MARINE SEMINAR

SUMMARY OF A GREAT LAKES FORECASTING SEMINAR

Great Lakes Environmental Research Laboratory
Ann Arbor, Michigan
14–18 September 1987

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1. INTRODUCTION

Approximately 40 million people live around the Great Lakes. This number comprises about 13 percent of the total United States population and 32 percent of all Canadians. It is estimated that over one million small boats use the Great Lakes and over 5 million sports fishermen fish them. In addition, the U.S. Great Lake shipping fleet totals 70 vessels of which 13 are 1000 feet in length.

In recognition of these facts, NOAA's National Ocean Service (NOS) and National Weather Service (NWS) sponsored a Great Lakes Forecasting Seminar for meteorologists and oceanographers concerned with operational marine forecasting in the region. The seminar was held at the Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, Michigan from 14 through 18 September 1987.

The seminar was organized by Dr. William Hubert, Chief Scientist of Ocean Data Systems Inc. (ODSI), under a contract to NOS. Welcoming remarks were given by Dr. Alfred Beeton on behalf of GLERL, by Dr. Glenn Flittner on behalf of NOS, and by Mr. Paul Jacobs on behalf of NWS. Mr. Jacobs served as session coordinator/moderator throughout the seminar. A list of seminar lecturers is found in Appendix 1, and a list of participating government offices and corporations is found in Appendix 2.

2. BACKGROUND

The purpose of the seminar was to improve the operational forecasters' knowledge of the latest techniques available to forecast marine weather events in the Great Lakes Region. The timing and location of the meeting were appropriate because the lakes have been experiencing the highest water levels in recent history. As a consequence, major storms over the Great Lakes have produced winds, waves, and storm surges which, when added to the already high lake levels, have produced severe damage to coastal properties.

3. CURRICULUM

The seminar was organized into four major modules (Winds, Waves, Storm Surges, and Severe Local Storms) and several other related modules. Case study or workshop sessions were conducted during each of the major modules. These sessions were conducted by the module lecturer or by invited forecasters of long experience and consisted of detailed discussions and hindcast activities for selected severe weather events. A list of the general topics which comprised the curriculum is shown in Table 1.

Table 1. List of topics covered in the Great Lakes Forecasting Seminar.

Lakes Limnology
Summary of GLERL Activities
Summary of Great Lakes Environment
Extratropical Storms (General)
Extratropical Storm Prediction for the Great Lakes
Central Guidance Support
Field Requirements for Guidance Support
Great Lakes Buoy and C-MAN Program
Great Lakes Winds
*Wind Forecast Techniques
Wave Forecasting (General and Great Lakes)
Great Lakes Wave Prediction Model
Great Lakes Wave Guidance
*Wave Forecast Techniques
Storm Surge (General)
Great Lakes Surge and Seiche
Great Lakes Water Level Network
*Surge Analysis and Forecast Techniques
Great Lakes Severe Local Storms
*Severe Local Storm Analysis and Forecast Techniques
Great Lakes Snowburst Forecasting
Great Lakes Enhancement Program Briefing
User Education/Outreach
Lakes Carriers Weather Requirements/Problems

As shown by the asterisks in Table 1, a considerable portion of the seminar was devoted to the case studies of selected severe storms around the Great Lakes. At least one severe storm was subjected to hindcast re-evaluation during each of the major modules covered by the seminar. Experienced forecasters served as discussion leaders for each storm and generally presented a synoptic overview of the storm to set the stage for the workshop. Case study materials consisting of observation collectives, surface and upper air charts, satellite images and radar images (in some cases) were available for each participant.

Two Personal Computers, furnished by GLERL, were set up in the conference room for the running of wave and storm surge models for selected storm cases. The participants constructed different scenarios of steady-state and time-varying wind fields and stability structures as inputs to the model runs. A list of the various severe storms subjected to case-study investigation is presented in Table 2.

The seminar also discussed an investigation of 1321 Great Lakes storm events covering the period from January 1960 through December 1985 prepared by NOS (4) and a new study

Table 2. List of severe storms used as workshop case studies at the Great Lakes Forecasting Seminar.

