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(4) (2)

Reply to
Department of
OCEANOGRAPHY

Dr. Joseph H. Kravitz
Office of Naval Research, Code 1125GG
800 N. Quincy Street
Arlington, Virginia 22217

January 12, 1989

Dear Joe,

Enclosed are our final report and the abstract for your Summary Report. The information is essentially the same for both, but the format is slightly different.

As a result of discussions during our poster presentation at AGU, we think we have a plausible reason for the long benthic storm when currents were not excessively high. The mooring was in a region where southern ocean spring blooms could occur, delivering material to the seafloor that is resuspended more easily than bioturbated sediment. As we describe in our report, we are pursuing this hypothesis by looking at satellite color data for that time of year.

Regards,

Wilford D. Gardner

Mary Jo Richardson

EDDY-KINETIC ENERGY, BENTHIC STORMS AND SEDIMENT REDISTRIBUTION IN THE ARGENTINE BASIN

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Final Report

Long-Range Scientific Objectives

To establish and define relationships between benthic storms (periods of intense currents and bottom resuspension, Gardner and Sullivan, Science, V. 213, 1981), sediment distribution patterns, and the intensity of eddy kinetic energy observed in surface or bottom waters.

A correlation between benthic storms, background particle concentrations and eddy kinetic energy has been established for the western North Atlantic. We seek to verify a similar correlation for another area known to have high standing stocks of resuspended sediments and surface eddy kinetic energy; the Argentine Basin.

Project Objectives

Previous data have shown the Argentine Basin to be a region of extremely high concentrations and large lateral gradients of suspended sediment. The highest suspended sediment loads found worldwide are located in the Argentine Basin, but, as in the western North Atlantic, maximum values are in the central basin, away from strong boundary currents that would normally be expected to account for resuspension. High values and gradients of eddy kinetic energy are found in surface waters across the Argentine Basin, and, based on Weatherly's findings in the western North Atlantic, are expected to be mirrored at reduced levels in abyssal waters. We plan to determine whether the presence of benthic storms can be predicted by the intensity of abyssal eddy kinetic energy as measured by Weatherly.

Current Status and Progress:

In 1988, we obtained time-series transmissometer data from year-long current-meter/transmissometer moorings deployed by Georges Weatherly (FSU) in a line across the Argentine Basin. The data clearly

show the occurrence of benthic storms based on decreased beam transmission (Fig. 1). The most intense storms, however, do not occur along the margin, where boundary currents are strongest, but further out in the basin, beneath the region of confluence of the Brazil and Falkland currents.

In some cases there is a good correlation between increases in bed-shear stress and particle concentration, but on the continental slope, where currents frequently exceed 40 cm/s, the correlation is particularly poor. There appears to be a better correlation between bed shear stress and increases in particle concentration after currents have been low for several weeks, and a fluff layer with low critical shear stress has been allowed to accumulate. A three-month period of extremely high particle concentrations (mg's/l), but only moderate, yet steady currents occurred at site 5. The material may be advected to the site, but we are exploring an important alternative: spring blooms. Phytoplankton blooms in surface waters have been observed to settle and cover the seafloor in 2-4 weeks in the North Atlantic. The organic fluff is resuspended at currents of 7 cm/s and has been photographed for several months after initial arrival (Lampitt, 1985, Deep-Sea Res., 32:885-897). Spring blooms in this region of the South Atlantic would occur in the September-November period of the high particle concentrations seen at site 5, so we are searching for satellite color data for that period from earlier years to see if such events occur at this site. This would account for the high organic carbon values in the sediment (1%) and would provide a good source of sediment that did not have to be advected long distances to form the drifts and mudwaves of the Argentine Basin.

In addition to comparing transmissometer data with Weatherly's current meter data to determine the relationship between eddy kinetic energy, bed shear stresses, and particle concentrations, we also want to determine the net sediment transport at each site to determine the relationship of transport to bed forms within the Argentine Basin. The particle concentration data will contribute toward verification of Flood's model of sediment wave deposition.

PUBLICATIONS FROM ONR SPONSORED WORK - FY 88

C Gardner, W.D., I.D. Walsh and V.L. Asper, 1987. Comparison of large-particle camera and transmissometer profiles. EOS, Trans. Amer. Geophys. Union, v. 67:1716.

C Gardner, W.D., I.D. Walsh and V.L. Asper, 1987. Comparison of large-particle camera and transmissometer profiles. JOA Meeting, Acapulco, Mexico; Special Symposium on New Techniques, August, 1988

IC Gardner, W.D. and I.D. Walsh, 1988. Role of aggregates in horizontal and vertical flux across a continental margin. EOS, Trans. Amer. Geophys. Union, v. 69:1093

IC Richardson, M.J., W.D. Gardner and G.L. Weatherly, 1988. Benthic storms in the Argentine Basin. EOS, Trans. Amer. Geophys. Union, v. 69:1258.

C Gardner, W.D., M.J. Richardson and D.A. Cacchione, 1988. Sedimentological effects of strong southward flow in the Straits of Florida. EOS, Trans. Amer. Geophys. Union, v. 69:1258.

P...Gardner, W.D., M.J. Richardson and D.A. Cacchione, 1989. Sedimentological effects of strong southward flow in the Straits of Florida. Marine Geology, (in press).

