Canadian Atlantic Storms Program

Programme Canadien d'Étude des Tempêtes dans l'Atlantique

ANALYSIS PLAN

ANALYSIS PLANS

for the

CANADIAN ATLANTIC STORMS PROGRAM (CASP)

FIELD EXPERIMENT

January 15 – March 15, 1986

ENVIRONMENT CANADA

FISHERIES & OCEANS

ENERGY, MINES & RESOURCES

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Chapter 1

INTRODUCTION

The Canadian Atlantic Storms Program (CASP) field experiment will be conducted during the period January 15 - March 15, 1986. This experimental period will be devoted to two principal tasks. An experimental forecast centre will be established at the Maritimes Weather Centre in order to test and assess a number of forecasting products such as new models and work stations. The second task is to enhance observations during storm episodes. This includes additional upper air, land-based, and oceanographic measurements. Some of the enhanced observations will be provided to the forecast centre in real time. In addition, in combination with the U.S. Genesis of Atlantic Lows (GALE) experiment, data on storm development at larger scales should be available. Details on all these aspects are described in previous CASP documents. These documents are the Experimental Design Document, the Operations Plan, and the Data Management Report.

In order to realize the potential benefits of the forecasting centre and the enhanced observations, a major effort to analyze information is being mounted. This phase of CASP will be accomplished by a number of individuals and groups.

The purpose of this CASP Analysis Plan is to summarize briefly the scope of the analyses to be undertaken. This information should prove valuable for those conducting research because it should allow them to maximize their efficiency by, for example, simply collaborating with others working on related aspects of the same problem.

The document also contains a preliminary list of milestones for the analysis phase. A number of workshops are planned in order to allow participants to be kept informed of progress being made in other areas.

A CASP Summary Report and a dedicated issue of a scientific journal are also proposed. The CASP Summary Report, to be written within approximately two years of the project completion, should bring many of the myriad aspects of the project into focus.

It is hoped that the salient results and scientific achievements of CASP will ultimately appear in a dedicated issue of a scientific journal such as Atmosphere-Ocean.

This CASP Analysis Plan therefore illustrates the extent of analysis which is planned. The scope of the analysis mirrors the nauture of the weather itself: many approaches and perspectives need to be pursued.

Chapter 2

ANALYSIS PROJECTS

Tables 2.1 and 2.2 contain lists of the analysis plans (separated by disipline) which individuals or groups have tentatively planned. The table provides a brief description of the objectives expected, outputs, and time frame for each plan where possible. Lists of the abbreviations used in these tables can be found in Appendix A, and lists of addresses and telephone numbers are contained in Appendix B.

There will undoubtedly be other analyses conducted in Canada that are not included in this table. If you are aware of such a situation, please inform the individual or group of the existence of this CASP Data Analysis Document. Also, please invite them to participate in the collective workshops. Such individuals or groups are most welcome at any time.

It is also anticipated that researchers from outside of Canada will be conducting analysis with the CASP data. Already, several enquiries have been made from the U.S. and interest has been expressed by individuals from Europe.

TABLE 2.1

CASP ANALYSIS PLANS (METEOROLOGY)

