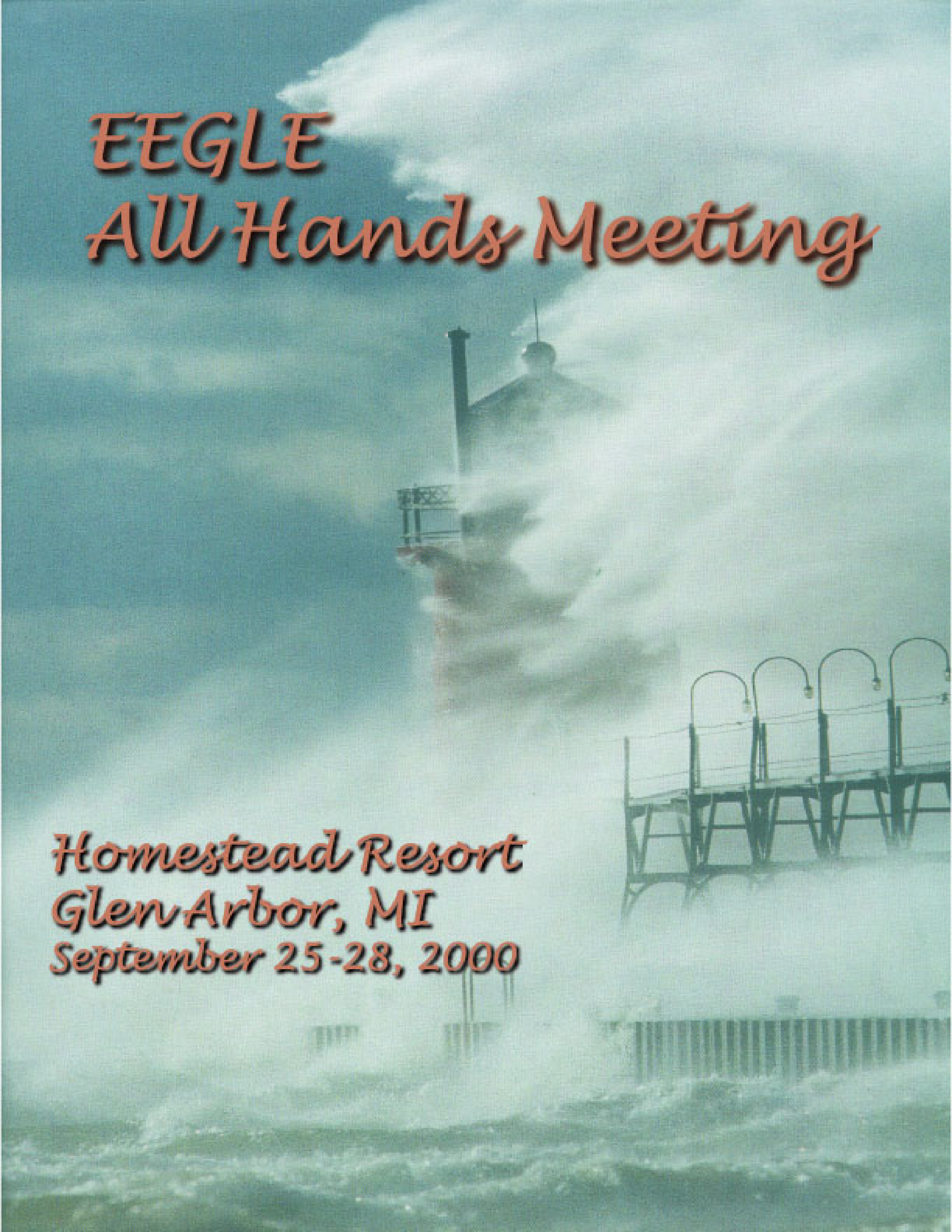
EEGLE
All Hands Meeting



Homestead Resort
Glen Arbor, MI
September 25-28, 2000

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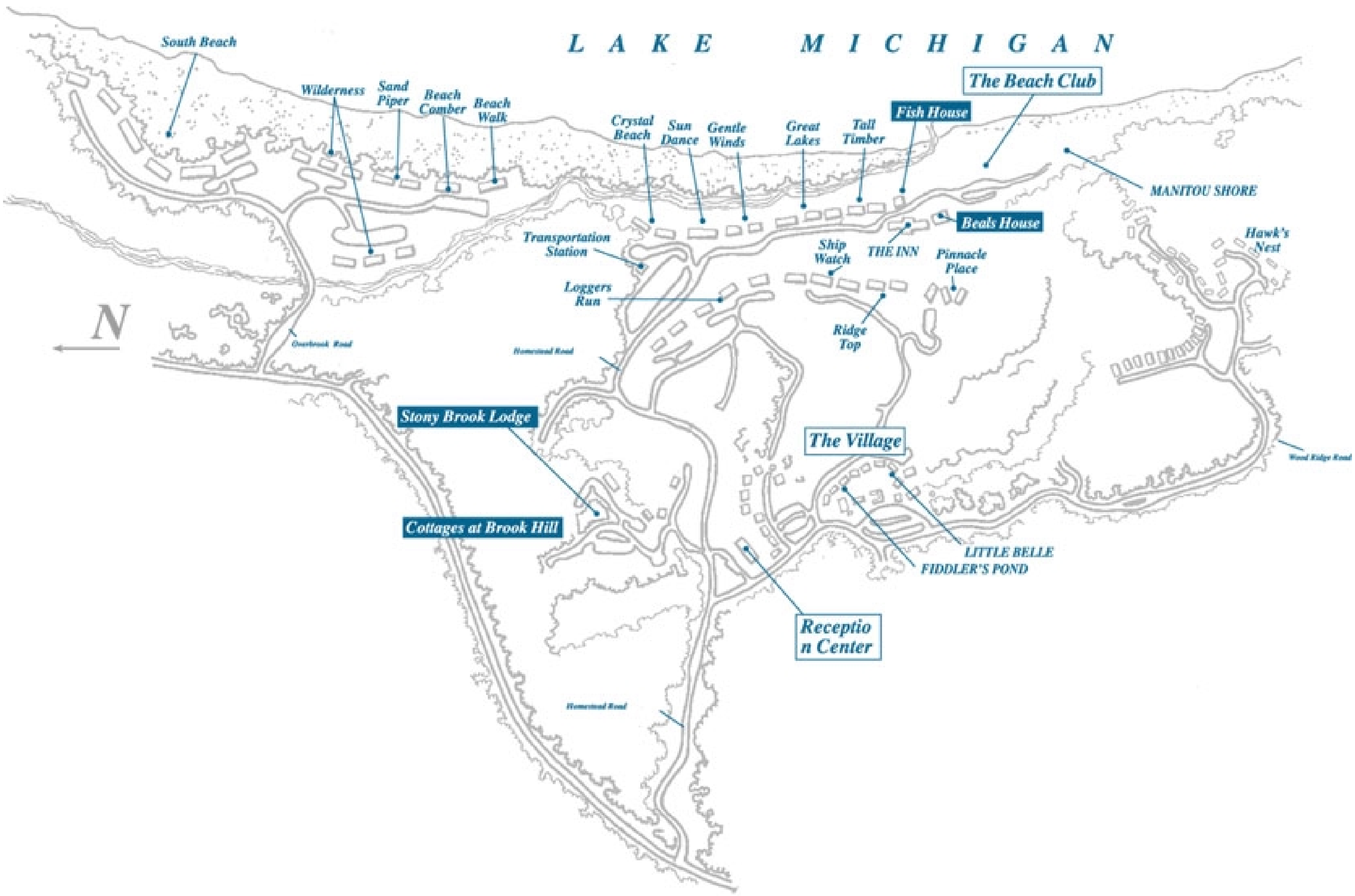


Directions: http://www.thehomesteadresort.com/summer/summerhome.html

Agenda for EEGLE – September 25-27, 2000 Meeting – Homestead Conference Center

Monday, September 25

Travel to Homestead – time to arrive soon after noon

1:00 Registration

2:00 Begin Plenary

- Review the agenda
- Goals for this meeting are to:
  - Distribute Workbook of results to date
  - refresh everyone on the breadth of activities and foster interdisciplinary thinking
  - New Strategy for use of the website to organize information (e.g.Schwab)
  - Charge to the Workgroups (below)

2:30 Break

2:45 Brief overviews of all 20 PI Reports (Schwab, Eadie and Fahnenstiel)

4:30 Any general discussions

5:00 Unstructured time

Dinner (on site)

Evening unstructured time

Tuesday, September 26

Plenary – presentations of preliminary modeling results to focus interdisciplinary discussions. Materials will be provided at the meeting.

8:30 Data synthesis (optimal integrated use of data sets and models)

McCormick and Murthy [~15 minutes]

Physical – ecological modeling.

Chen et al. [~15 minutes]

Sediment transport modeling

Schwab et al. [~15 minutes]

Bedford et al. [~15 minutes]

10:00 Charge to Workgroups

- Discuss progress, problems, etc
- Discuss and identify tentative integrated products
- List of Questions
- Identify participants to a dedicated issue (titles, participants and deadlines)
- Tentatively, Continental Shelf Research, includes KITES
- Reports (20 minutes) to plenary on Thursday at 9:30

10:40 Break, then adjourn to workgroup meetings

- Physical – Ecological [Chair – to be selected by the group]
- Sediment [Chair – to be selected by the group]
- Physical data assimilation [Chair – to be selected by the group]

12:00 Lunch (Provided - on site)

1:00 Reconvene Workgroups

Work while productive then go to smaller group discussions

3:00 Break

Dinner (on your own)

