Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 1997		**00-00-1997 to 00-00-1997**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Evolution of Particle Size in Turbid Discharge Plumes	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Dalhousie University,Department of Oceanography,Halifax, Nova Scotia, Canada, B3H 4J1,**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a REPORT	b ABSTRACT	c THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**2**	

EVOLUTION OF PARTICLE SIZE IN TURBID DISCHARGE PLUMES

Paul S. Hill
Department of Oceanography
Dalhousie University Halifax, Nova Scotia, CANADA B3H 4J1
phone: (902) 494--2266 fax: (902) 494--3877
e-mail: paul.hill@.dal.ca

Timothy G. Milligan
Bedford Institute of Oceanography
P. O. Box 1006 Dartmouth, Nova Scotia, CANADA B2Y 4A2
phone: (902) 426--3273 fax: (902) 426--7827
e-mail: tim.milligan@scotia.dfo.ca
Award #N00014--97--1--0160

LONG-TERM GOALS

The long-term goals of this research are to develop and test a particle aggregation parame- terization in turbid, river, discharge plumes.

SCIENTIFIC OBJECTIVES

The proposed research has two objectives. The first is to monitor the evolution of in situ and disaggregated particle size distributions in the Eel River plume during major discharge events. The second is to develop and test a simple parameterization of particle aggregation that can be incorporated directly into dynamic plume models.

APPROACH

The field effort employs a rapid response strategy, in which preset streamflow levels in the Eel River elicit a mobilization of people and gear. Within 24 hours of a ``trigger,'' an instrument package comprising a CTD, optical backscatter sensor, silhouette floc camera (SFC), and 2 depth-actuated Niskin bottles is ready to be deployed from a Coast Guard helicopter. On a wire the instrument package is lowered into the water on a grid of 9-12 stations in the Eel River plume.

The theory component of this research is focussed on development of a parameterization of the aggregation process. By assuming a form for evolving size distributions the system of coupled ordinary differential equations normally employed to model aggregation can be reduced to a single equation. Substantial savings in computational effort derive from this approach, making possible the routine incorporation of aggregation into models of sediment transport.

WORK COMPLETED

In winter 1997 particle size distributions were monitored during two flood events on 7 heli- copter missions. SFC photos for each mission have been digitized, and image analysis has been performed. Water samples have been analyzed for SPM, and disaggregated grain size distributions have been generated with a Coulter Multisizer. A method for fitting Rosin's dis- tribution to disaggregated grain size data has been developed and applied to data. A digital floc camera has been designed and built. A parameterization of aggregation in non-diluting suspensions has been developed.

RESULTS

The Eel River plume is constrained to a narrow band along the coast. It does not flow over the flood deposit as previously expected. Up to 75% of Eel River sediment bypasses the Eel River shelf when discharge is high and alongshelf currents are strong. Flocs in the Eel River plume are always present and tend to be small (d ß 0.25 mm). Flocs are larger (d ß 1mm) when wind and wave energy are low. These observations indicate that aggregation occurs rapidly within the plume, and they suggest turbulence limits floc size during storms. Evolution of disaggregated grain size distributions records time since leaving the river mouth for a parcel of suspension, providing a powerful new tool for environmental interpretation of fine-grained deposits. Finally, by characterizing aggregating size distributions with a simple Junge distribution, a reasonably accurate prediction of aggregation rate within a suspension is possible.

IMPACT/APPLICATION

Observations are helping to refine understanding of modes of delivery of flood sediment to the Eel River Shelf. Bottom-boundary-layer transport of sediment must occur to shift sediment from the nearshore plume to the midshelf flood deposit. Also, significant bypassing of the shelf occurs.

TRANSITIONS No transitions have occurred to date.

RELATED PROJECTS

Similar observations of in situ and disaggregated grain size were made with ONR support in a turbid discharge plume in Yakutat Bay, Alaska. Collaborators are James Syvitski (U. Colorado), Ellen Cowan (Appalachian St. U.) and Ross Powell (N. Illinois U.). Control of floc size by turbulent kinetic energy is being investigated under the aegis of ONR's Coastal Mixing and Optics program. Collaborators are George Voulgaris and John Trowbridge (WHOI).

REFERENCES

Gonzalez, E. A. and P. S. Hill. A method for estimating the flocculation time of monodis- persed sediment suspensions, submitted to Deep-Sea Research, July, 1997. Gonzalez, E. A. and P. S. Hill. An improved estimate of aggregation time, submitted to Colloids and Surfaces A: Physicochemcial and Engineering Aspects, July, 1997.