Analysis of the February 7, 2002 Wind Storm Using the Weather Event Simulator (WES)

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Introduction

On February 7, 2002 a rapidly developing low pressure system and ensuing strong winds moved into southwest Oregon then northward across the southern Willamette Valley, which produced significant property damage and power outages across Lane, Linn, Benton, and Marion Counties in northwest Oregon. This storm produced 50 to 70 mph wind gusts in Lane and Linn Counties over a two to three hour time frame and was the worst wind storm to hit the southern Willamette Valley since the Columbus Day Storm of October 12, 1962. Maximum wind gusts reported over western Oregon were 100 mph in Winchester Bay, 88 mph in Bandon, 85 mph in Gold Beach, and 70 mph in Eugene, OR.

Several weeks after the event we performed a post event analysis using the Weather Event Simulator (WES) in order to gain some insight to the meteorological situation and find any parameters or data analysis tools that may improve forecasting this type of event in the future.

Synoptic Features

At approximately 1800 UTC on 7 February 2002, a developing low pressure system was located near 41N/129W with an estimated surface pressure of 1003 mb according to nearby ship, buoy data, and satellite imagery. At 2100 UTC (Fig 1), the low pressure center was located near 43N/125.5W with a derived surface pressure of 1001 mb according to the NCEP analysis. At 0000 UTC on 8 February 2002 the low pressure center came onshore near the county line of Lane and Lincoln Counties (44.3N/124W with a surface pressure of 995 mb). The storm tracked NE over Salem, OR then into the counties of Hood River, OR and Skamania, WA around 0300 UTC before exiting WFO Portland's County Warning Area after 0300 UTC.

The first report of strong winds in our County Warning Area (CWA) was around 0015 UTC 8 Febraury 2002 with a 63 mph gust at Florence, OR in Lane County. The first damage report at 0031 UTC was from a spotter in Lane County who reported 10 inch diameter trees were blown down. Additional reports of widespread damage due to trees down and power poles blown over came in during the next 75 minutes. These reports were from an areas stretching from southern Lane County northward into Linn County.

As the storm moved into the Cascade Foothills and Cascades, additional reports of strong winds and downed trees were received. Yellowstone RAWS had wind gusts of 68 mph and Trout Creek RAWS had 67 mph wind gusts.

Model Performance

None of the model analyses and prognoses were adequate to provide a useful tool for the forecaster to determine a high wind event would occur. In retrospect, real-time data analysis would have been the best tool for short term forecasting.

The 1200 UTC run of the Eta model was extremely poor in depicting the character of this storm. The 6 and 12 hour forecasts (valid at 1800 UTC and 0000 UTC) of the sea level pressure field indicated no surface low and the surface pressure gradient between the central Oregon Coast and southwest Oregon was only 2 mb. Instead, observations later revealed the surface low had a surface pressure of 995 mb with a 17 mb surface pressure gradient between the central Oregon Coast and southwest Oregon .

The 1800 UTC run of the MesoEta model was not much better–only depicting a 1008 mb surface low near the southwest Oregon Coast at 0000 UTC with a 2 mb gradient from the central Oregon Coast to extreme southwest Oregon.

The 1200 UTC run of the Aviation model was also poor, but the 1800 UTC Aviation model was slightly better depicting a 1007 mb surface low at 1800 UTC, but it was located too far south. The six hour forecast, valid at 0000 UTC, deepened the surface low to 1001 mb, but again was too far south. Furthermore, the strongest gradient was only 5 mb–primarily between south Central Oregon and the Northern California border. However, the 1800 UTC run was not available to the forecaster until approximately 2200 UTC.

Data Analysis using WES

Water vapor imagery depicted a strong short wave developing at 1400 UTC 7 February 2002 near 40N/135W. A dry slot began to form around 1700 UTC with a total wrap around by 2300 UTC near the Central Oregon Coast (Fig 2). Infrared imagery also showed significant development of this storm between 1800 UTC and 2100 UTC as it approached the coast during the early afternoon hours. Visible imagery between 1945 UTC and 2100 UTC showed convective clouds near the center of the storm and along the frontal boundary, which may have aided in transporting the higher winds aloft to the surface.

