8.6 March 12 - 13th "Bora" Windstorm across much of South-central Alaska

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ABSTRACT

A record breaking wind storm struck the Susitna and Matanuska Valleys, the Anchorage Municipality, portions of the Kenai Peninsula and Prince William Sound on Wednesday and Thursday, March 12 and 13, 2003. What made this windstorm especially interesting was that it was a "Bora", or cold-advection windstorm as opposed to the more common downslope, "Chinook" windstorm.

An unseasonably strong high latitude blocking pattern set up across North Central Alaska late in the first week of March. The block proceeded to retrogress west during the second week of March, and a vigorous short wave trough on the west side of the Hudson Bay Vortex drove south across Alaska. The westward movement of this upper ridge allowed the "blocked" low-level arctic air to phase with the strong cold advection aloft to produce the damaging winds across South Central Alaska.

The Ted Stevens International Airport tower experienced record wind speeds around midnight Thursday, with sustained winds of 80 to 82 kt (92 mph to 94 mph), and a peak wind gust of 95 kt (109 mph). The tower was abandoned and the airport was shut down for several hours during the early morning hours of Thursday. Peak winds of 73 kt to 86 kt (84 mph to 100 mph) were reported from the Matanuska Valley (north of Anchorage) to Valdez on Prince William Sound. Ambient air temperatures during the event were around 0F (-17C).

Damage from the wind event exceeded $3.5 Million in Anchorage alone with almost $4.5 Million reported in the Matanuska Valley. Total damage from the storm across South Central Alaska exceeded $5 Million.

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Discussion

The March 12-13 event was unusual in that a strong high latitude blocking pattern set up, for the first time, late in the winter over Siberia. The block ultimately allowed a vigorous short wave trough on the west side of the Hudson Bay Vortex to drive south across Alaska causing the strong cold advection surface winds across South Central Alaska. Duration of the most intense winds was generally 18 hours or less...beginning during the day on Wednesday March 12 and ending Thursday March 13.

At 0000 UTC on March 11 an unseasonably strong 5730 meter 500 HPa high was centered over extreme northeast Siberia (Figure 1). The associated upper ridge was oriented east-west, and extended across central Alaska into the Yukon Territory of Canada. The aforementioned shortwave trough embedded in the northwest flow aloft was located across central Alaska which indicated a 105 kt Jet maximum at 500 HPa. The surface pattern at this time exhibited an unseasonably cold Arctic Front in the vicinity of the North Slope. 850 HPa temperatures of -28C were indicated with1000-500mb thicknesses minimum values of 4950 meters. A 1050 HPa surface high associated with the high aloft was centered west of Bennett Island (Figure 2).

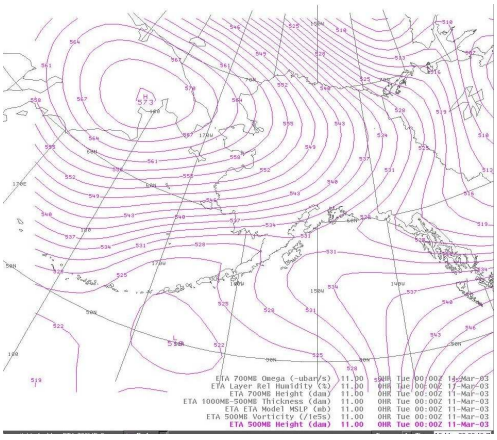

Figure 1. 500 HPa Heights at 0000 UTC 11 March 2003

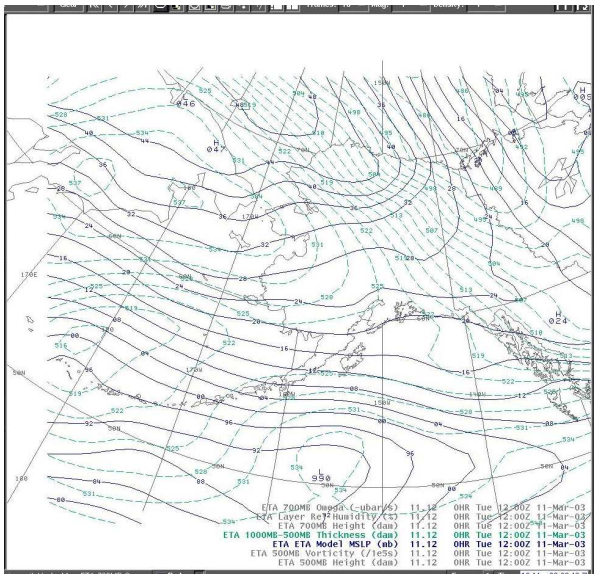

Figure 2. Surface Mean Sea Level pressure with 1000-500 mb Thickness for 0000 UTC 11 March 2003

