Mesoanalysis

USE OF MESOSCALE ANALYSIS AND COMPUTER PLOTTED DATA TO EXPLAIN UNEXPECTED WINDS IN ALASKAN COASTAL WATERS

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ABSTRACT

Supergradient winds in Alaskan coastal waters are a common wintertime occurrence caused by the damming effect of massive coastal mountain ranges and by flow through channelled terrain. Alaskan forecasters are aware of the areas that have a high probability of supergradient winds, and under favorable synoptic conditions, forecast the winds. However, supergradient winds can occur in unexpected locations and the forecaster must use every tool at his disposal to explain the phenomenon and then adjust forecasts accordingly. Such a situation arose early December 5, 1982, over southern Cook Inlet.

1. INTRODUCTION

Cook Inlet is a very important waterway located in southcentral Alaska (Figure 1). Freighters carrying much of Alaska's cargo from Seattle to Anchorage ply these waters along with fishing boats and tugs with barges in tow. Except for the extreme southern section, the inlet is relatively protected from the worst of the Gulf of Alaska's weather by the mountainous backbone of the Kenai Peninsula to the east (Figure 2). However, early December 5, 1982, unexpected gale to storm force winds were reported in Cook Inlet. A small craft advisory was in effect for the inlet and looking at the synoptic situation, this forecast seemed entirely appropriate. However, by using the National Weather Service Alaska Region's "Prime" computer to plot a mesoscale surface map and then performing a mesoscale analysis on the data, the phenomenon was explained and the forecast immediately amended.

2. THE SITUATION

The synoptic analysis at 00Z December 5 (Figure 3) showed a persistent southeast flow over the Gulf of Alaska and south central Alaska. Near gale force winds were expected to occur over coastal waters southeast of the Kenai Peninsula as a trough embedded in the flow approached the coast, but gales were not expected over Cook Inlet. However, at 03Z the fishing boat "Mars" reported northeast winds 40 to 60 knots over the southern Inlet while, less than 25 nautical miles away, the tug "Margaret Foss" inport at Seldovia had calm winds and the Homer Airport reported northeast winds at 7 knots (Figure 4). This situation seemed to defy the synoptic situation and common sense. As the marine forecaster on duty, my initial thought was that the observation from the "Mars" was completely out of line and was to be regarded with suspicion. However, knowing the vagaries of the Alaskan coastal waters, I felt that closer investigation was warranted before ignoring the data.

3. THE SOLUTION

Using the variable scale plot feature of the "Prime" Computer (2) I called for a surface plot which zoomed in on southcentral Alaska. I then plotted the additional ship data on the plot and performed a one millibar mesoscale analysis (Figure 5). Figure 5 is a copy of the actual analysis used December 5. This analysis provided the key to understanding the cause of the high winds observed by the "Mars". A mesoscale ridge had developed between 00Z and 03Z along the southeast coast of the Kenai Peninsula while a lee trough had deepened over lower Cook Inlet. The arctic front, which had been quasi-stationary over the central part of the Inlet, had suddenly surged to the southern Inlet in response to the increased troughing in that area. This was confirmed due to the fact that the "Mars" had an air temperature of -8C (17F) while the "Margaret

Foss" and the Homer Airport had temperatures of -1C (30F) and -3C (27F) respectively (Figure 4).

The combination of the deepened lee trough and the surge of dense, cold air from the northern sections of the Inlet had combined to produce the supergradient winds experienced by the "Mars". Since it appeared that the conditions could cover much of the lower Inlet, the forecast was immediately amended to reflect the change.

4. CONCLUSION

Although mesoscale analysis is most usually associated with severe weather situations, this case clearly shows that it can successfully be applied to other meteorological situations. Also, the use of a computer to plot the surface chart greatly speeds up the forecast amendment process by freeing the forecaster from the time consuming task of plotting the data. The time can be used by the forecaster to study the situation with greater care and concentration without sacrificing a timely amendment.

It should also be noted that a course graphics display is all that is needed by the operational forecaster. A sophisticated graphic background with great geographical or topographical detail is desirable, but not necessary to do the job.

REFERENCES AND FOOTNOTES

1. Steve Harned attended Florida State University and worked summers at NWS offices in Bristol and Nashville, TN. After graduating, he entered the Navy and was assigned to weather officer duties in Spain from 1970-74. He has had National Weather Service assignments in Anchorage, Raleigh and Lubbock, and served on the staff of the director at National Weather Service Headquarters in Washington.

He served as the Fire Weather Focal Point at Raleigh, NC, and was one of the four meteorologists who provided weather services for the 1980 Winter Olympics in Lake Placid.

He is a member of the National Weather Association and the American Meteorological Society and holds the rank of Lieutenant Commander in the Navy Reserves. He is currently the MIC at the Houston, TX WSO.