Surface pressure tendency data available on AWIPS via the MSAS data set showed tremendous pressure falls throughout the late morning and into the afternoon, maximizing at 8.5 mb/3 hr at 2200 UTC over the central Oregon Coast. The track of the pressure fall tendencies were coincident with the subsequent track of the storm. At 1800 UTC, maximum pressure falls were 3.5 mb/3 hr near Curry County in southwest Oregon, increasing to 7.5 mb/3 hr at 2100 UTC near Florence, OR on the central Oregon Coast, then moving northeast with 7.5 mb/3 hr falls at 0000 UTC near Salem, OR. Pressure tendencies continued to decrease and were at 5.5 mb/3 hr at 0100 UTC near Hood River, OR.

The MSAS data also showed a very strong pressure fall-rise couplet with this storm. However, even the MSAS analysis incorrectly analyzed the strength of the pressure rises that occurred near the northwest California and southwest Oregon coasts. At 2300 UTC, surface observations indicated a 5.7 mb/1 hr pressure rise at Crescent City, CA, while the MSAS analysis only showed a 3 mb/1 hr pressure rise in this area (Fig 3). The maximum fall/rise couplet of 11 mb/3 hr near Brookings, OR on the southwest Oregon Coast and a fall of near 5.5 mb/3 hr near Skamania County, WA occurred at 0100 UTC, after the storm produced damage (Fig 4).

Conclusions

The utility of the WES proved to be a valuable tool for completing a post storm analysis and identifying the value and benefits of real time data analysis for identifying salient features associated with a rapidly developing low pressure system.

In-depth analysis and use of satellite data to determine the strengthening and evolution of these types of systems may provide useful insight into the subsequent development. In this case, water vapor imagery indicated a dry slot and subsequent development of this system when the dry slot totally wrapped around the low at 2200 UTC, well before any reports of high winds or damage. IR and visible imagery can also provide additional useful information. Since MSAS does not adequately analyze data offshore, a detailed hand analysis at 2100 UTC may have proved to be a useful tool.

The WES analysis also showed the importance of surface pressure tendencies and MSAS data in this event. Prior to this storm entering our CWA, metar data showed pressure falling rapidly prior to the onset of high winds. The track of the MSAS pressure falls showed the subsequent track of the storm (Fig 5). The MSAS pressure fall-rise couplet can be a very good indicator of strong winds.

Routinely incorporating all data sources such as satellite imagery, pressure tendency data, ship and buoy data in the analysis process, and doing asynoptic surface analyses (e.g., 2100 UTC) can provide a useful tool for diagnosing the strength of a rapidly developing system.

Acknowledgments

We would like to thank Bill Schneider, WFO PQR SOO, for comments and suggestions on this TA-Lite.

