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A PWC Evaluation of the Automated Shipboard Aerological Program

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INTRODUCTION

The Automated Shipboard Aerological Program (ASAP) is a system for obtaining upper air meteorological data coverage over the oceans using ships of opportunity. This experimental program was initiated in April 1982 to evaluate the feasibility of providing "real time" conventional vertical sounding data across the North Pacific Ocean.

The purpose of this report is to evaluate the usefulness of this program for operational forecasting at the Pacific Weather Centre (PWC).

BACKGROUND

For the initial test phase, one Japanese car carrier ship M.V. Friendship (designator ELXP) was recruited. A fully containerized set of meteorological and communications equipment was placed on deck and a Japanese crew member was trained to assist with operating the ASAP equipment.

The data is obtained using a liquid helium balloon inflating system, balloon launcher, and Nav-aid tracking. The data is then transmitted to GOES-W. Receipt of data from GOES-W is made at NCAR and then transmitted to PWC for monitoring and entry into the AES meteorological communications network.

From April 25 to September 7, 1981, several sailings were made between Japan and North America, see Figure 1. For the purpose of this study, the data from these trips will be examined.

METHOD OF EVALUATION

A two part evaluation method has been chosen. The first part is an assessment of the number of reports reaching PWC, their timeliness, and their impact on the early and late CMC analyses.

The second part is based on a questionnaire given to 21 PWC Operational Forecast Meteorologists. This is a subjective assessment of ASAP's usefulness relative to other existing or possible programs.

RESULTS - Part 1

Usefulness of data for operational use can be assessed on the following factors:

1) type of data
2) accuracy
3) location
4) timeliness
5) regularity
6) format
7) impact on numerical models

1) type of data: upper air soundings such as provided by ASAP are ranked as highly important.

2) accuracy: the ELXP reports have been correlated with land based Aleutian Island reports as the ship passed through these islands. Reports were found to be accurate.

3) location: with regards to the lack of continuity of reports from one location, this is an obvious fault of ASAP. This could be somewhat mitigated by the use of several more ships to complement reports from ELXP. Also the most preferred location for data is in an area bounded by the North American continent, 180° longitude and 35° latitude.

4) timeliness: ELXP data was found to be timely enough to be operationally useful. Vertical sounding data was generally available at PWC 1½ hours after the synoptic times of 0000Z and 1200Z. Timely 3 hourly surface reports were also received and plotted on PWC surface charts.

5) regularity: some improvement is required in this regard. Approximately 70% of all expected ELXP upper air reports were received at the PWC.

6) format: the upper air code being employed is fully compatible with North American upper air format. One irritation experienced is the inability of AES common computer programs/data base to accept radiosonde type reports from moving ships. Consequently these reports must be hand-plotted on tephigrams and upper air charts.

7) impact on numerical models: of the 70 ELXP reports received at the PWC, none were plotted on the CMC early 500 mb analysis and 17 were plotted on the late CMC 500 mb analysis.

Comparing the early 500 mb analysis against the late analysis at the ELXP location the following mean absolute errors were computed.

	Cases	Error early analyses (dam)	Error late analyses (dam)
a) ELXP not on early 500 mb but on late 500 mb analysis	17	1.82	.76
b) ELXP not on either early 500 mb or late 500 mb analysis	53	2.32	2.0

The above results suggest that the mean absolute error in CMC early analyses is about 1.8 - 2.3 dam over the North Pacific during the spring and summer, and the late analysis without ELXP makes only a small reduction in this error. With ELXP reports a significant improvement can be made.

To remove some generality in the above statements an example is presented in Figures 2 and 3. Figure 2 compares the early 500 mb analysis (without benefit of the ELXP report) and the correction made to the late analysis with benefit of the ELXP report. Figure 3 shows the analysis 12 hours later. This figure shows that the error in vicinity of ELXP is 5 dam and goes uncorrected in the late analysis. Examination of satellite images during the period of Figure 2 and 3 (June 21, 0000Z - June 21, 1200Z) show that an organized cloud centre was forming. The CMC analysis was reluctant to acknowledge it and also kept attempting to prematurely move the broad trough eastward.