Unstructured time

Wednesday, September 27

- 8:00 Reconvene Workgroups
- 10:00 Break
- 12:00 Lunch (Provided - on site)
- 1:45 Bus trip to Sleeping Bear Dunes National Park
- 5:00 Workgroups or unstructured time
  Dinner (on your own)

Thursday, September 28

- 8:00 Reconvene Workgroups to produce plenary report (copy will be added to web report)
- 9:30 Plenary – Workgroup reports (~20 minutes)
- 10:30 General discussion – consensus on dedicated issue (venue [JGR, Continental Shelf Research, other], participants, and timing)
- 12:00 Lunch (Provided - on site)
- 1:00 Unstructured time

Tentative workgroup assignments

Physical – ecological

Kerfoot, Cotner, Johengen, Fahnenstiel, Lohrenz, Schofield, Millie, Goad, Vanderploeg, Bundy, Gardner, Lavrentyev, Chen

Sediment transport

Schwab, Bedford, Eadie, Edgington, Lesht, Klump, Robbins, Hornbuckle, Liu, Hawley

Physical data assimilation

Budd, Stumpf, Saylor, Miller, McCormick, Vesecky, Beletsky, Roebber, Murthy, Chu

Charge to Workgroups

- Discuss progress, problems, etc
- Discuss and identify tentative integrated products
- List of Questions for discussion (below)
- Develop list of remaining "critical" questions in light of research results to date.
- Identify participants to a dedicated issue (titles, participants and deadlines)
- Tentatively, Continental Shelf Research, includes KITES
- Reports (20 minutes) to plenary on Thursday at 9:30

Some integrating questions / ideas. Also review those for other groups and add others to any group

Workgroup 1: Physical data assimilation

- What meterological conditions needed to initiate a major event ?
- Surrogates for a climatology of Lake Michigan events (timing, duration, magnitude) – length and quality of record(s)
- Ways to quantify the amount of 'stuff' remobilized in events
- How large is the transport to the open lake ?
- Can we tell the story of a major event (1998) or compare events (98 vs 99) as a mechanism for integrating themes ?

Workgroup 2: Sediment

- Can we identify the primary/immediate sources of plume materials
- What do we know about particle transport times ? Residence times in the water and temporary sediment reservoirs
- Ways to quantify the amount of 'stuff' remobilized in events
- How large is the transport to the open lake ?
- Can we tell the story of a major event (1998) or compare events (98 vs 99) as a mechanism for integrating themes ?

Workgroup 3: Physical – ecological

- Ways to quantify the amount of 'stuff' remobilized in events
- How much of these materials become 'active' vs remaining unavailable on the particles ?
- How do the primary producers respond (locally and basin-scale) ?
- How much of the resuspended nutrients pass through the heterotrophs ? Is mineral dissolution an issue ?
- Can we tell the story of a major event (1998) or compare events (98 vs 99) as a mechanism for integrating themes ?

NSF Coastal Ocean Processes (CoOP)

Goals and Objectives

Human activity profoundly affects the coastal ocean, and coastal waters, in turn, influence the lives of the vast and increasing populations that live near them. A better understanding of this environment is imperative for reasons that range from navigation and defense needs to fisheries and weather forecasting.

Toward this end, an interdisciplinary group of coastal ocean scientists has joined together to launch CoOP (Coastal Ocean Processes). We define the coastal ocean as extending from the surf zone to the edge of the continental rise, an area generally ranging from 100 to 1000 kilometers wide and including large inland water bodies that exhibit similar processes. The coastal ocean provides a buffer between the land and the deep ocean. It is dynamically distinct and often isolated from the rest of the ocean. It harbors a number of unique physical and meteorological processes that promote high biological productivity, active sedimentary processes, dynamic chemical transformations and intense air-sea interaction.

Coastal ocean science has traditionally been undertaken by small groups of investigators from one or two disciplines. This approach has succeeded in studies of processes specificto a single discipline, such as tides, but has not built understanding of the complex processes that cut across traditional scientific divisions, such as toxic blooms or sediment dynamics. Although there will always be a crucial role for small groups of investigators, we believe the time is right for large-scale, fully interdisciplinary approaches to the study of the coastal ocean. CoOP therefore encompasses biological, chemical and geological oceanographers as well as marine meteorologists and physical oceanographers. This group's goal is:

to obtain a new level of quantitative understanding of the processes that dominate the transports, transformations and fates of biologically, chemically and geologically important matter on the continental margins.

Understanding cross-margin transport is central to achieving this goal. It links processes at work near the coast to those operating over the shelf and farther offshore. Different processes dominate this transport near the surface, in the central water column, and near the bottom, so that we must pay close attention to each zone. These considerations helped to shape the particular CoOP objectives, to understand:

- The quantitative mechanisms, rates and consequences of cross-margin transport of momentum, energy, solutes, Articulates organisms.