WINDS MODULE	
• June 20, 1987.	The Oshawa Yacht Club incident.
• August 9, 1987.	Wind and wave conditions over Lake Ontario during the sinking of the ROGUE WAVE.
WAVES MODULE	
• November 9–11, 1975.	The famous EDMUND FITZGERALD storm.
STORM SURGE MODULE	
• November 13–15, 1972.	A "Northeasterly" storm with severe winds, surge, waves, and flooding.
• January 26–27, 1978.	A record-setting "Blizzard Cyclone" with strong surges on Lake Erie.
• April 5–6, 1979.	The "Spring Monster" of the year.
• February 8–9, 1987.	The storm which closed Lake Shore Drive in Chicago.
SEVERE LOCAL STORMS MODULE	
• July 20, 1987.	A "Derecho" situation with a persistant outbreak of tornados and severe thunderstorms over the lower Great Lakes.

prepared for the Atmospheric Environment Service of Canada (AES) for about 100 classical storms around the Great Lakes (5).

4. GREAT LAKES FORECASTER'S HANDBOOK

Prior to the seminar, Dr. Hubert and Mr. Dean R. Morford of ODSI prepared a Great Lakes Forecaster's Handbook (6) which was distributed to each participant upon arrival at the seminar. The handbook was assembled in loose-leaf form so that attendees could add any new material which became available as the lectures progressed. A final version which contains copies of pertinent articles as well as charts, lists of observations, cloud images, etc. used in workshop sessions has been assembled (7) and distributed to each office represented at the seminar.

Mr. Marvin Miller, Meteorologist-in-Charge at the Weather Service Forecast Office (WSFO), Cleveland, video-taped the entire seminar. It is anticipated that an edited version and the final handbook will be used for local reference and training at offices concerned with marine forecasting around the Great Lakes.

5. OPERATIONAL CONSIDERATIONS

In recognition of the importance of marine forecasting in the Great Lakes Region, NOAA has implemented a *Enhancement Program for Marine Weather Services on the Great Lakes*. WSFO Cleveland has been designated as the focal point for marine weather information, warning coordination and user outreach in the Enhancement Program. They are in the process of activating a "Marine Forecast Desk" to carry out the following objectives:

- Ensure that Great Lakes storm episodes affecting the safety and efficiency of interlake navigation are addressed in a prompt and consistent manner.
- Develop an automated Marine Monitoring (MARMON) Program to be run on the new MicroVax system at WSFO Cleveland for alerting Great Lakes WSFO's to warning update situations based on changes in marine observation thresholds.
- Provide the Great Lakes marine community with a uniform package of updated marine weather products issued by NWS Offices.
- Apply to the Great Lakes service program the warning and forecast expertise and automation capabilities developed in conjunction with other regional and national program efforts.

During the course of the seminar, a number of problem areas and/or operational considerations became apparent. Since solutions to these problems would help to improve marine forecast services for the region, they were given careful consideration in an end-of-seminar critique. The most important of these are summarized in Table 3.

REFERENCES

1. William E. Hubert is Vice President for Consulting, Systems West, Inc., Carmel, California. Dr. Hubert holds a Filosofi Licentiat (Ph.D. equivalent) in Meteorology from the University of Stockholm and an M.S. in Aerological Engineering from the U.S. Naval Postgraduate School. He did his undergraduate work at UCLA and the University of Colorado. Dr. Hubert's career spans 28 years in the Navy (retiring as Captain), 4 years as Director of Research at the Navy Fleet Numerical Weather Center, Monterey, and 15 years as Senior Scientist with Ocean Data Systems, Inc., Monterey. He has been in his current position for 2 years.

2. Paul A. Jacobs is Deputy Chief of the Marine and Applied Services Branch, National Weather Service Headquarters, Silver Spring, Maryland. Mr. Jacobs holds B.S. and M.S. degrees in meteorology from the City College of New York and New York University, respectively. He has been with the National Weather Service for 25 years.

