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A Case of Missing Data Creating an Erroneous Automated
Mesoscale Analysis Product

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Introduction: Mesoscale analysis has become an important tool for short range forecasts. Several automated mesoscale analysis programs are available to National Weather Service forecasters via the Automation of Field Operations and Systems (AFOS). However, it is the forecaster on duty who must determine if the analysis is correct. Erroneous or missing data can produce a product that is not representative of the weather situation.

Discussion: On November 23, 1989 an early season snow storm struck southern New England. Southern New Hampshire and coastal Maine were on the northern fringes of the snow shield. The forecast office at Portland ME (PWM) routinely runs upper air mesoscale analysis at 0000 UTC and 1200 UTC. One product from this analysis is 850 MB convergence.

At 1200 UTC on 11-23-89 the 850 MB convergence chart showed a maximum value of divergence east of Portsmouth, NH (PSM) with a value of $+64 * 10^{-6} \text{ sec}^{-1}$ (see figure 1). The axis of the maximum divergence extended north across extreme western Maine and south across Cape Cod, MA. Remember, low level divergence (at 850 MB) suggests sinking motion, while low level convergence implies upward vertical motion.

A plot of surface observations at 1200 UTC on 11-23-89 (figure 2) shows that an area of snow extended from southwest Maine into New York state and south across all of southern New England. An area of moderate snow was occurring over Cape Cod westward to Connecticut. The area of heaviest snowfall was occurring directly under the analyzed axis of maximum divergence at the 850 MB level at 1200 UTC.

It is quite obvious that the 850 MB convergence chart is not representative of the ongoing weather situation. But why?

A close look at the 1200 UTC 850 MB upper air plot (figure 3) reveals that Portland ME (station 72606) was missing and Chatham MA (station 74494) had some missing and some questionable data. Due to ground equipment failure the 1200 UTC upper air sounding for Portland, ME (PWM) was not available (figure 4a). The 1200 UTC upper air sounding for Chatham, MA (CHH) showed that wind and dew point depression at 850 MB were not available. Also the temperature trace was inaccurate with

a minus 27.7 degrees Celcius, much colder than any nearby station (see figure 4b).

The upper air mesoanalysis program uses sounding data to produce output. When two upper air sites (especially neighboring sites as in this case) provide no data or bad data then the upper air mesoanalysis can be inaccurate. In this case the analysis was grossly in error from southwest Maine to southern New England. This was enhanced by the boundary problem of the Atlantic Ocean to the east of the sounding sites, since error free data were not available to smooth the erroneous data.

The area of low level divergence should be located further north as implied by the NGM 1200 UTC 850 MB height analysis (figure 3) with a ridge extending from a high centered over northeast Vermont to just south of Yarmouth, Nova Scotia (station 71603) where the 850 MB wind was from the west southwest.

Over half a foot of snow was accumulating over southern New England at this time as described in a special weather statement issued by WSFO Boston (BOS) at 900 am (figure 5).

Conclusion: Fortunately, forecasters at the Weather Service Forecast Office (WSFO) PWM were able to realize that the 850 MB convergence chart was not representing the true atmosphere and subsequently disregarded this product. This situation was rather obvious. However, not all situations will be this clear cut. Forecasters must routinely compare mesoanalysis with the raw data to be sure that the analysis does indeed accurately represent what is going on in the atmosphere. With this in mind, mesoanalyses can be very useful in short range forecasting.