RESULTS - Part 2

The usefulness of data is often difficult to ascertain objectively because of the many factors dependent on weather regimes, type of forecaster (airways, public, prog. analyst, satellite, etc.), and availability of other supporting data. For the ASAP an objective evaluation becomes even more difficult due to the transient nature of the data source.

In order to subjectively assess the ASAP, a comparison was made of its usefulness relative to current or possible future programs. To do this a survey was made of 21 PWC operational meteorologists. The results of this survey are tabulated in Appendix A.

The survey shows that the ASAP is not as useful as one land based radiosonde. This is primarily because of the problems resulting from the transiency of the ASAP data. However ASAP was judged to be more useful than MAPS stations and about equal to 5 Pacific drifting buoys.

SUMMARY

The ASAP reports are found to be useful for operational forecasting at the PWC. This is partly due to the sheer inadequacy of sounding data across the Pacific, therefore any report of this nature can be very important due to its singularity. The reports have an impact on CMC analyses. Although no reports were received by CMC for the early 500 mb analyses, the late analyses on several occasions were corrected significantly by ASAP reports.

FIGURE 1.

ASAP SHIP ROUTES DURING PERIOD OF ASSESSMENT (APRIL 25-SEPTEMBER 6, 1982)
SYMBOL PLOTS INDICATE LOCATION OF SUCCESSFUL RECORDING/TRANSMISSION
OF OBSERVATIONS TO PWC