INVESTIGATOR	STUDY OBJECTIVES	OUTPUT	1986	1987	1988	1989
CASP and NWC/MWC forecasters(B. Appleby/M. Danks MWC)	- extend CASP findings to regular operations	-Atlantic Region Tech. Note				
CASP forecasters(B. Appleby/ M. Danks, MWC)	- evaluate the benefits of extra CASP data, an electronic workstation, and the performance of numerical models - overview of the CASP forecasting experiment	- Atlantic Region Tech. Notes - Brief report				
G. Austin, McGill U.	- assess the potential use of radar and satellite data in numerical models					
R. Benoit/C. Chouinard/J. Mailhot/M. Roch/J. Cote, RPN	- determine the relative importance of high resolution data and analyses on the prediction of storms - determine the usefulness of CASP data for short-term forecasting	- scientific articles - conference papers				
S. Bisanti, L. Findleton, CMC	- determine the utility of the RID work station as a tool for operational meteorology	- reports				
H. Cho, U. of Toronto	- analyze the flow structure in the vicinity of banded features using objective analysis methods	- M.Sc. thesis				
E. Freire, ARPP	- develop a microphysical model of precipitation type evolution	- scientific articles conference papers				
R. Gabison, ARMF	- evaluate a snow squall model - test a thermodynamic sea-ice model	- scientific articles				
G. Isaac, ARPP	- understand precipitation formation mechanisms in maritime wintertime storms					
M. Khandekar, ARMF	- test the parametric and spectral wave models	- scientific articles				
B. Kerman, ARQL	- determine the areal extent of breaking waves	- scientific articles - conference papers - model updates				
P. King, ARMA	- determine the performance of RAINSAT - develop conceptual models for weather analysis - develop techniques for inputting satellite data into RPN models	- reports				
R. Leaitch, ARPP A. Wiebe, ARQA	- examine the spatial variability of aerosol concentrations in storms - contrast the effects of maritime versus polluted continental air on nucleation	- scientific articles - conference articles				
C. Lin, U. of Toronto	- develop a 2D dynamical model to simulate rain/snow boundaries, freezing rain episodes, and the nature of fronts and bands	- scientific articles - conference papers				
K. Macdonald/J. McLeod/ E. Goldberg, ARMF	- evaluate the operational utility of radiometer data - assess operational requirements for graphics display stations					
L. MacPherson, NAE	- conduct aircraft icing studies	- scientific articles				
G. McBean, AES/IOS	- study boundary layer changes near land/ocean boundaries	- scientific article				
K. Moore, U. of Toronto	- test theoretical predictions of storm structure	- scientific articles - conference papers				
V. Neralla, ARMF	- test the AES regional sea-ice model	- scientific articles - reports				
A. O'Toole/J. Alexander, ACET	- develop approaches to implement findings on cyclogenesis, mesoscale structure, and precipitation processes into operational meteorology routines	- conference papers - technical notes				
R. Ramseier, ACIS	- compare windspeed data derived from satellite passive microwave radiometry with offshore observations - determine marginal ice zone effects on windspeeds as detectable- AES Internal from satellite data	- scientific articles - conference papers - AES Internal Report				
R. Rogers, McGill U.	- use radiometric and other observations to infer atmospheric processes	- Ph.D thesis - conference paper				
R. Schemenauer, ARPP	- examine surface precipitation chemistry dependence on precipitation type, storm structure, and airmass	- journal article				
R. Shaw, AES/BIO	- study surface chemistry observations in relation to storm structure - use buoy, dropsonde data to estimate air/sea fluxes of heat, moisture, and momentum	- scientific article - conference papers				
D. Steenbergen, ARMA	- comparison of satellite soundings with high-density radiosonde observations - develop techniques for inputting satellite soundings into RPN models	- reports				
R. Stewart, ARPP	- understand the organization of mesoscale features in storms - test theoretical explanations for mesoscale features and develop models to predict the onset of instabilities - understand the dynamics of and precipitation processes occurring in rain/snow boundaries, freezing rain episodes and mesoscale bands and fronts - study and model the effects of land/ocean/ice boundaries on precipitating mesoscale features	- scientific articles - conference reports				
W. Strapp, ARPP	- use tracer variables to infer cloud entrainment processes - assess the use of high frequency sampling and new instrumentation on atmospheric studies	- scientific articles				
G. Strong, ARC	- evaluate the adiabatic method of computing vertical velocities - compile a set of forecast rules for East Coast storms for possible artificial intelligence (AI) applications	- scientific article - possible AI model				
P. Taylor, ARQL	- study boundary layer changes during storms - develop a numerical model to simulate these changes	- scientific articles - conference papers				
J. Thiebaux, Dalhousie U.	- develop mesoscale objective analysis algorithms					
L. Wilson/W. Burrows, ARMF	- examine the evolution of synoptic and meso-structures using isentropic analysis - assess the operational performance and accuracy of statistical forec techniques	- scientific articles - conference papers				
M. Woodhead, ACSL/ B. Sheppard, ACSL	- assess the use of a radiometer information for various tasks including identifying aircraft icing levels and supercooled water regions - assess the use of automatic precipitation and freezing rain detectors	- reports				
P. Yau, McGill U.	- conduct a diagnostic study on the role of convection on cyclogenesis - numerically simulate the effect of convection on cyclogenesis	- Ph.D thesis - M.Sc. thesis - scientific articles				
L. Zawadski/P. Zwack, UQAM	- calculate synoptic and mesoscale vertical motions - compare measured vertical motions with RPN calculations - develop a composite storm structure	- M.Sc. thesis - scientific articles - journal papers				

TABLE 2.2

CASP ANALYSIS PLANS (OCEANOGRAPHY)

