Western Region Technical Attachment
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AVN/NGM MODEL COMPARISON

Richard Grumm and Robert Oravec of NMC have recently completed a comparison of model errors associated with surface cyclones and anticyclones during the spring of 1991. We summarize here some of the differences between the errors made by the NGM and AVN models that should be of interest to forecasters in the Western Region.

The mean pressure errors for surface cyclones were always negative for the NGM and were negative after 12 hours for the AVN. This means that both models tended to forecast the central pressure of surface cyclones ("lows") too low (overdeepen). The AVN tended to make smaller errors with the central pressure than the NGM (the values in the "pressure RMS" columns are smaller for the AVN for each forecast time). The "distance errors" were also smaller for the AVN than for the NGM, indicating that the AVN was better able to forecast the placement of the surface low pressure at all forecast periods.

Even though the overall tendency for the NGM was to forecast the central pressure of surface low pressure systems slightly too low, the tendency was much greater in the western U.S. than in other areas. The maps for 36 hour forecasts indicate that the NGM tended to forecast the central pressure of surface lows off the northern California coast as much as 4 mb too low as shown in Fig. 1 (other forecast times were similar). The AVN errors were smaller, and did not show as much of a regional bias.

Both the NGM and AVN tended to forecast 850-mb temperatures and 1000-500-mb thicknesses above surface cyclones too low (a "cold bias"). Both models had a stronger tendency for this cold bias over the elevated terrain of the western U.S. and western Canada than over the eastern part of North America (Fig. 2). Even though the AVN model had smaller thickness and temperature errors than the NGM (smaller RMS errors), the cold bias tended to be stronger in the AVN than the NGM (larger mean errors).

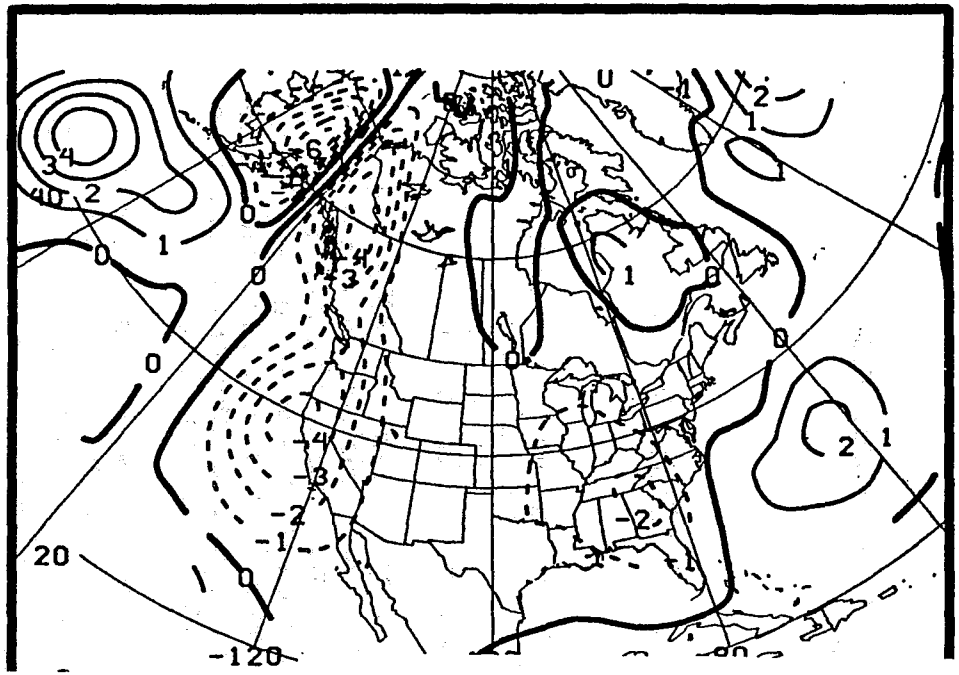
For surface anticyclones (high pressure centers) the AVN tended to forecast the pressure too high as shown in Fig. 3. The NGM tended to forecast the pressure too low during the first 24 hours and too high during the last 24 hours. The AVN also had a cold bias when forecasting high pressure systems, while the NGM had a warm bias.

To summarize, at all forecast times the AVN tended to outperform the NGM in terms of position and strength of surface high and low pressure systems. However, the AVN had more of a tendency to forecast the thickness (and 850-mb temperature) too low over low pressure systems. This cold bias also tended to be present in AVN forecasts over high pressure systems while the NGM tended to have a warm bias over surface high pressure systems.