3. William S. Richardson is Chief of the Ocean Observations Division, National Ocean Service Headquarters, Rockville, Maryland. Mr. Richardson holds a B.S. in Mathematics from Virginia Polytechnic Institute and an M.A. in Marine Science from the College of William and Mary. He was with the National Weather Service for 17 years and has been with the National Ocean Service for 4 years.

*4. NOAA, National Environmental Satellite, Data, and Information Service, 1960–1985:*Storm Data

*5. Lewis, P. J., 1987: Severe storms over the Great Lakes, a catalog summary for the period 1957 to 1985,*CSC Report *J1066, in press, prepared for Atmospheric Environment Service*

6. NOAA, 1987: Great Lakes Forecaster's Handbook, Jet Propulsion Laboratory contract no. 957762

7. Ibid.

Table 3. Significant problem areas/operational considerations which came to light during the Great Lakes Forecasting Seminar.

1. The number of conventional observations around the lakes is slowly decreasing. There is a need for more ship, buoy, and C-MAN observations.
2. Great Lakes forecasters need real-time access to water level measurements. NOS should publish telephone dial-in numbers for the central water level database.
3. Many field forecast offices do not have access to the latest NMC analyses of Great Lakes sea surface temperature and ice cover.
4. More work is needed on the development of forecast wind fields to be used to drive wave and storm surge models in the forecast mode. (Consider computing geostrophic winds for NGM surface pressure forecasts, correcting for stability/curvature/isallobaric change etc. and introducing MOS forecast winds at selected points.)
5. Determine the best place to run Great Lakes wind, waves, and storm surge models. (Consider NOS Ocean Applications Group Monterey, NMC/Ocean Products Center, WSFO Cleveland MicroVax or local office PCs.)
6. Wider and more rapid distribution is needed for the Oceanographic Monthly Summary.
7. Consideration should be given to adding more stations to the automated (MOS-type) storm surge forecast list.
8. NMC should consider transmission of the NGM 850 mb temperature advection field over AFOS to aid local severe storm prediction.
9. Some lakes ship Captains are *reportedly* unhappy with the MAFOR program. The NWS should investigate these reports.

APPENDIX 1
List of Seminar Lecturers

MAJOR MODULES	
Dr. William E. Hubert	ODSI
Dr. David Schwab	GLERL
Mr. John O'Reilly	AES, Canada
Mr. Jack Hales	NSSFC, NWS
RELATED MODULES	
Mr. Paul A. Jacobs	Headquarters, NWS
Dr. Tom Croley II	GLERL
Mr. William Gemmill	NMC/OPC, NWS
Dr. Manfred Holl	OAG, NOS
Dr. Glenn Hamilton	NDBC, NWS
Mr. Harry Lippincott	Sea and Lake Levels Branch, NOS
Mr. Henry Yarlo	WSFO Chicago
Mr. Jack Cooley	WSO Grand Rapids
Mr. Tom Niziol	WSFO Buffalo
Mr. Marvin Miller	WSFO Cleveland
F.Capt. Gene Stafford	Inland Lakes Management, Inc.

APPENDIX 2
List of Participating Government and Corporate Offices

AES Canada, Ontario Weather Centre
AES Canada, Professional Training Division
National Ocean Service
National Ocean Service, Headquarters
National Ocean Service, Ocean Applications Group
National Weather Service, Headquarters
National Weather Service, Central Region
National Weather Service, Eastern Region
National Meteorlogical Center
National Severe Storms Forecast Center
National Data Buoy Center
Great Lakes Environmental Research Laboratory
Weather Service Forecast Office, Ann Arbor
Weather Service Forecast Office, Buffalo
Weather Service Forecast Office, Chicago
Weather Service Forecast Office, Cleveland
Weather Service Forecast Office, Milwaukee
Weather Service Office, Alpena
Weather Service Office, Duluth
Weather Service Office, Erie
Weather Service Office, Grand Rapids
Weather Service Office, Green Bay
Weather Service Office, Marquette
Weather Service Office, Rochester
Weather Service Office, Sault Sainte Marie
Weather Service Office, Toledo
Inland Lakes Management, Inc.
Ocean Data Systems Inc.