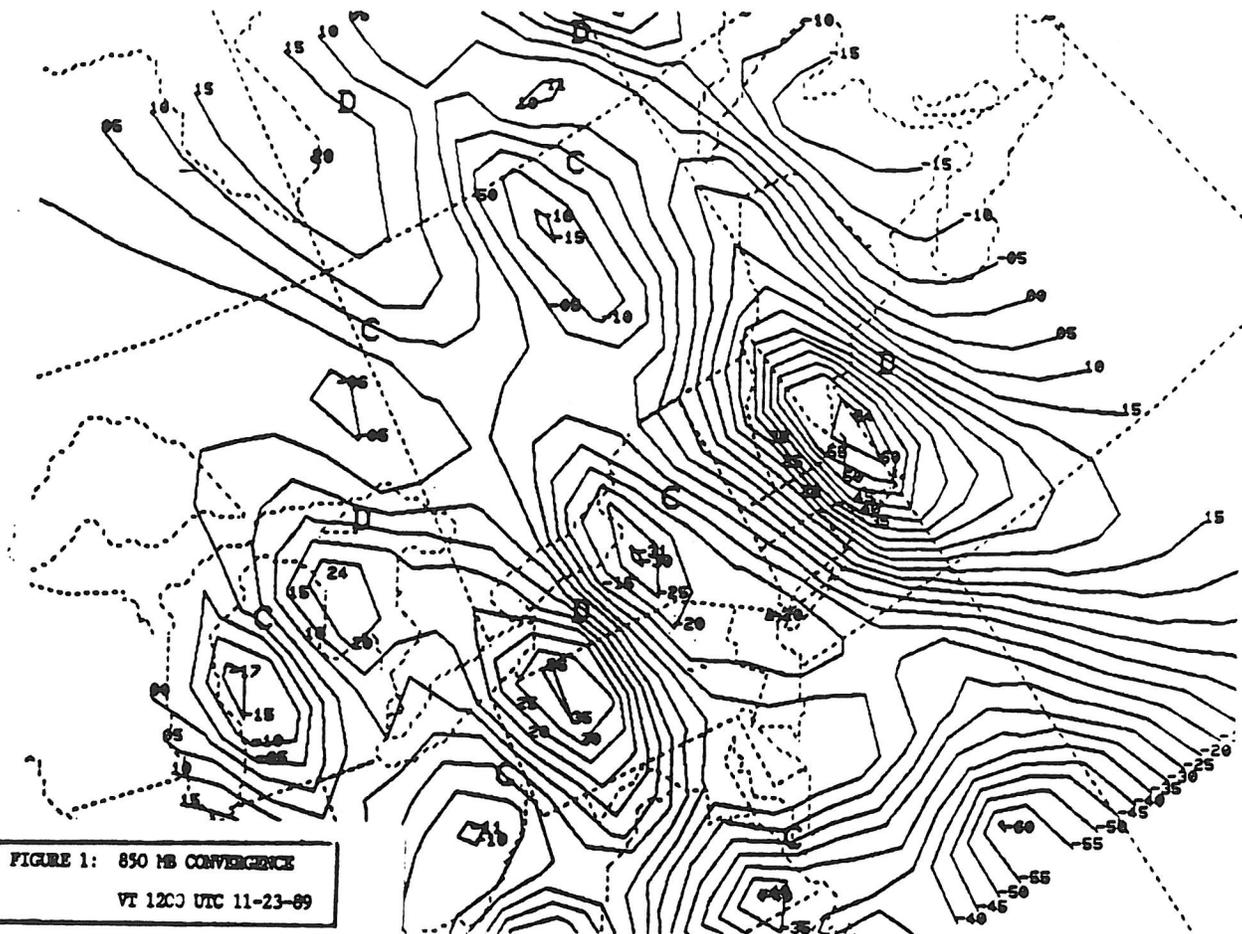


FIGURE 1: 850 MB CONVERGENCE
VT 1200 UTC 11-23-89