INVESTIGATOR	STUDY OBJECTIVES	OUTPUT	1986	1987	1988	1989
P.C. Smith, AOL C. Anderson, AOL	- analyze subtidal circulation and sea level response to winter storms - investigate inertial wave response to passage of fronts - investigate supratidal response (e.g. edgewaves) to mesoscale forcing	- Data Reports - Scientific articles				
D.J. Lawrence, AOL	- evaluate HF groundwave radar (CODAR) measurements of surface current and waves against direct measurements	- Scientific articles				
D.G. Wright, AOL	- compare observed low-frequency variability to results of coastal trapped wave models - examine energy exchange rates between "mean" and "eddy" fields for evidence of hydrodynamic instability.	- Reports - Scientific articles				
D. Greenberg, AOL/ MEP LTD., Toronto	- produce real time forecasts of ocean currents during CASP using MEP 2 1/2-D model - test and calibrate model using CASP data	- Reports - Scientific articles				
D. Greenberg, AOL	- develop a two-layer circulation model for the Scotian Shelf	- Scientific articles				
C.L. Tang, AOL	- study the influence of winter storms on mixed-layer properties	- Data report - Scientific articles				
W. Perrie, AOL B. Toulany, AOL F. Dobson, AOL	- investigate the evolution of the directional surface wave spectrum in shallow water - evaluate the effects of turbulent bottom dissipation, refraction and currents on surface wave energetics - use CASP data to improve predictive capability of BIO surface wave model	- Scientific articles				
N. Freeman, RADARSAT C. Livingston, CCRS	- compare the directional surface wave spectra derived from C-band SAR with those from direct measurement - evaluate the scatterometer measurements of surface wind stress at high wind speed	- Data report - Scientific articles				
D. Farmer, IOS D. Lemon, Arctic Sci. Ltd. F. Dobson, AOL	- evaluate WOTAN measurements of high wind speed and precipitation against direct measurements using surface meteorological buoys and radar	- Data report - Scientific articles				
F. Schwing, DAL K. Thompson, DAL	- investigate the influence of local and distant wind forcing on the subtidal shelf circulation	- Scientific articles - Ph.D. thesis				
Y. Andrade, DAL B. Topliss, AOL	- analyze infrared satellite images for evidence of low-frequency variability	- Scientific articles - Ph.D. thesis				
T. Bowen, DAL	- map the spatial and temporal variance of wave energy in the surf zone - investigate the dynamics of low-frequency fluctuations of current and pressure fields in surf zone - estimate current and wave energy extrema and their relationship to scour and sediment transport	- Data base - Scientific articles - Ph.D. thesis				
B. Boczar-Karakiewicz, INRS	- investigate low-frequency oscillations in surface wave field and their relation to the formation and movement of sand ridges	- Scientific articles				
D. Forbes, AGC R. Boyd, DAL K. Kranck, AOL	- produce time series of near-bottom transport in shallow water using data from bottom-mounted tripod (RALPH) - estimate wave directional spectrum from measurements of bottom current and pressure	- Data report - Scientific articles				
W.D. Winsor, C-CORE	- make groundwave radar (CODAR) measurements of surface current patterns for storm periods	- Data report				
J. Walsh, MUN S.P. Singh, MUN	- develop analytical algorithms to extract ocean wave information from groundwave radar return - test algorithms against direct measurements from CASP wave array	- Data report - Scientific articles				
Ian Webster, MUN	- develop coastal-trapped wave models for the Scotian Shelf - evaluate coastal-trapped wave model results against CASP observations of current, sea level and bottom pressure	- Scientific articles				

Chapter 3

ANALYSIS MILESTONES

Each of the analysis projects will be carried out by the individuals or groups of investigators according to their own priorities. In order that participants can appreciate other aspects of the analysis and therefore potentially improve their own work, a number of workshops are planned (Table 3.1). These will be held at approximately 6 month intervals. Locations of the workshops will alternate among Halifax, Montreal, and Toronto.

There will undoubtedly be an evolution in the nature of the workshops. The first workshop will focus on preliminary findings, and if appropriate, some discussion will be made to narrow down the number of storm cases that will be examined in detail. Following workshops will undoubtedly become more focussed on individual topics. Examples of such natural foci include operational improvements, modelling, surface wave and sediment dynamics, and mesoscale processes.

Where clear, the timing of other events is also indicated. This includes reports based on the CASP field experiment, as well as pertinent conferences. Special emphasis is given to the annual Canadian Meteorological and Oceanographic (CMOS) Congress.

The Experiment on Rapidly Intensifying Cyclones over the Atlantic (ERICA) has also been mentioned in Table 3.1. This project, scheduled for January-February, 1989, is funded by the U.S. Office of Naval Research and its objective is to understand the processes responsible for cyclogenesis. It will concentrate on the area south of Sable Island (approximately 40° N, 60° W) and, due to the difficulty of sampling at the needed spatial resolution, will probably rely heavily on dropwindsonde aircraft.

The role of CASP investigators in ERICA is unclear at this time. ERICA, as presently proposed, will focus attention for offshore and hence will not be of direct interest to some CASP investigators. However, as ERICA evolves and becomes better defined, the possible contributions of CASP scientists will be made clearer. This potential involvement will be discussed at workshops prior to the ERICA experiment.