Figure 1

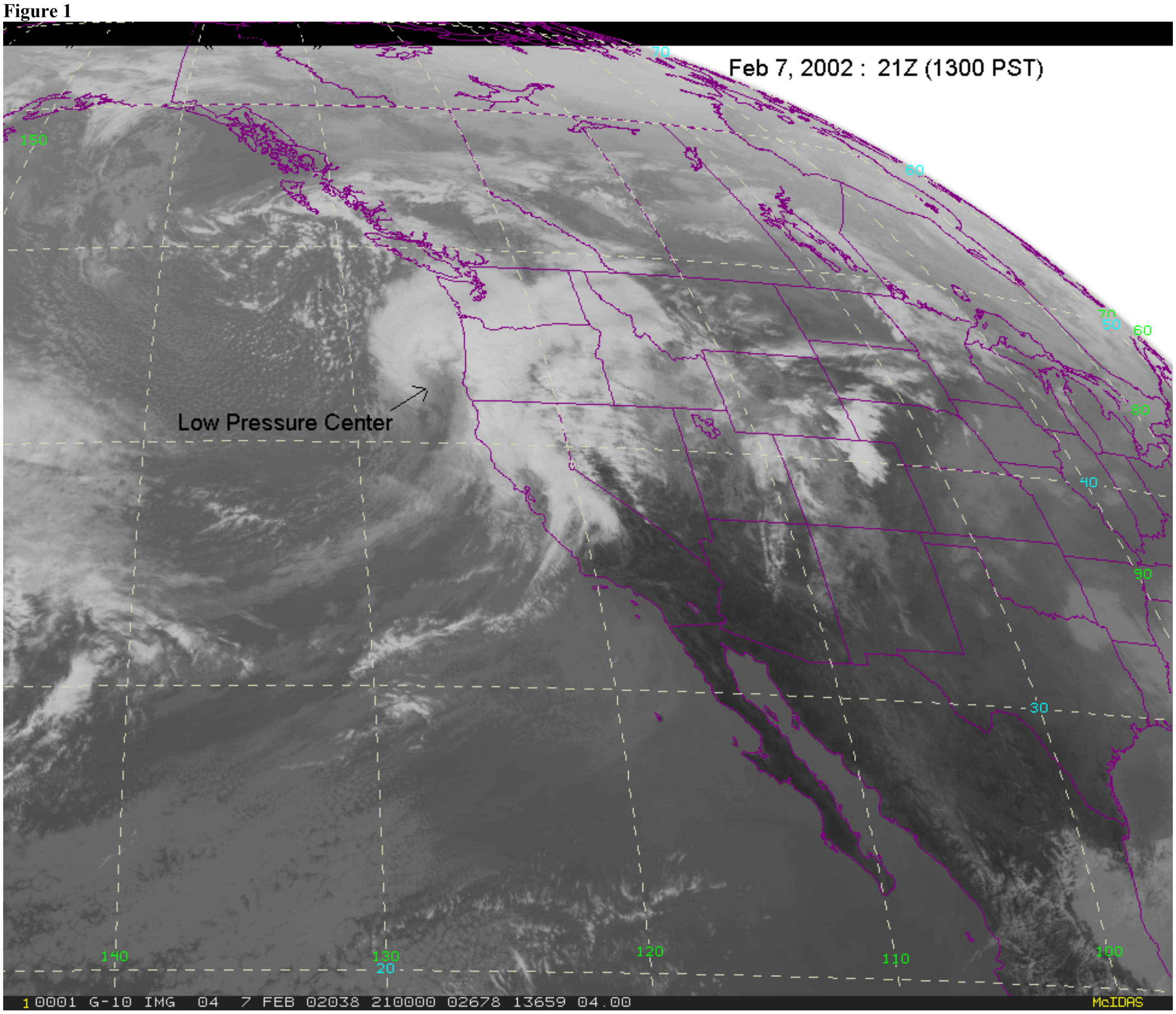


Figure 2

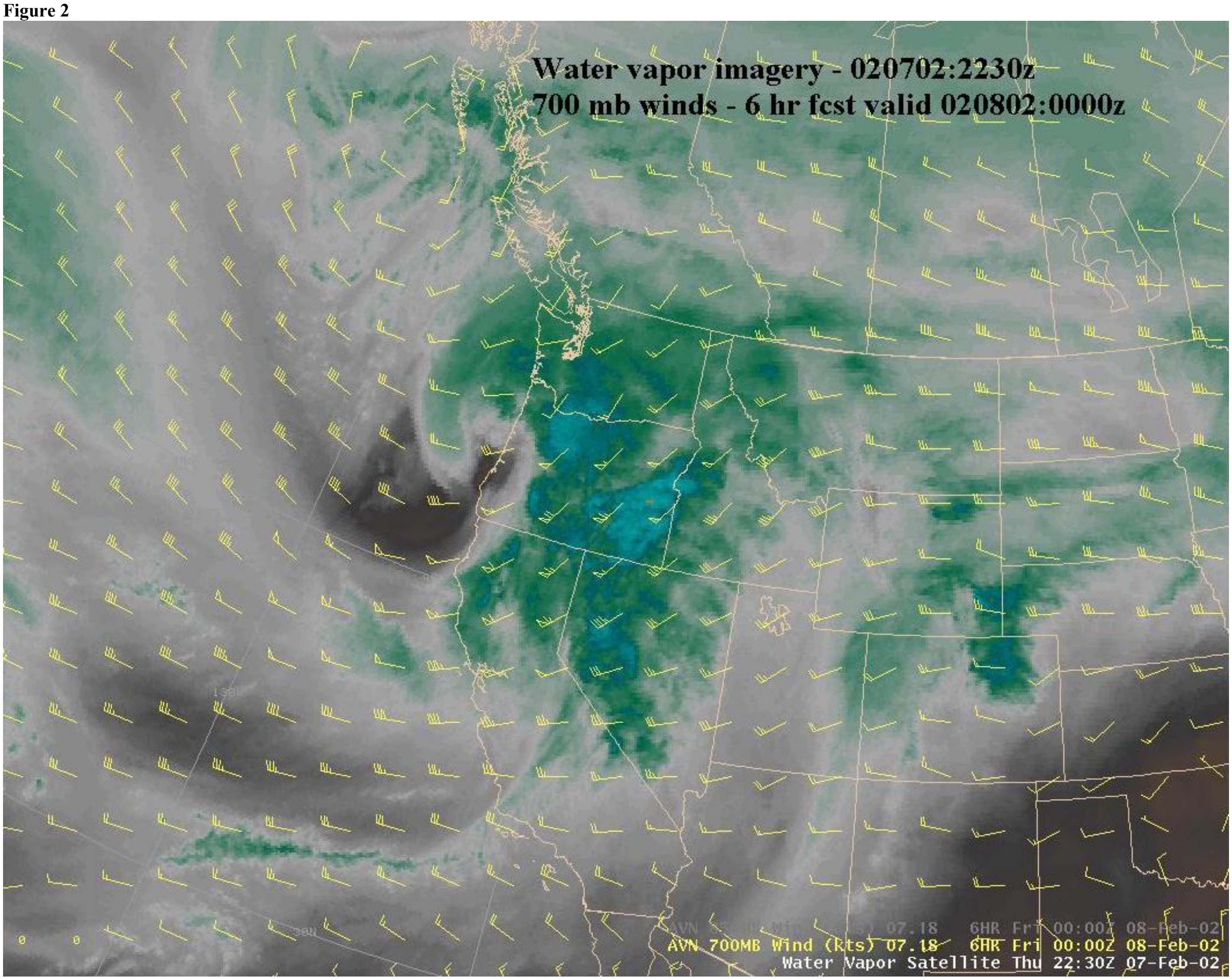


Figure 3