- The atmospheric and air-sea interaction processes that affect biological productivity, chemical transformations and cross-margin solute and particulate transport.
- The role of transport processes that couple the benthic and pelagic zones of the continental margin.
- The nature, effects and fates of terrestrial inputs of solutes, particles and productivity in the coastal ocean.
- The transformations of solutes, particulates and organisms across the continental margin.

To address this set of objectives, the CoOP plan calls for an extended effort. A sequence of process studies receives primary emphasis and gives structure to the overall CoOP effort. Each of these studies focusses on a specific coastal region where one important process dominates. Modeling
studies will be integrated with the process studies and used as a means to synthesize and generalize study results. The geographical diversity of the coastal ocean is too great to allow careful measurements throughout, so the generalizing capabilities of models are crucial to the overall effort. In addition, long time-series measurements, exploratory studies, technological development, and communications (including with the applied science community) all require attention. CoOP is expected to attract support from a number of agencies having an interest in the coastal ocean sciences.

The organization of CoOP calls for scientists to initiate the major CoOP field studies; for each, one scientist will be charged with organizing a workshop to define the specificinterdisciplinary objectives and approach. The CoOP steering committee will then work with the scientist to refine the resulting plan to assure that it is well-defined, scientifically satisfying and appropriately interdisciplinary. Further, the steering committee will interact with funding agencies to help coordinate and prioritize the scientific efforts.

From Brink et al. 1992. Coastal Ocean Processes: A Science Prospectus. Technical Report WHOI-92-18. Woods Hole Oceanographic Institution, Woods Hole, MA

NOAA Coastal Ocean Program (COP)

Goals and Objectives

NOAA's Coastal Ocean Program (COP), part of the National Centers for Coastal Ocean Science (NCCOS), provides scientific information to assist decision makers to meet the challenges of managing our Nation's coastal resources. COP targets critical issues which exist in the Nation's estuaries, coastal waters, and Great Lakes. COP translates its findings into accessible information for coastal managers, planners, lawmakers, and the public. Its aim is to create near-term and continuous improvements in environmental decisions affecting the coastal ocean and its resources. The Coastal Ocean Program (COP) provides a focal point through which the agency, together with other organizations with responsibilities for the coastal environment and its resources, can make significant strides toward finding the solutions that will protect coastal resources and ensure their availability and well-being for future generations.

EEGLE: Episodic Events - Great Lakes Experiment

The Impact of Episodic Events on the Nearshore-Offshore Transport and Transformation of Biogeochemically Important Materials in the Great Lakes

B. Eadie, D. Schwab, V. Klump, W. Gardner

Program Summary

This proposal is submitted in response to the NSF/OCE and NOAA/COP Joint Announcement of Opportunity for Coastal Studies in the Great Lakes (NSF Publication 97-38). This proposal has been developed to focus on a critical theme that was common to two workshops (NOAA 1992; Klump *et al.* 1995): the importance of episodic events on nearshore-offshore transport and subsequent ecological consequences. Each of the components of this program is being led by a team of scientists with proven experience and long-term interest in coastal research. The episodic events study described in these proposals provides a unique opportunity to combine their talents in a comprehensive program directed toward the NSF-NOAA goals as defined in the Announcement of Opportunity:

1. to determine what processes control the cross-margin (inshore to offshore) transport of biological, chemical, and geological materials in the coastal margins of the Great Lakes, and
2. to develop and test scientific strategies for assessing, quantifying, and predicting the impacts of multiple stressors, both natural and anthropogenic, in the Great Lakes or selected sub-regions.

Issue: A tight coupling between contaminated sediments and overlying water exists in lakes and coastal ecosystems through the process of sediment resuspension. Recent satellite observations of suspended sedimentary material in Lake Michigan illustrate a unique opportunity to investigate an annually recurrent major episode of nearshore-offshore transport, a 10 km wide plume of resuspended material extending over 200 km along the southern shores of the lake (Fig. 1). The plume appears to be initiated by a major late winter storm after the melting of surface ice, and it eventually veers offshore along the eastern shore of the lake, coincident with the area of highest measured sediment accumulation in the lake. The inventory of particulate matter in the plume, on April 2, 1996, is approximately equal to the total annual load of fine sediments into the southern basin. Preliminary evidence indicates that this episodic event may be the major mechanism for cross-margin sediment transport in Lake Michigan. We believe this type of event is ideal for studying internal recycling of biogeochemically important materials (BIMS), ecosystem responses, and one of the major processes controlling cross-isobath transport in the Great Lakes. While we are focusing on a particular episodic process in southern Lake Michigan, the program results will be applicable to similar events in many coastal areas.