X APRIL 25 - MAY 2, 1982

⊙ JUNE 6-14, 1982

\+ JULY 7-14, 1982

△ MAY 27 - JUNE 2, 1982

□ JUNE 20-28 1982

⊙ AUGUST 28 - SEPTEMBER 6, 1982

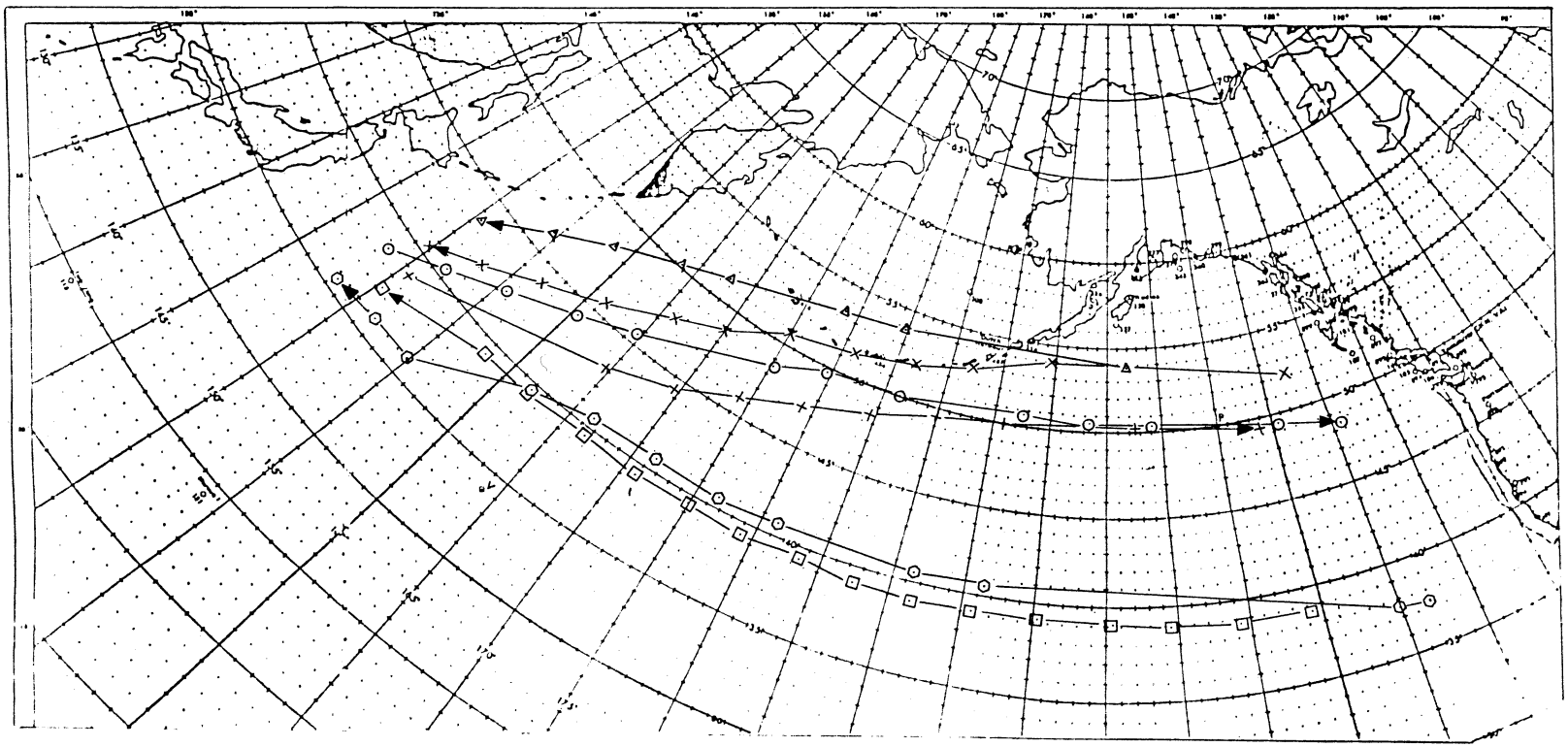
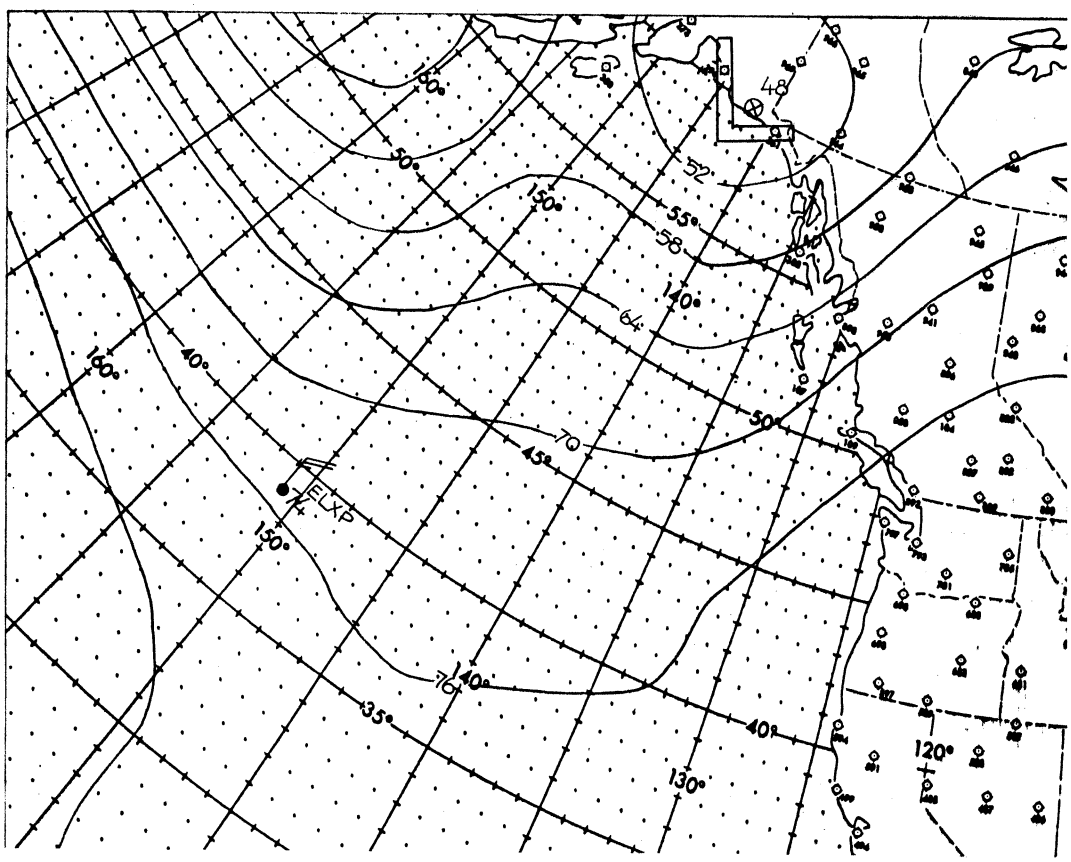
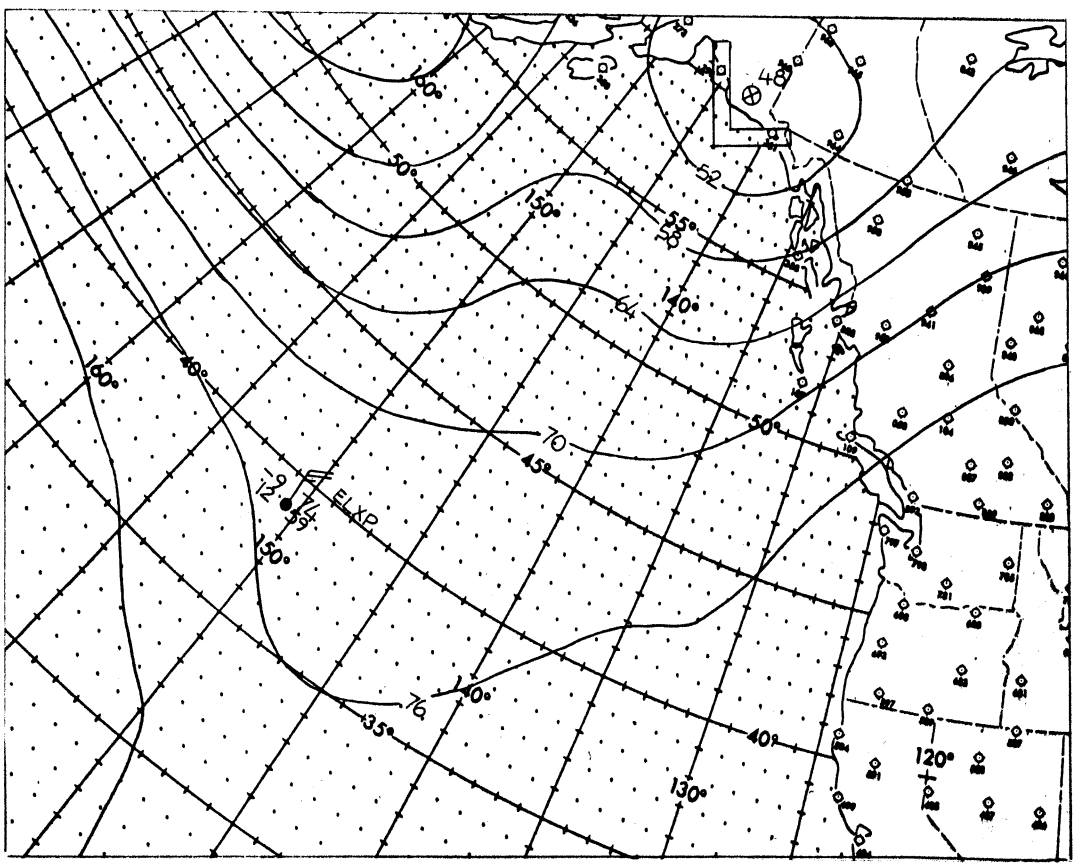