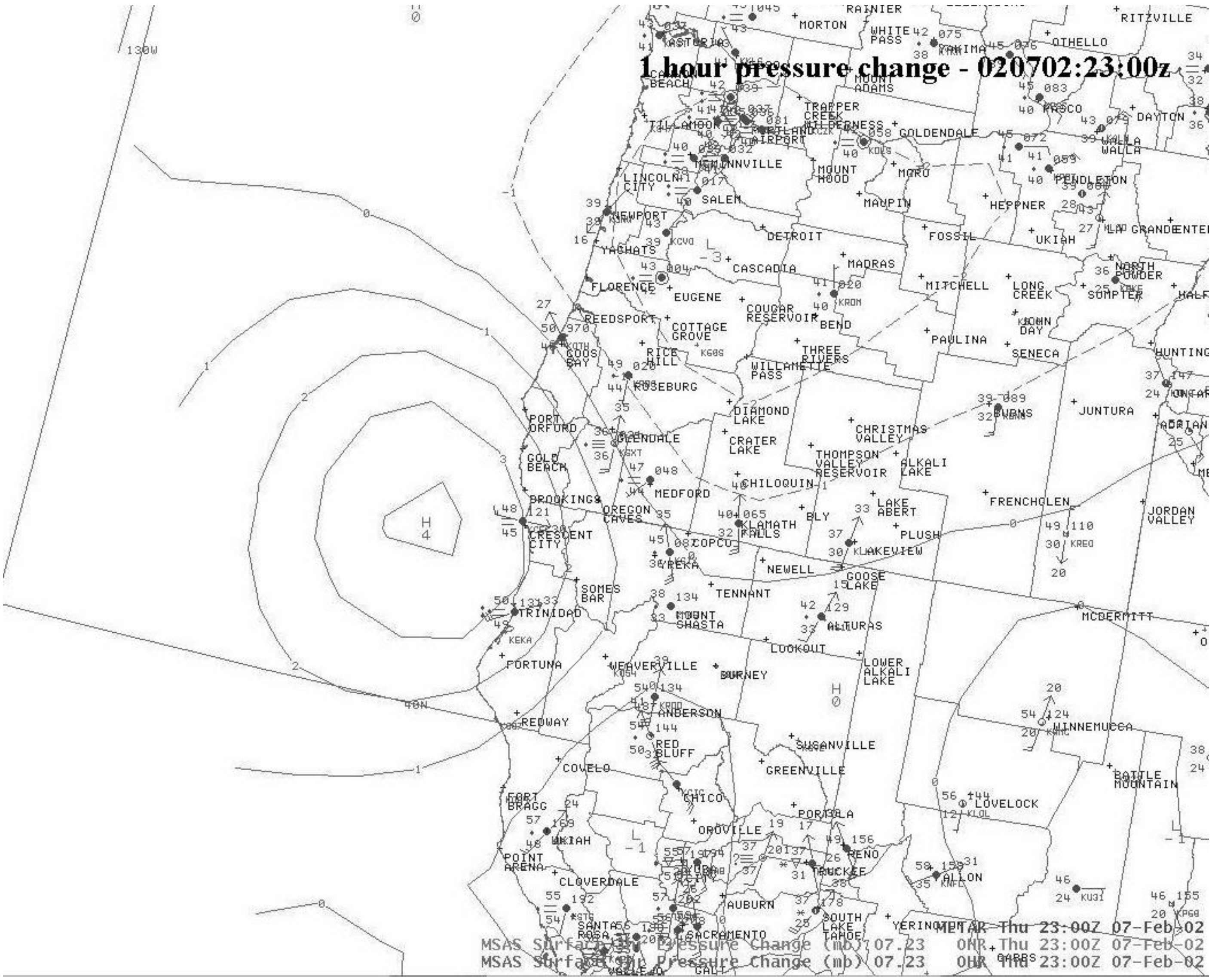

1 hour pressure change - 020702:23:00z
MSAS Surface Pressure Change (mb) 07.23 0HR Thu 23:00Z 07-Feb-02