Significance: The episodic resuspension and subsequent transport of surface sediments profoundly influences biogeochemical processes in coastal ecosystems. Resuspension and transport of the large inventories of nutrients and contaminants deposited over the past few decades (e.g. P, ^{137}Cs, PCBs), presently results in much greater fluxes to the water column than from all external inputs. In addition, control of biological processes can occur as a result of effects on light and substrate availability and the introduction of meroplanktonic species. The magnitude and episodic nature of these processes in the Great Lakes has been poorly described from a few point measurements or as the residual term in mass balance models. This multi-disciplinary project will employ a comprehensive measurement and modeling approach to examine and compare effects of episodic physical forcing in relation to more persistent long-term (i.e., seasonal meteorological) forcing on nutrient inventories, fluxes and distributions, and on biological distributions and rate processes. The results of this proposed research will improve our understanding of critical processes and support the development of a resource management-oriented information and modeling system.

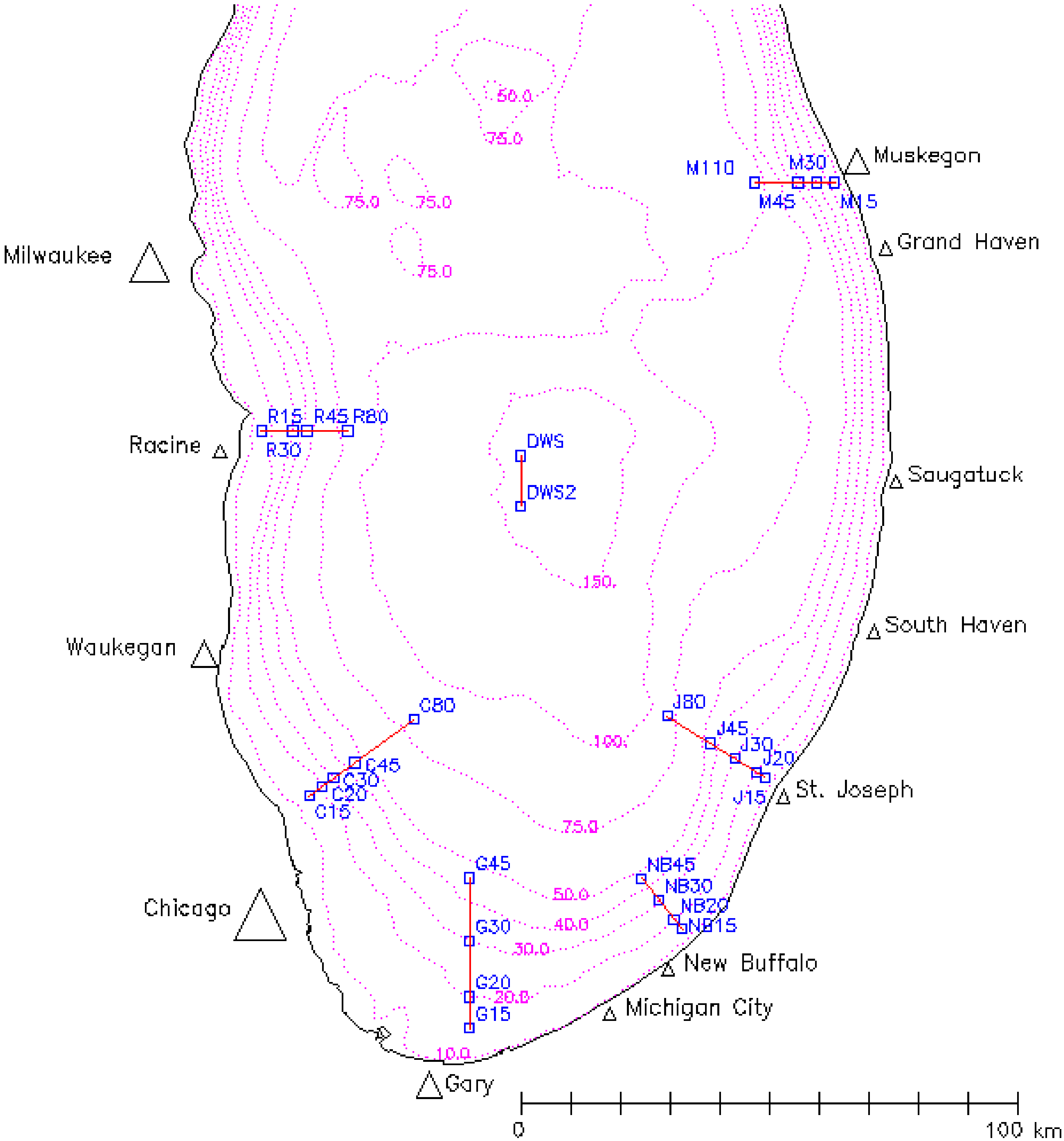
Program Goal: The purpose of this program is to create an integrated observational program and numerical modeling effort to identify, quantify, and develop prediction tools for the winter-spring resuspension event and to assess the impact of this event on the transport and transformation of BIMS and on lake ecology. Three fundamental hypotheses focus this program:

1. that the plume is a result of the first winter-spring storm after ice-out and represents the resuspension of particulate materials (and associated constituents) that have been stored in the lake as surface sediment "floc" for a distribution of times, during which they have undergone differential diagenesis,

2. that the forced, two-gyre vorticity wave response of the lake to episodic wind events, occasionally modified by stratification, is a major mechanism for nearshore-offshore transport of particulate matter and associated constituents in the Great Lakes, and

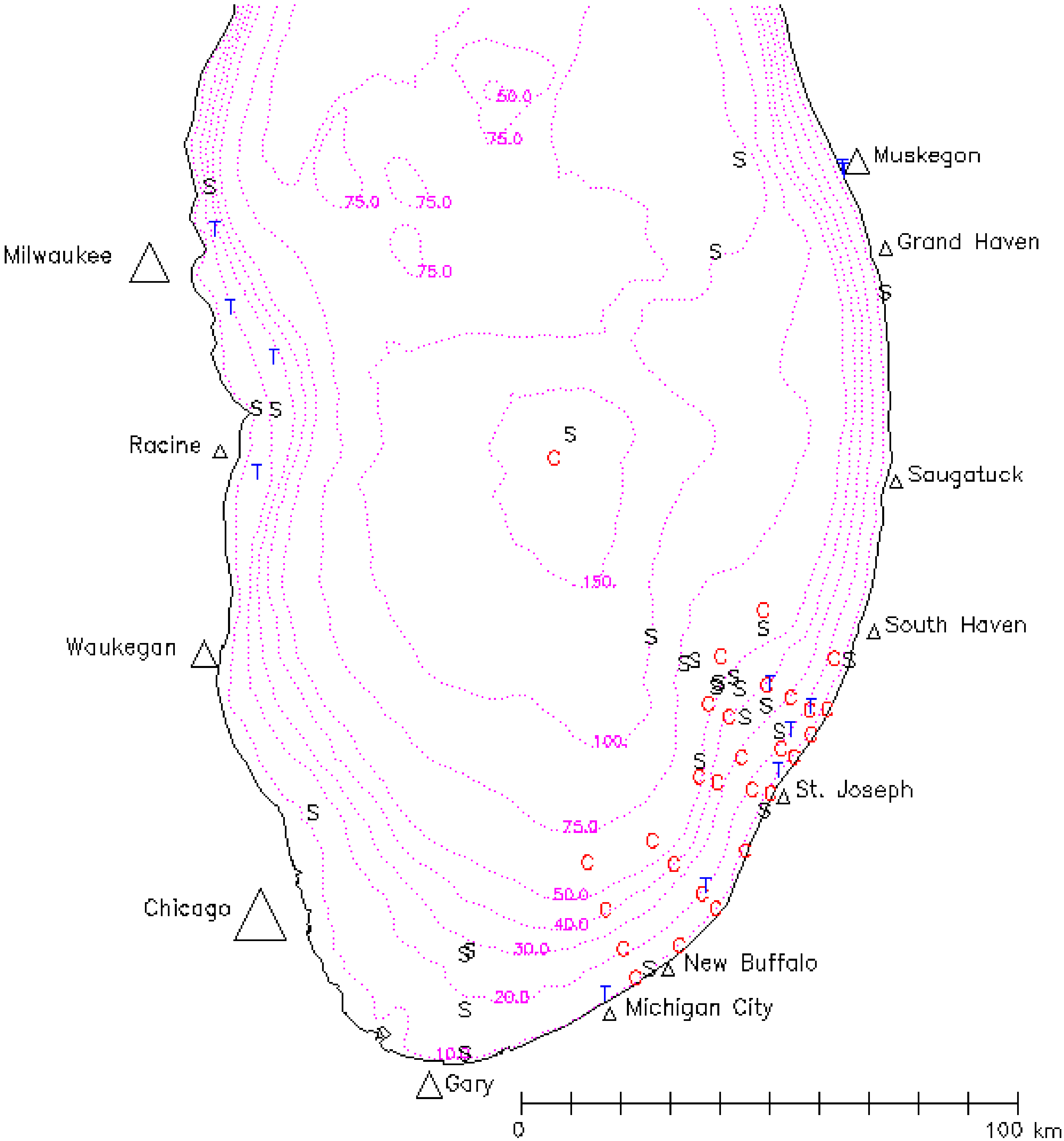
3. that physical processes, (e.g. resuspension, turbulence) associated with the plume event are important in determining the nutrient and light climate, and in structuring the biological communities throughout the spring isothermal period, and in setting the conditions for the critical `spring bloom' period.