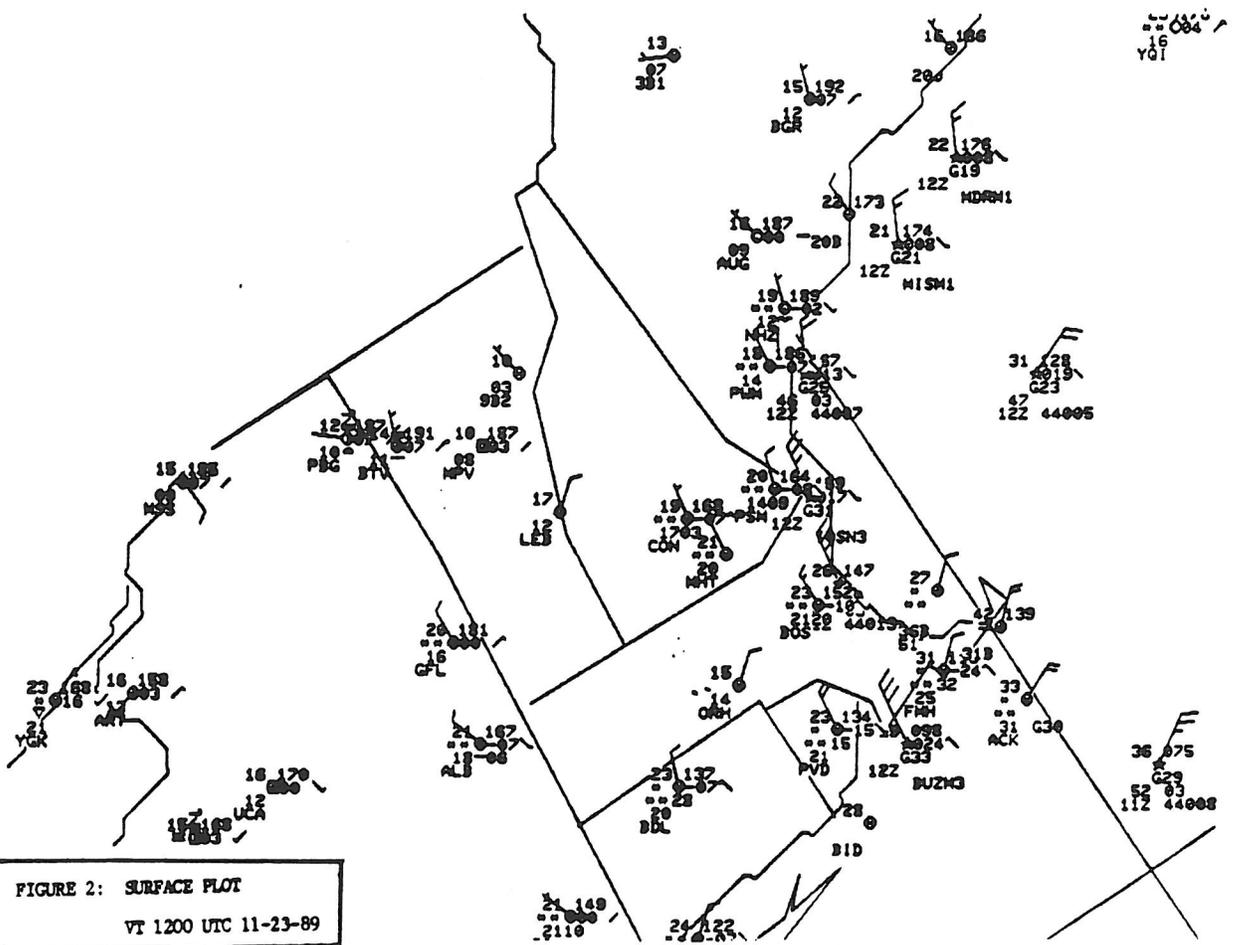
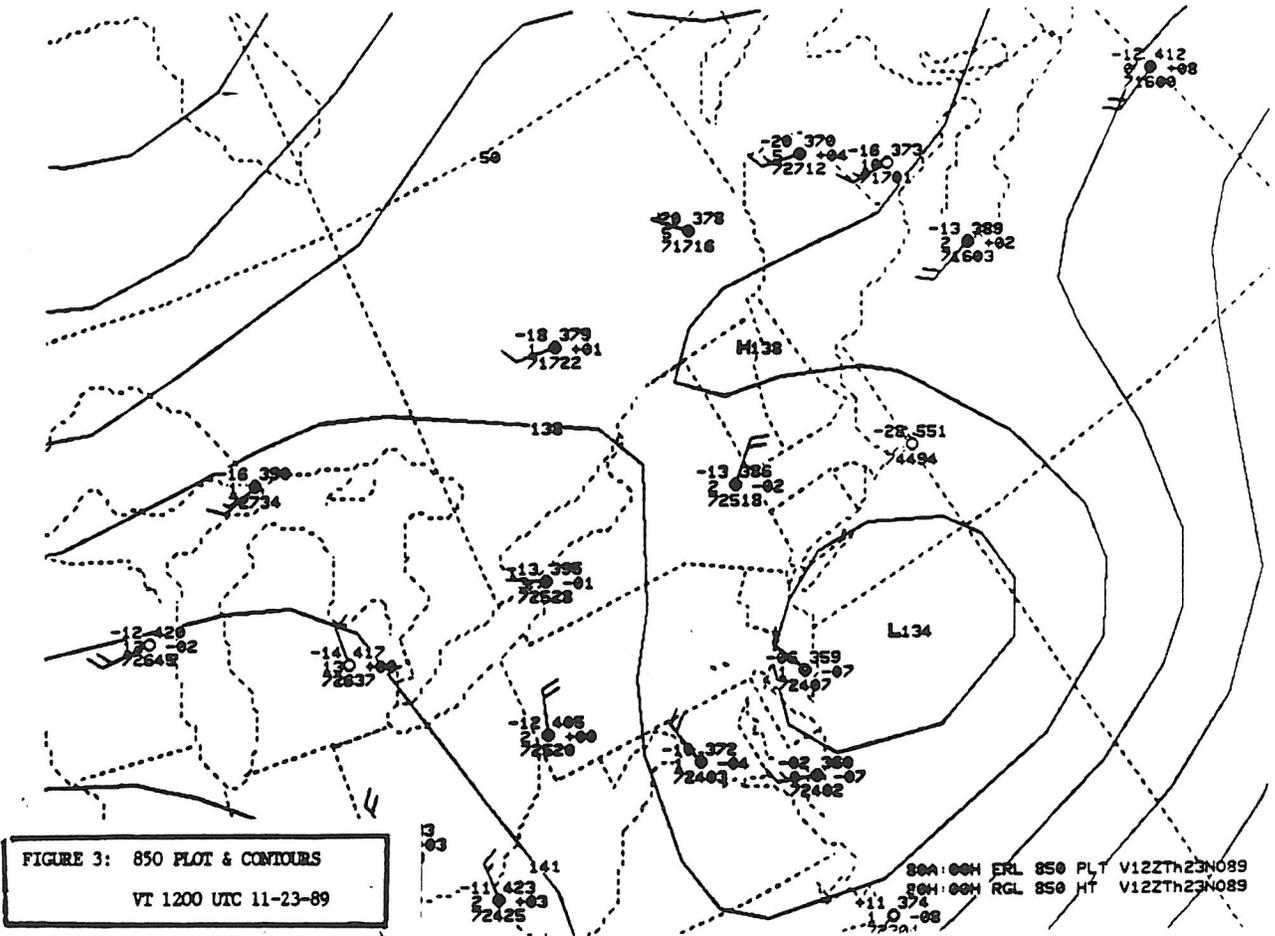