Both models had a tendency (especially in the western U.S.) to not forecast surface cyclones and anticyclones that were eventually observed (figures not shown). In other words, both the NGM and AVN often miss the initial development of surface cyclones and anticyclones.

NGM errors for surface cyclones, Spring 1991

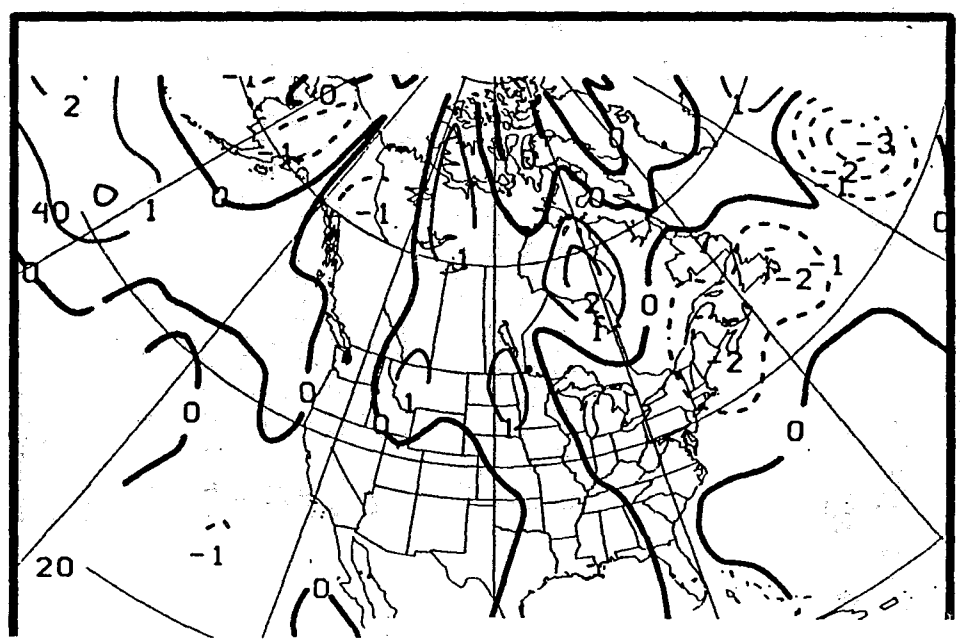
Month	Fcst	Number	Pressure (mb)		Distance (km)	
			mean	RMS	mean	RMS
SP91	12	816	-0.12	2.69	149	189
SP91	24	727	-0.36	4.21	214	272
SP91	36	650	-0.13	5.59	280	351
SP91	48	559	-0.04	6.62	337	423



NGM surface cyclone pressure errors - 36hr forecasts

AVN errors for surface cyclones, Spring 1991

Month	Fcst	Number	Pressure (mb)		Distance (km)	
			mean	RMS	mean	RMS
SP91	12	710	0.06	1.93	122	163
SP91	24	656	-0.11	2.89	185	245
SP91	36	580	-0.46	3.80	220	284
SP91	48	553	-0.69	4.69	281	359
SP91	60	499	-0.88	5.21	358	445
SP91	72	444	-0.62	5.92	427	527