Location of EEGLE Transects, 1997–2000

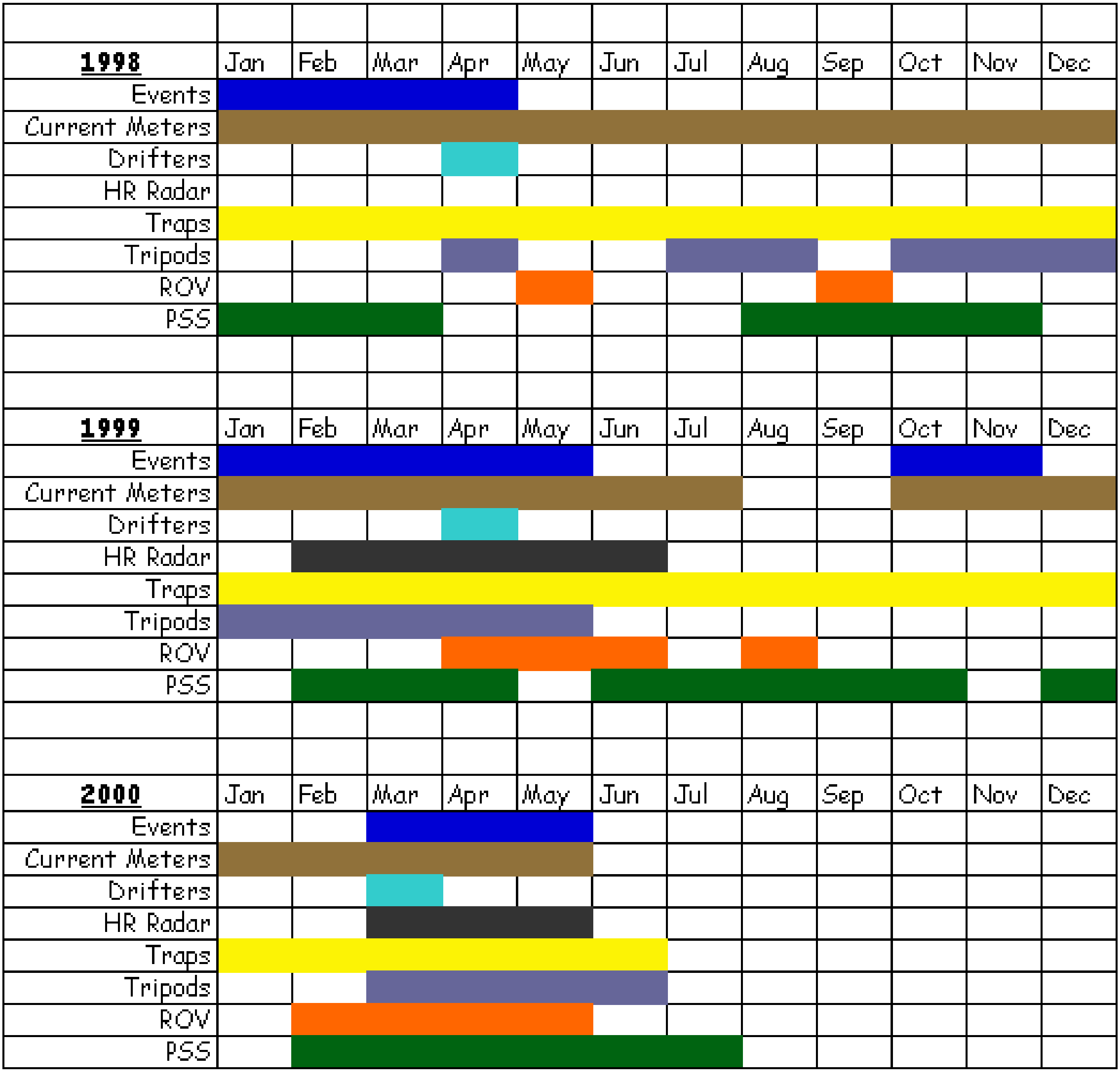


Location of EEGLE Moorings, 1997–2000

C = Current Meter   T = Tripod   S = Sediment Trap



EEGLE Field Activities



EEGLE Cruise, Web, & Data Statistics
(www.glerl.noaa.gov/eegle)

	1997 - 2000
Cruises	109
Total Days	396
Water Samples	675
Plankton Survey Tows	115
Trap samples	816
Current meters	66
Drifter days	690
Papers	13
Presentations - Public	46
Presentations - Professional	58
Data Objects Submitted	871 (540 MB)
Visits to EEGLE web site	58,325

- statistics as of August, 2000

Special Sessions at:
- ASLO-99 Sante Fe, NM, Feb, 1999
- IAGLR-99 Cleveland, OH, May, 1999
- Ocean Sciences, San Antonio, TX Feb, 2000
- SIL Melbourne, Australia Feb, 2001

EEGLE All-hands meetings (3 day workshops)
- Milwaukee, WI Oct, 1997
- Ann Arbor, MI Oct, 1998
- Minneapolis, MN Oct, 1999
- Glen Arbor, MI Sep, 2000
- Argonne National Lab Dec, 2000