FIGURE 2.

COMPARISON OF EARLY AND LATE CMC 500MB ANALYSES
(ELXP DATA ONLY AVAILABLE FOR CMC LATE ANALYSIS)



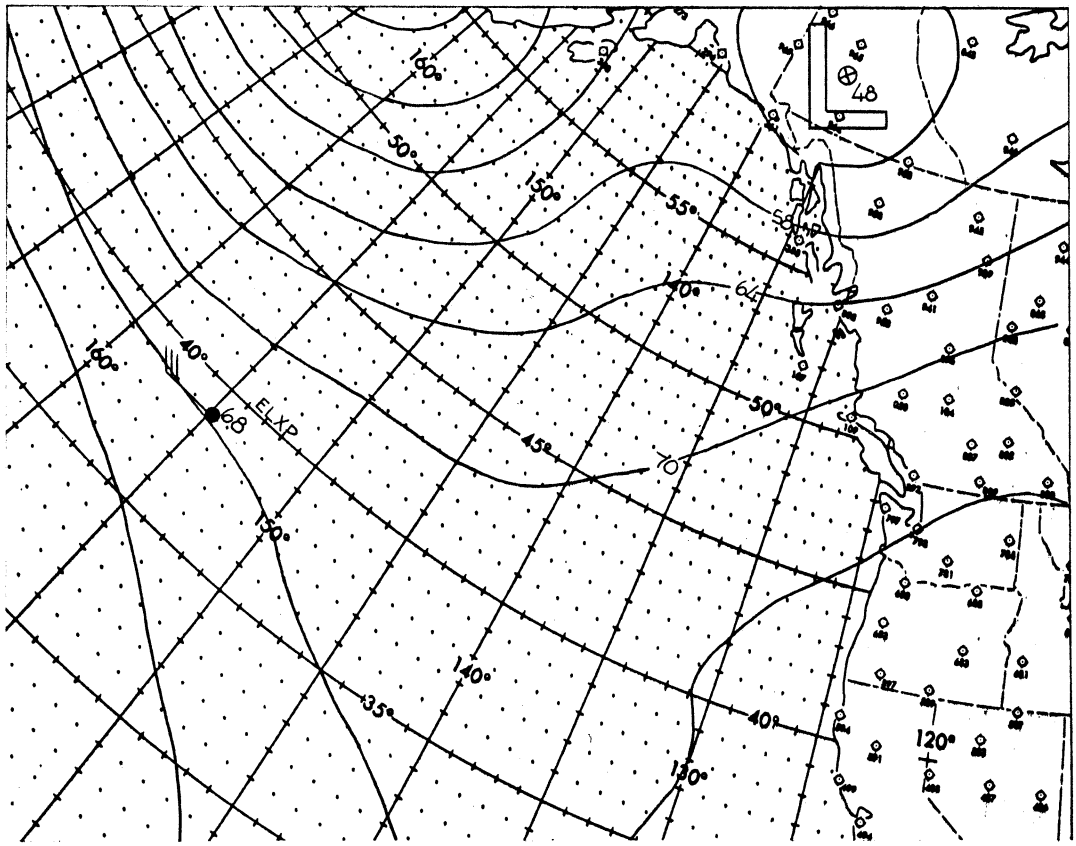
EARLY 500MB 82/06/21 0000Z (ISSUED 0127Z)