PI Gardner, W.D. and I.D. Walsh, 1988. Role of aggregates in horizontal and vertical flux across a continental margin.

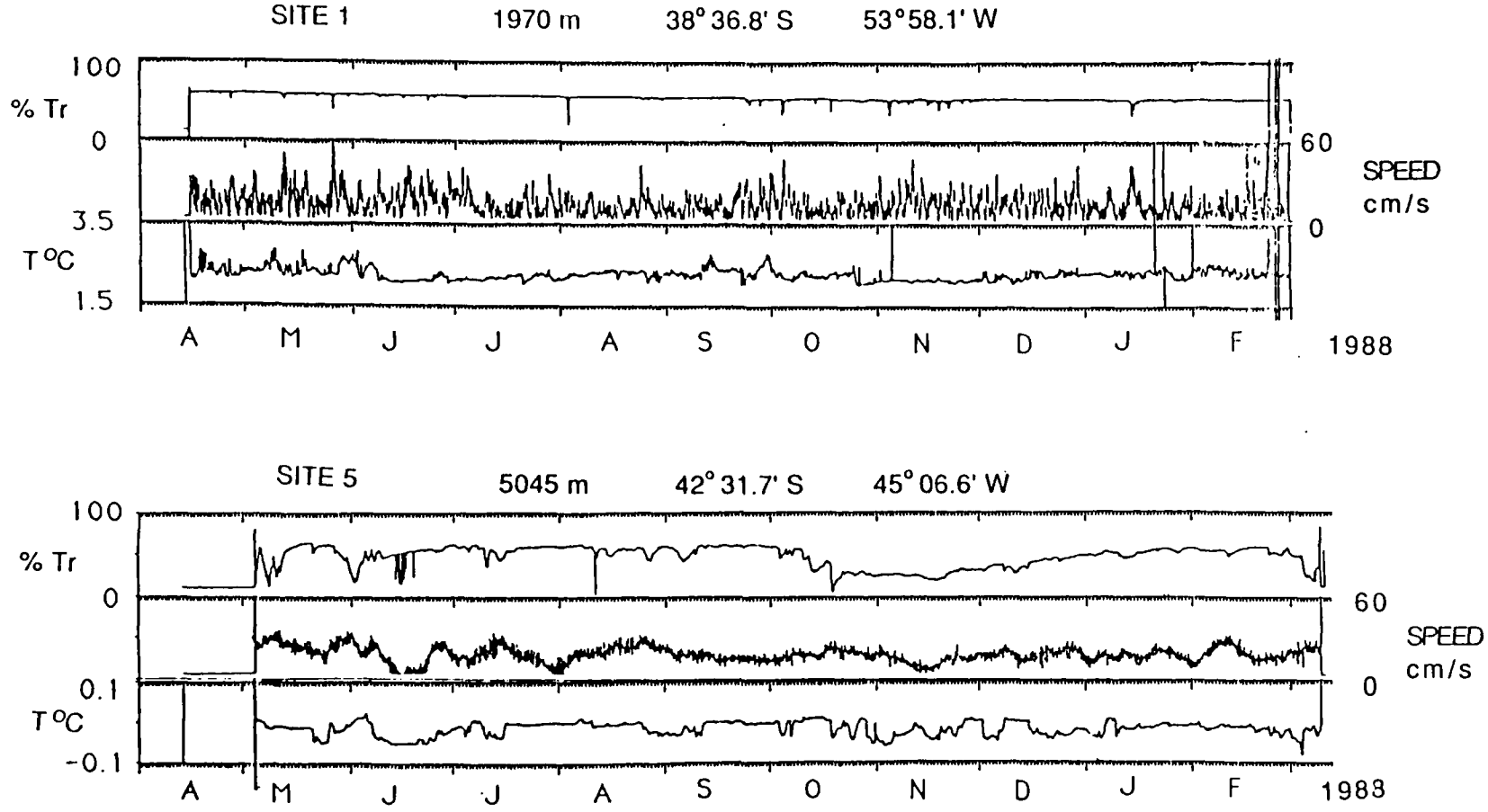

Figure 1. Year-long records of raw percent transmission, current speed, and temperature for sites 1 and 5 in the Argentine Basin (CM data from G. Weatherly, FSU). Instruments were 10 m above the seafloor. Despite frequent strong currents on the slope (Site 1), particle concentrations were generally low, whereas in the central basin particle concentrations were sometimes high even though current speeds were below the expected threshold for erosion. See text for discussion.

Enclosure (3)

PI Summary Data - for ONR programs
(please fill in on this form)

PI W.D. GARDNER/M.J. RICHARDSON

	FY-88**
Papers published in refereed journals	—
Papers accepted or in press, refereed journals	1
Books or chapters published, refereed non-serial publications	—
Books or chapters accepted or in press, refereed non-serial	—
Invited presentations at scientific conferences	2
Contributed presentations at scientific conferences	3
Technical reports and papers in non-refereed journals	—
Patents filed or granted	—
Undergraduate students supported*	—
Graduate students supported*	2
Post-docs supported*	—
Other professional personnel supported*	—
Awards, Honors and Prizes (please list):	—

Names of Graduate Students (GS) and Post-Docs (PD):

Ian Walsh 9mo
Bret Berglund 3mo

* At least part time
** FY 88 = 1 Oct 1987 - 30 Sep 1988