FIGURE 2: SURFACE PLOT
VT 1200 UTC 11-23-89



NNNN>##<A< -
<ZCZC PWMMANPMM
TTAA00 KRWM 231223
72606 TTAA 7312/ 72606 51515 10142=

NNNN>##<A<
<ZCZC BOSMANCHH
TTAA00 KCHH 231304 COR
74494 TTAA 73120 74494 99009 00007 03025 00081 36923 21522
35551 277// 88999 51515 10150 10158 10164 00095 10194 /////
//////=

FIGURE 4: UPPER AIR MANDATORY LEVELS
PORTLAND ME & CHATHAM MA

VT 1200 UTC 11-23-89

NNNN>##<A<
<ZCZC BOSSPSBOS
TTAA00 KBOS 231415

SPECIAL WEATHER STATEMENT FOR MASSACHUSETTS
NATIONAL WEATHER SERVICE BOSTON MA
912 AM EST THU NOV 23 1989

WINTER STORM WARNINGS ARE POSTED FOR ALL OF EASTERN MASSACHUSETTS,
INCLUDING CAPE COD AND THE ISLANDS...AS WELL AS ALL OF RHODE ISLAND
AND ALL OF CONNECTICUT EXCEPT THE NORTHWEST TIP.

HEAVY SNOW IN SOUTHERN NEW ENGLAND THIS MORNING HAD DUMPED BETWEEN
3 AND 6 INCHES SO FAR...EXCEPT 6 TO 10 INCHES ON THE CAPE AND ISLANDS.
SNOW WAS ABATING IN FAR WESTERN NEW ENGLAND BUT AN ADDITIONAL 2 TO 4
INCHES CAN BE EXPECTED IN EASTERN MASSACHUSETTS THE REMAINDER OF THIS
MORNING.

A FEW SNOW TOTALS AS OF 9 AM IN MASSACHUSETTS ARE AS FOLLOWS

BOSTON	3 INCHES
WORCESTER	5 INCHES
HOLDEN	6 INCHES
CHATHAM	6 INCHES
NANTUCKET	9 INCHES

IT IS A TOUGH MORNING FOR TRAVEL IN SOUTHERN NEW ENGLAND. IF YOU
DO NOT HAVE TO TRAVEL...DON/T. GUSTY NORTH WINDS TO 35 MPH WERE
COMPOUNDING SNOW CLEARANCE MEASURES ALONG COASTAL MASSACHUSETTS.

CONDITIONS SHOULD IMPROVE RAPIDLY LATER THIS AFTERNOON THOUGH HEAVY
SNOW MAY CONTINUE ON CAPE COD UNTIL LATE IN THE DAY.

FIGURE 5: SPECIAL WEATHER STATEMENT
BOSTON MA ISSUED 11-23-89