Figure 4

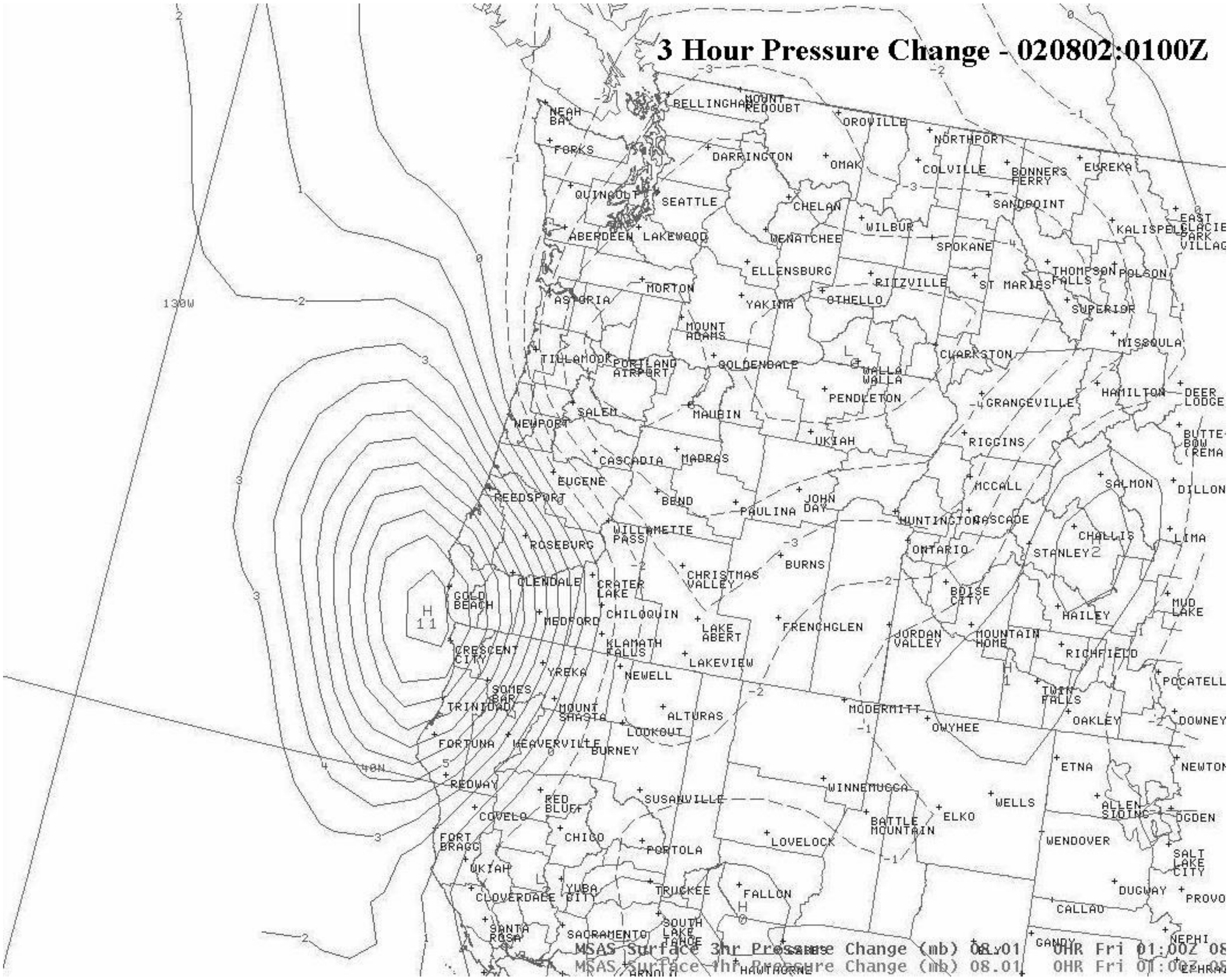