By 1200 UTC on March 11 the strong short wave trough had dropped south along the Gulf of Alaska coastal region pushing the upper ridge into the Gulf of Alaska (Figure 3). Though the upper level flow remained generally northwest from the Bennett Island area north of Siberia through South Central Alaska the short wave trough had begun veering the wind field as the Hudson Bay vortex showed signs of retrogression. Middle and upper atmospheric winds were acquiring a slightly more north component across central Alaska. This orientation allowed the broad penetration of the Arctic airmass into interior Alaska.

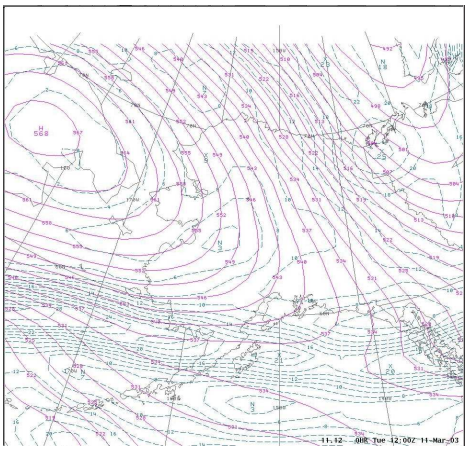

Figure 3. 500 HPa Heights and Vorticity at 1200 UTC 12 March 2003

The Arctic Front spread rapidly into the Gulf of Alaska west of Cook Inlet by 1200 UTC March 12. The nose of a broad 80 kt jet maximum was evident at 500 HPa from the Siberian Arctic to the Anchorage area. With cold Arctic air now pouring offshore into the Gulf of Alaska, cyclogenesis was enhanced and a rapidly deepening 980 HPa developed west of Kodiak Island (Figure 5).

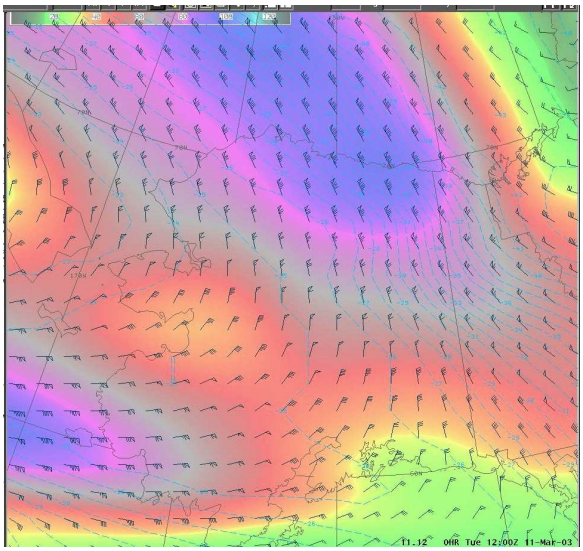

Figure 4. 500 HPa Wind Vectors and Windspeed at 1200 UTC 12 March 2003

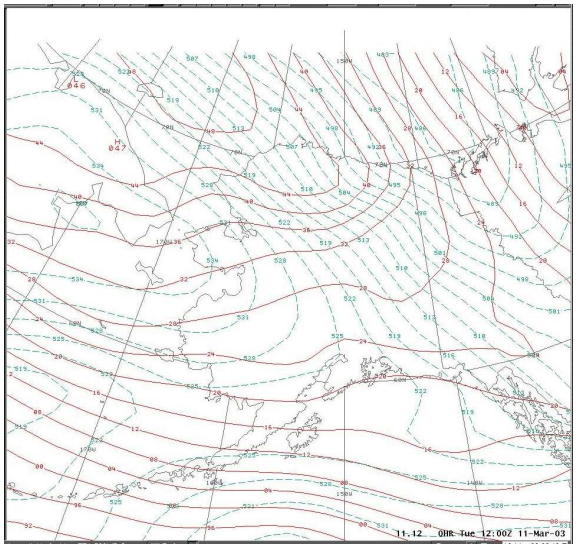

Figure 5. Surface Mean Sea Level pressure with 1000-500 mb Thickness for 1200 UTC 12 March 2003