TABLE 3.1

CASP ANALYSIS MILESTONES

1986	**MILESTONE**
Mar	- report at the end of the field project
May	- CASP daily summary document
May	- CASP analysis workshop #1, identify storm cases
June	- CMOS Congress, preliminary reports
July	- assessment report of wave models during CASP
Oct	- final MWC/NWC reports on operations
Oct	- GALE analysis workshop
Nov	- CASP analysis workshop #2
1987	
Feb	- Operational Meteorology Workshop, Montreal
Apr	- CASP analysis workshop #3
June	- CMOS Congress, CASP session
Aug	- IAMAP and Mesoscale conferences, Vancouver
Nov	- CASP analysis workshop #4
Nov	- CASP involvement in ERICA finalized
1988	
Mar	- CASP Summary Report, first version
Apr	- CASP analysis workshop #5
June	- CMOS Congress, CASP session
July	- CASP Summary Report, final version
Nov	- CASP analysis workshop #6
1989	
Jan	- dedicated issue of scientific journal (eg. Atmosphere-Ocean)
Jan-Feb	- ERICA field project
Apr	- CASP (ERICA) analysis workshop #1
June	- CMOS Congress, CASP session
Nov	- CASP (ERICA) analysis workshop #2
1990 and following	
	- CASP (ERICA) analysis workshops
	- CMOS Congress, CASP sessions
	- summary document of CASP (ERICA) results

Chapter 4

CASP SUMMARY REPORT

There are in excess of 75 separate analysis projects planned in the meteorological and oceanographic disciplines. The output of these will be massive. In order to summarize some of the findings and recommendations arising from the analysis, it is proposed that a short (100 page) report be produced by the summer of 1988 as indicated in Table 3.1. A proposed table of contents for this report is indicated in Table 4.1.

The nature of the document will be discussed in the workshops. Discussions in workshops preceding the draft version will have to determine the final detailed table of contents as well as the means by which the document can be collectively written. Discussions in the workshop following the release of the draft version will focus on final changes.

It is also desired that the significant scientific achievements of CASP be featured in a dedicated issue of a referred journal, presumably Atmosphere-Ocean. It should be possible to draw a concise description of the project from the CASP Summary Report as a lead article and to supplement that with a number of papers presenting the important results of particular CASP studies. As with the Summary Report, the lead journal article would be multi-authored, whereas the rest of the articles would be contributed by (solicited from) individual investigators or groups. A reasonable target data for publication of the special journal issue would be a 6 to 12 months following the completion of the CASP Summary Report. To accomplish this, a list of tentative titles should be compiled in early 1988.

TABLE 4.1

CASP SUMMARY REPORT

(Completion date: July 1988)

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APPENDIX A

ABBREVIATIONS USED IN TABLES 2.1 AND 2.2

ACET	Professional Training Section (English), AES Downsview
ACIS	Ice Research and Development, AES Ottawa
ACSL	Technology Support Division, AES Downsview
AES	Atmospheric Environment Service
AGC	Atlantic Geoscience Centre, EMR, BIO, Dartmouth, N.S.
AOL	Atlantic Oceanographic Laboratory, OSS, DFO, BIO, Dartmouth, N.S.
ARC	Alberta Research Council, Edmonton, Alberta
ARMA	Aerospace Meteorology Division, AES, Downsview
ARMF	Forecast Research Division, AES Downsview
ARQA	Atmospheric Chemistry Criteria & Standards Division, AES, Downsview
ARQL	Boundary Layer Research Division, AES Downsview
BIO	Bedford Institute of Oceanography, Dartmouth, N.S.
C-CORE	Centre for Cold Ocean Resources Engineering, MUN, St. John's, Nfld.
CMC	Canadian Meteorological Centre,AES Dorval, P.Q.
CCRS	Canadian Centre for Remote Sensing, Ottawa
DAL	Department of Oceanography, Dalhousie University, Halifax, N.S.
INRS	Institute of National de la Recherche Scienfifique, Rimouski, P.Q.
IOS	Institute of Ocean Sciences, DFO, Sidney, B.C.
MEP	Meteorological and Environmental Planning Limited, Toronto
MUN	Memorial University of Newfoundland, St. John's, Newfoundland
MWC	Maritimes Weather Centre, Bedford, N.S.
NAE	National Aeronautical Establishment, NRC Ottawa
NRC	National Research Council of Canada
NWC	Newfoundland Weather Centre, Gander, Newfoundland
RADARSAT	Radarsat Project Office, EMR, Ottawa
RPN	Division de la Recherche en Prevision Numerique, AES Dorval, P.Q.
UQAM	Universite du Quebec a Montreal, Montreal, P.Q.

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