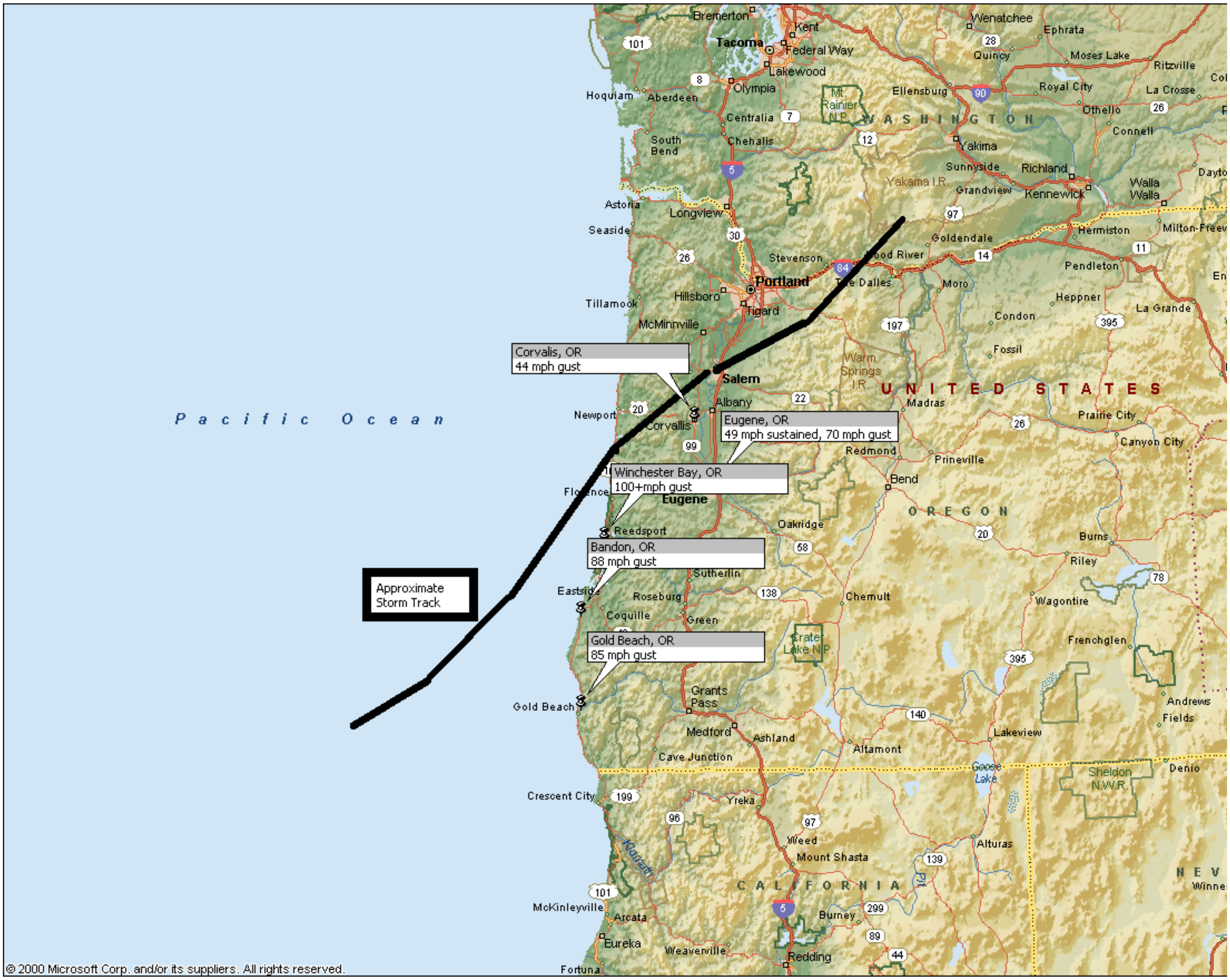

