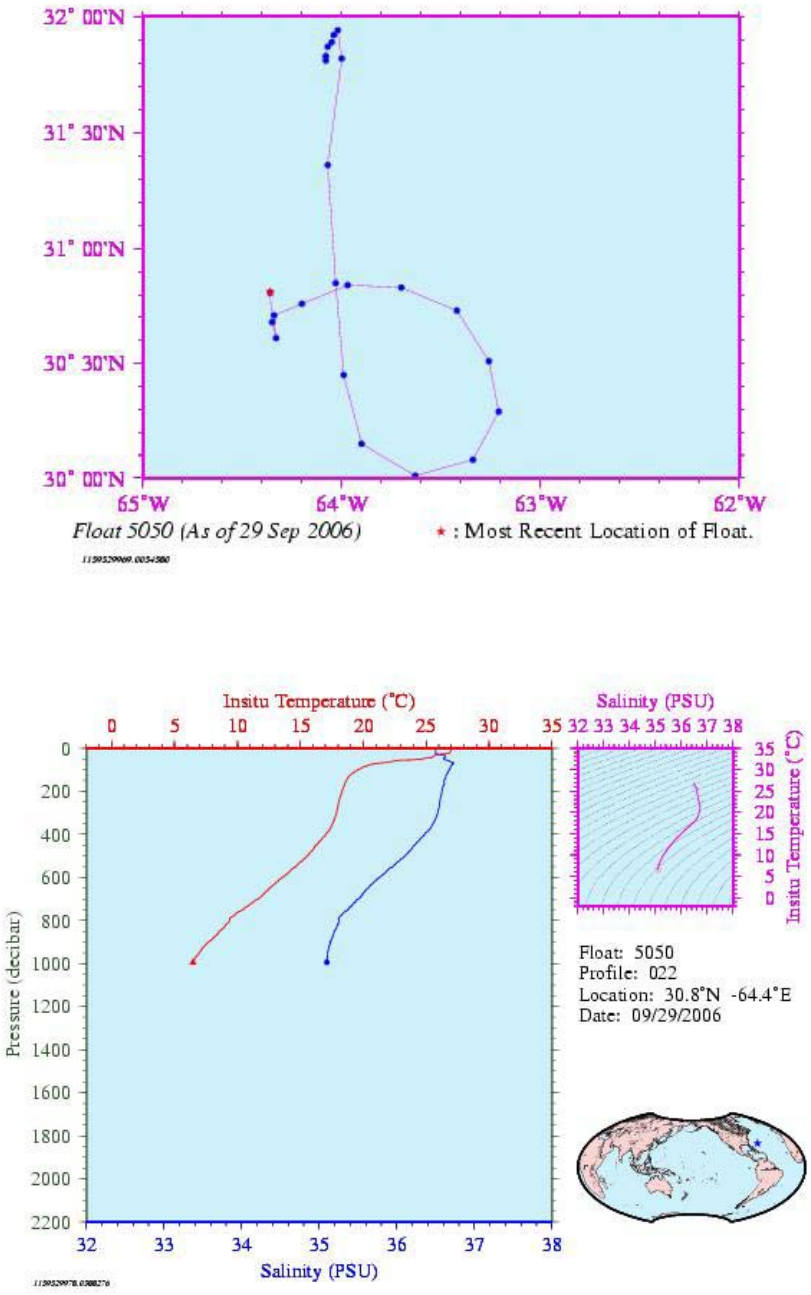

Figure 1. (Top) The trajectory of float 5050 in the western N. Atlantic. Positions are shown at 10-day intervals; these fixes are determined by GPS while the float is on the surface. Between each of these fixes are 10 daily fixes determined by RAFOS techniques, using ranging from moored acoustic sources located in the western N. Atlantic. (Bottom) A CTD profile collected from the float in June, 2006. Data are collected at 2-meter intervals.