Example of Planned Web Pages for each EEGLE Activity

Project 5
The Impact of Episodic Events on Nearshore-Offshore Transport in the Great Lakes:
Hydrodynamic Modeling Program
D. Schwab and D. Beletsky

- **Abstract**
- **Full Proposal (pdf)**
- **Products**

  Reports

  1. Summary of Project Results, Sep, 2000
  2. Report from 3rd Modeling Workgroup Meeting, GLERL, June, 2000
  3. Report from 2nd Modeling Workgroup Meeting, GLERL, May, 1998

  Manuscripts

  1. Lou, J., D.J. Schwab, and D. Beletsky. 1999. Suspended sediment transport modeling in Lake Michigan. Proceedings of the 1999 Canadian Coastal Conference, May 19-22, 1999, Victoria, British Columbia, Canada, pp.391-405.
  2. Schwab, D.J., Beletsky, D., and Lou, J., 1999. The 1998 coastal turbidity plume in Lake Michigan. Special issue of Estuarine, Coastal, and Shelf Science on Visualization in Coastal Marine Science (in press). MS Word (430 KB) | Postscript (520 KB) | PDF (700 KB)

  Presentations

  1. D.J. Schwab, D. Beletsky, J. Lou, M.J. McCormick, G.S. Miller, P.J. Roebber. 2000. Modeling the 1998 Coastal Turbidity Plume Event in Lake Michigan. 2000 Ocean Sciences Meeting, ASLO-AGU, Jan 24-28, San Antonio, TX.
  2. Beletsky,D., D.J. Schwab, M.J. McCormick, G. S. Miller, J.H. Saylor, and P.J. Roebber. 1999. Hydrodynamic modeling for the 1998 Lake Michigan coastal turbidity plume event. The 6th International Conference on Estuarine and Coastal Modeling, November 3-5, 1999, New Orleans, LA.
  3. Beletsky, D., Schwab, D.J., Lou, J. 1999. Hydrodynamics of a coastal turbidity plume in Lake Michigan. IAGLR Meeting, May 24-28, 1999, Cleveland, OH.

4. Lou, J., Schwab, D.J., and Beletsky, D. 1999. Sediment resuspension and transport under waves and currents in Lake Michigan: A model study. IAGLR Meeting, May 24-28, 1999, Cleveland, OH.
5. Schwab, D. J., Beletsky, D. and Lou, J., 1999, Modeling and Visualization of Circulation Patterns and Sediment Transport in Lake Michigan During Episodic Events. ASLO Meeting, Feb. 1-5, 1999, Santa Fe, New Mexico
6. Schwab, D.J. 1998. EEGLE update to NSF/CoOP Steering Committee, Salt Lake City, UT. Oct, 1998

Posters

1. Hydrodynamic and Sediment Transport Modeling of March 1998 Resuspension Event in Lake Michigan. Beletsky et al. GLERL/CILER. 3rd EEGLE/KITES Workshop. Minneapolis, MN. Oct 27-30, 1999.

- **Miscellaneous Results**

Figures

1. Figure 1. Geometry and bathymetry of Lake Michigan showing 2 km computational grid, meteorological stations, and location of mid-lake station in southern Lake Michigan.
2. Figure 2. Satellite measurements of surface reflectance in southern Lake Michigan.
3. Figure 3. Long term sediment accumulation in southern Lake Michigan (Foster and Colman, 1992). The five ranges of sediment thickness depicted in the map are (from lightest to darkest): 1-2 m, 2-6 m, 6-10 m, 10-14 m, and 14 m. Labeled bathymetric contours are in meters.
4. Figure 4. Time series of interpolated wind and modeled waves at a location in the center of southern Lake Michigan for 1-30 March, 1998.
5. Figure 5. Snapshots of particle trajectory animation at times corresponding to satellite images in Figure 2.
6. Figure 6. Snapshots of suspended sediment concentration animation at times corresponding to satellite images in Figure 2.
7. Figure 7. Net sediment erosion or deposition calculated from the sediment transport model during March, 1998. The positive values (red) represent deposition, and the negative values (blue) show erosion in mm.

Animations

1. Modeled significant wave height in Lake Michigan for 1-30 March, 1998. AVI (6MB) | FLC (11MB) |
2. Modeled particle trajectories in Lake Michigan for 1-30 March, 1998. AVI (5MB) | FLC (4MB) |
3. Modeled surface suspended sediment concentration in Lake Michigan for

1-30 March, 1998. AVI (8MB) | FLC (8MB) |

4. Rotating 3-d Bathymetry of Lake Michigan. AVI (59MB) | FLC (67MB) |
5. 1998 Lake Michigan Circulation, Mar-Apr (FLC, 8MB)
6. 1999 Lake Michigan Circulation, Mar-Apr (FLC, 8MB)