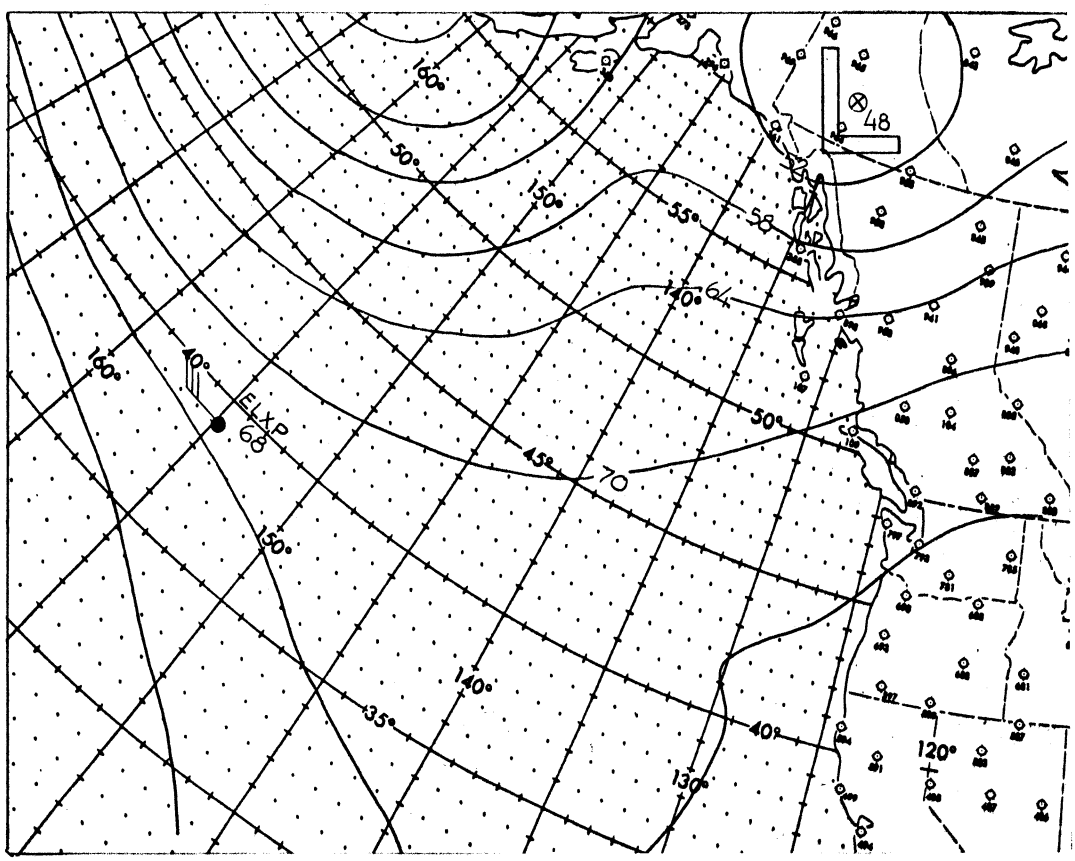
LATE 500 MB 82/06/21 0000Z (ISSUED 0332Z)

FIGURE 3.

COMPARISON OF EARLY AND LATE CMC 500MB ANALYSES
(ELXP DATA NOT AVAILABLE FOR CMC EARLY OR LATE ANALYSIS)



EARLY 500 MB 82/06/21 1200Z (ISSUED 1331Z)



LATE 500 MB 82/06/21 1200Z (ISSUED 1536Z)

APPENDIX A

Survey of 22 PWC Operational Forecast Meteorologists

The usefulness of one ASAP ship as compared against each of the listed current or possible programs:

QUESTION:

Would you consider one ASAP ship more operationally useful than:

		Forecasters answering YES (%)
1.	One B.C. Radiosonde Station	10
2.	Abbotsford Radar	76
3.	PWC Rooftop Radar	43
4.	Five Drifting Buoys	57
5.	Two MAPS Stations	100
6.	Twenty MAPS Stations	71
7.	An AFOS Link to PWC	62
8.	PWC Full-time Verification and Training Met.	71
9.	More professional development days equivalent to the two person years distributed amongst staff.	48
10.	Lytton Observing Site	38
11.	Overnight observations at Quesnel	48
12.	Movement of Abbotsford radar to West Coast of Vancouver Island.	24