The high wind event began in the Anchorage area during the late morning of March 12 at about the time the 1000-500 mb thickness and the 1000-850 mb thickness advection exceeded -10C/12 hours. This was coincidental with the intrusion of the nose of the 80 kt 500 HPa jet maximum over the South Central Alaska. The evolution of the wind pattern was best evidenced in the Talkeetna wind profiler (Figure 6). A time crossection from the profiler showed the veering and strengthening of the low level flow during the morning of the 12th as the Arctic airmass deepened, and the momentum from the higher level jetstream was mixed downward.

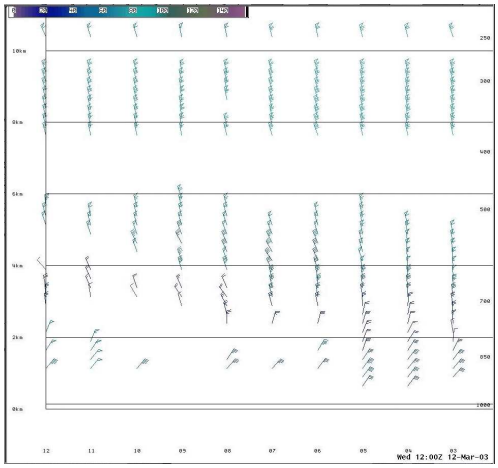

Figure 6. Talkeetna, Alaska Profiler at 1200 UTC 12 March, 2003

Somewhat unusual was the fact that the maximum surface winds occurred coincidental with the time of largest pressure falls (delineated by the -5mb/6 hours contour). More often than not cold advection, momentum-mixing wind cases are accompanied by strong pressure rises as high pressure builds in to the affected area. The March 12-13 case was different in that strong cyclogenesis continued in the north Gulf of Alaska (surface pressure minimum around 955 HPa) during the time of the strongest cold advection and mid level winds (Figure 7, near the end of the event).

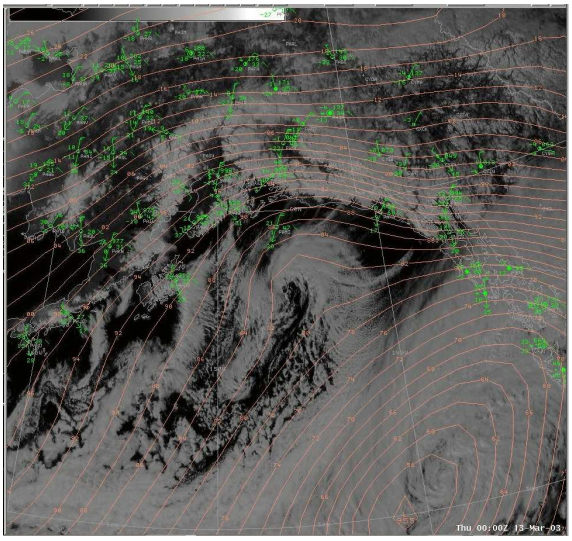

Figure 7 Surface Mean Sea Level pressure for 1200 UTC 14 March 2003

CONCLUSION

Work continues on this particular case. However, a few items have been identified as significant:

1) Synoptic transport of deep, cold arctic air in a strongly anti-cyclonic flow.

2) Formation and deepening (bomb) of Low east of Kodiak Island served to increase N-S pressure gradient. This was due in part to the strong baroclinicity set up by the dry polar air moving over the warmer Gulf of Alaska waters.

3) Enhancement (acceleration) of downslope (subsidence) by vorticity maximums embedded within northerly flow.

Based on viewing of Eta model runs: Model identified the Low-Level Jet over Southwest Alaska oriented NE to SW. However, the Eta did not pick up on second jet running North to South through South Central Alaska. The 850 HPa Omega field indicated a Max over Southcentral Alaska during the peak wind period (at 06z on 3/13/03 -16 microbars/second).