2. "Prime" is the name of the computer company which has provided the hardware for the Alaska Region Communication Computer System (ARCCS). The ARCCS is Alaska Region's alternative to AFOS. It is a fully utilized computer system serving the forecasting, research and administrative needs of the Region. It is programmed, maintained and managed exclusively by Alaska Region NWS employees, who have tailored the system to the Region's requirements.

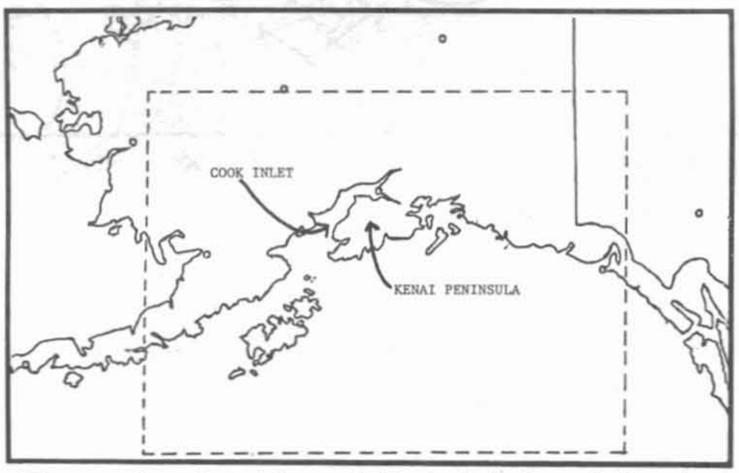


Figure 1. Location of Cook Inlet and Kenai Peninsula.

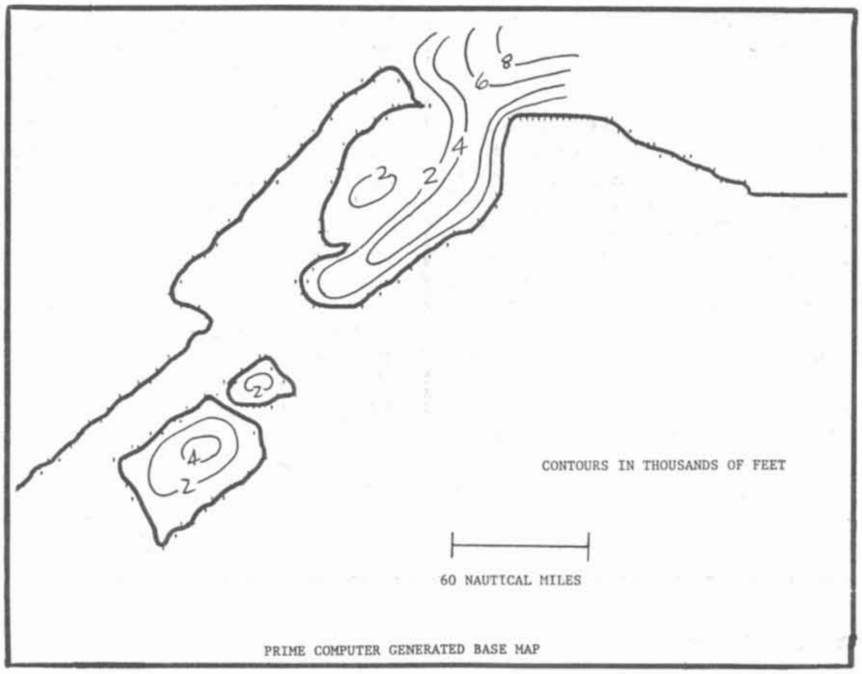


Figure 2. Kenai Peninsula Topography.

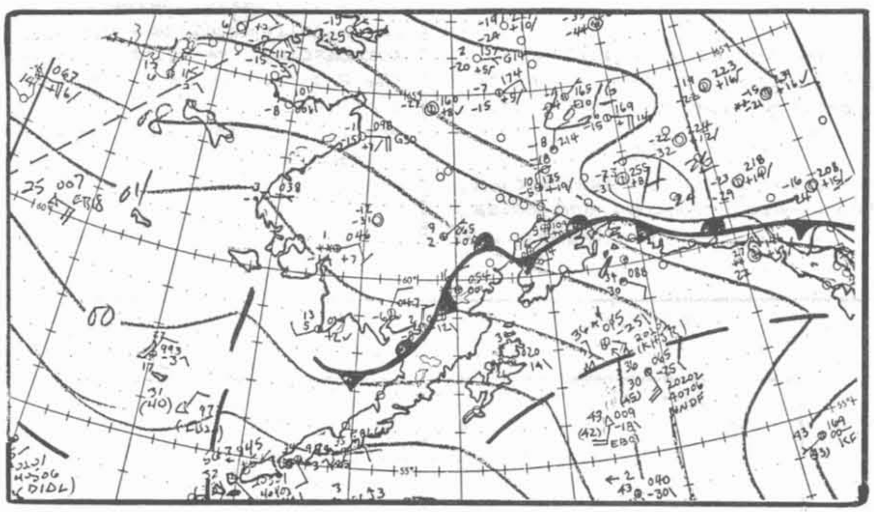
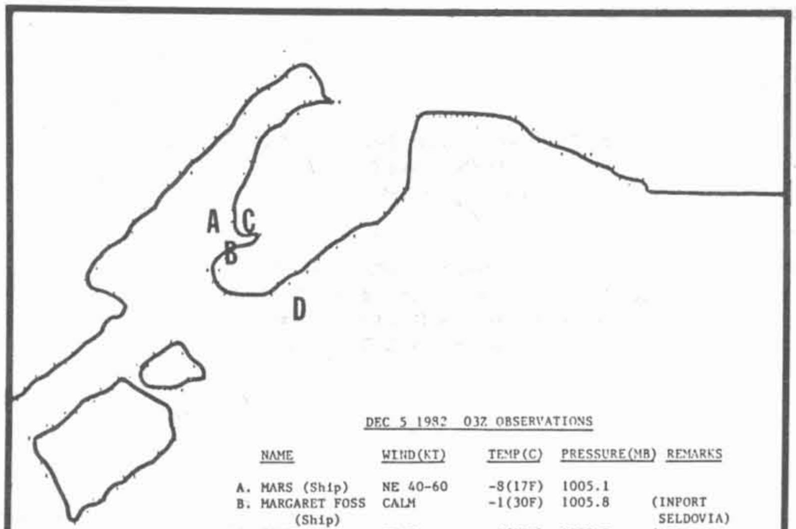


