Horizontal Variability in Surface Mixing in Response to Wind Forcing

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LONG-TERM GOALS

Our long term goal is to develop a tethered glider vehicle that will carry the microstructure profiler EPSONDE and to use this system to study the horizontal and vertical variability of mixing processes in the ocean mixed layer in response to atmospheric forcing.

OBJECTIVES

The technical objectives for the project have been to complete the mechanical design and testing of the EPSONDE-Glider including flight control design and testing of both hardware and software. Science objectives included performing quasi- horizontal turbulence profiles in the ocean mixed layer as part of an integrated field experiment. Objectives for the last year have been to complete the analysis of data from a field program in the early summer of 1996 which included quasi-horizontal turbulence profiles in the ocean mixed layer as part of an integrated field experiment.

APPROACH

This program involved the integration of an existing vertical profiler with a new mechanical superstructure to enable quasi-horizontal turbulence measurements. The approach minimized design and testing costs for the instrument. A field experiment complemented by vertical microstructure profiles, air-sea flux and wave spectra measurements was completed in the summer of 1996. Key individuals participation in the work were the PI and Dr. Blair Greenan who supervised the development instrument flight control system.

WORK COMPLETED

The instrument design (Figure 1) and testing was completed and a field experiment completed in June,1996 on the Scotian shelf. on Emerald Bank at 43.483N, 62.75W. A total of 116 profiles were performed with the glider on the CSS Parizeau. As a complement to the glider measurements, vertical microstructure profiles with EPSONDE, air-sea flux measurements with a bow anemometer system, boundary layer meteorological data collected with a minimet buoy, wave spectra from a wave rider buoy, ADCP and CTD profiles, wave measurements with a ship-mounted radar. A technical report which details the design and testing of the instrument has been completed, two papers on the experiment have been presented at meetings, and a paper submitted to a journal.

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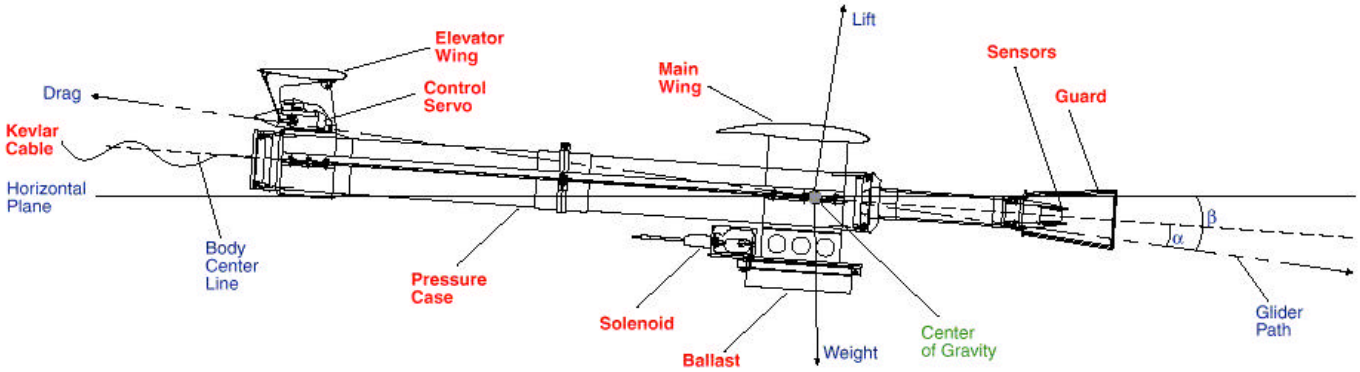

Figure 1: Schematic layout of glider

RESULTS

EPSONDE-Glider has been successfully used at sea to gather microstructure profiles along a quasi-horizontal flight path close to the surface in the mixed layer during a field program in June of 1997. It provides a low-noise platform for near surface dissipation measurements with a noise level of order (10^{-9} W/kg). At the start of a profile the glider rests horizontally at the surface; when the tether is released the nose of the glider sinks below the surface and the pitch increases to 30 degrees but within 20 seconds levels out to a very stable pitch of 14 degrees and remains at this angle until the end of the run. The depth recorded by the pressure transducer increases linearly with time. The vehicle speed initially peaks around 0.6 m/s at the start of the run and then quickly settles to 0.55 m/s. Due to increased drag of the tether towards the end of the flight, the glider speed is reduced to 0.4 m/s. Using the speed and depth results, it is apparent that the actual glider path is a 4:1 ratio of horizontal to vertical distance traveled. The glider payload consisted mainly of the EPSONDE microstructure profiler which measures temperature and velocity microstructure using thermistors and velocity shear probes.

IMPACT/APPLICATIONS

The successful tests and use of EPSONDE-Glider have provided the technical information necessary to this new approach to microstructure profiling. The results have demonstrated that the glider is a feasible platform with a low noise level on the order of 1E-9 W/kg.

TRANSITIONS

RELATED PROJECTS

REFERENCES

Greenan, B.J.W., N.S. Oakey, S.W. Young, L.D. Clark, J.-G. Dessureault, , Canadian Technical Report of Hydrography and Ocean Sciences 186: vii + 193pp.

Greenan, B.J.W., N.S. Oakey,1997. A Tethered Free-Fall Glider to Measure Ocean Turbulence, submitted to Journal of Atmospheric and Oceanic Technology.

Greenan, B.J.W., F.W. Dobson, N.S. Oakey, S.D. Smith,1997, Horizontal Variability in Ocean Surface

Mixing in Response to Wind Forcing, Poster paper presented at the “12th Symposium on Boundary Layers and Turbulence”, Vancouver, July 28 - August 1, 1997.

Greenan, B.J.W., N.S. Oakey,1997. Measuring Turbulence With a Tethered Free-Fall Glider, Proceedings of the Oceans ‘97 MTS/IEEE Conference, Halifax, October 6 - 9, 1997.

Further information on this project may be viewed at
http://www.maritimes.dfo.ca/science/ocean/epsonde/welcome.html