3 Hour Pressure Change - 020802:0100Z
130W
40N
BELLINGHAM
MOUNT REDOUBT
OROVILLE
NEAH BAY
FORKS
NORTHPORT
DARRINGTON
OMAK
COLVILLE
BONNERS FERRY
EUREKA
QUINAULT
SEATTLE
CHELAN
SANDPOINT
ABERDEEN
LAKEWOOD
WENATCHEE
WILBUR
SPOKANE
KALISPELL
ELLENSBURG
RITZVILLE
ST MARIES
THOMPSON FALLS
POLSON
ASTORIA
MORTON
YAKIMA
OTHELLO
SUPERIOR
MOUNT ADAMS
MISSOULA
TILLAMOOK
PORTLAND AIRPORT
GOLDENDALE
WALLA WALLA
CLARKSTON
PENDLETON
GRANGEVILLE
HAMILTON
DEER LODGE
NEWPORT
SALEM
MAUPIN
UKIAH
RIGGINS
CASCADIA
MADRAS
EUGENE
MCCALL
SALMON
DILLON
REEDSPORT
BEND
PAULINA
JOHN DAY
HUNTINGTON
CASCADE
WILLAMETTE PASS
CHALLIS
LIMA
ROSEBURG
ONTARIO
STANLEY
CHRISTMAS VALLEY
BURNS
GLENDALE
CRATER LAKE
BOISE CITY
GOLD BEACH
CHILOQUIN
HAILEY
MUD LAKE
MEDFORD
LAKE ABERT
FRENCHGLEN
JORDAN VALLEY
MOUNTAIN HOME
CRESCENT CITY
KLAMATH FALLS
RICHFIELD
LAKEVIEW
YREKA
NEWELL
POCATELL
SOMES BAR
TWIN FALLS
TRINIDAD
MOUNT SHASTA
ALTURAS
MCDERMITT
OWYHEE
OAKLEY
DOWNEY
LOOKOUT
FORTUNA
WEAVERVILLE
BURNEY
ETNA
NEWTON
REDWAY
SUSANVILLE
WINNEMUCCA
WELLS
RED BLUFF
BATTLE MOUNTAIN
ELKO
ALLEN SIDING
OGDEN
COVELO
FORT BRAGG
CHICO
LOVELOCK
WENDOVER
PORTOLA
SALT LAKE CITY
UKIAH
YUBA CITY
TRUCKEE
FALLON
DUGWAY
PROVO
CLOVERDALE
CALLAO
SANTA ROSA
SACRAMENTO
SOUTH LAKE TAHOE
NEPHI
MSAS Surface 3hr Pressure Change (mb) 08.01 0HR Fri 01:00Z

Figure 5


Corvalis, OR
44 mph gust
Eugene, OR
49 mph sustained, 70 mph gust
Winchester Bay, OR
100+mph gust
Bandon, OR
88 mph gust
Gold Beach, OR
85 mph gust
Approximate
Storm Track
Pacific Ocean
UNITED STATES
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