Figure 3. Synoptic situation 00Z Dec. 5, 1982.



DEC 5 1982 03Z OBSERVATIONS

NAME	WIND(KT)	TEMP(C)	PRESSURE(MB)	REMARKS
A. MARS (Ship)	NE 40-60	-8(17F)	1005.1	
B. MARGARET FOSS (Ship)	CALM	-1(30F)	1005.8	(INPORT SELDOVIA)
C. HOMER	NE 7	-3(27F)	1005.3	(AIRPORT OBSERVATION)
D. GALE WIND (Ship)	E 30	0(32F)	1010.8	

Figure 4. 03Z Dec. 5, 1982 synoptic reports.

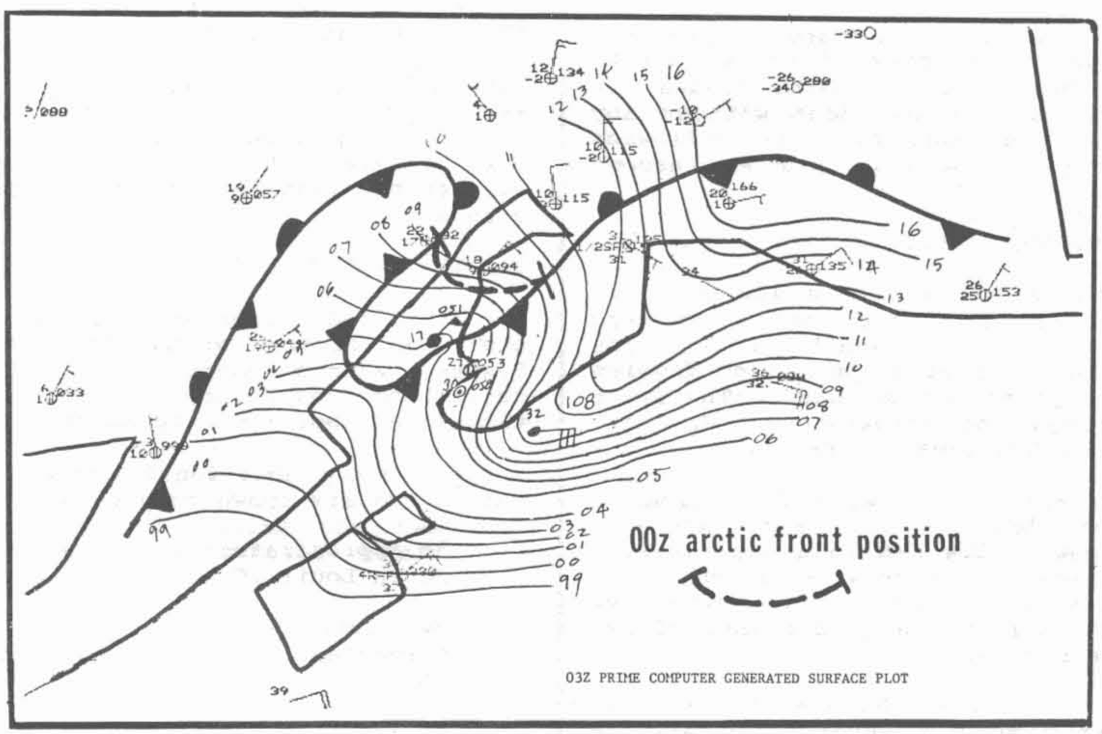


FIGURE 5. 03Z Dec. 5, 1982 mesoscale analysis.