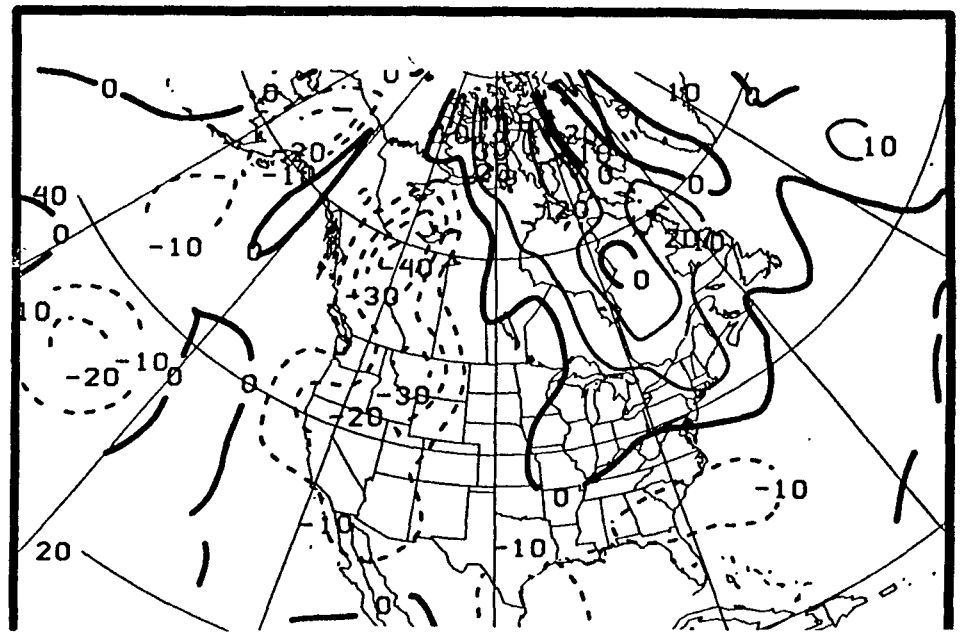


AVN surface cyclone pressure errors - 36hr forecasts

Fig. 1

NGM errors for surface cyclones, Spring 1991

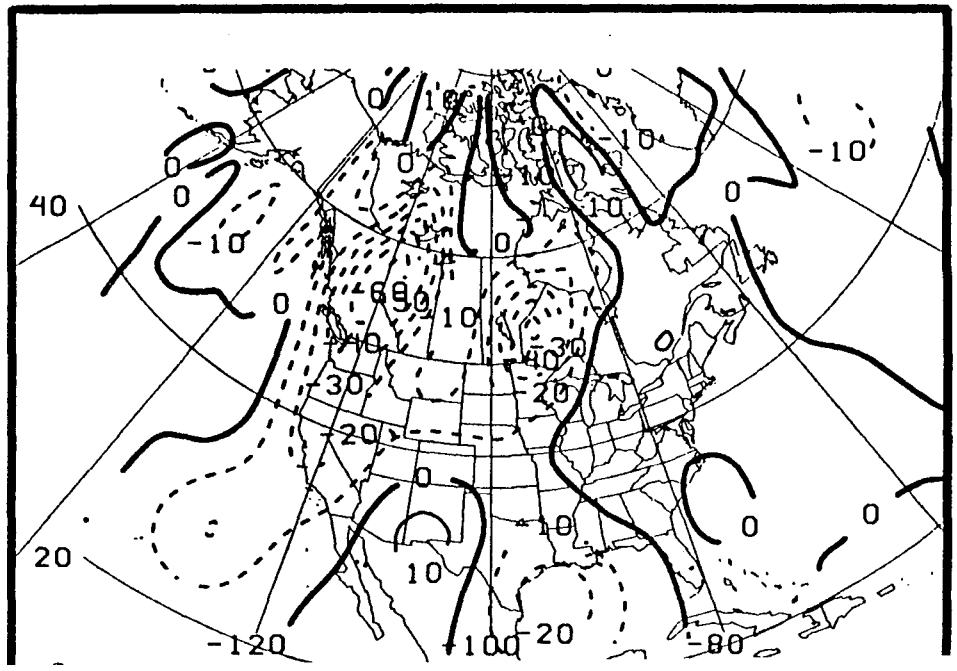
Month	Fcst	Number	Temp 850 (K)		Thickness (m)	
			mean	RMS	mean	RMS
SP91	12	816	-0.24	2.66	-4.93	36.05
SP91	24	727	-0.23	3.05	-5.56	44.80
SP91	36	650	-0.02	3.43	-1.94	54.20
SP91	48	559	-0.07	3.49	-1.36	56.71



NGM surface cyclone thickness errors - 36hr forecasts

AVN errors for surface cyclones, Spring 1991

Month	Fcst	Number	Temp 850 (K)		Thickness (m)	
			mean	RMS	mean	RMS
SP91	12	710	-0.14	1.91	-3.48	29.35
SP91	24	656	-0.29	2.43	-7.45	38.87
SP91	36	580	-0.28	2.72	-8.67	43.12
SP91	48	553	-0.38	3.17	-9.81	51.27
SP91	60	499	-0.29	3.66	-8.64	60.82
SP91	72	444	-0.37	3.94	-9.38	66.83



AVN surface cyclone thickness errors - 36hr forecasts

Fig. 2

NGM errors for surface anticyclones, Spring 1991

Month	Fcst	Number	Pressure (mb)		Temp 850 (K)		Thickness (m)		Distance (km)	
			mean	RMS	mean	RMS	mean	RMS	mean	RMS
SP91	12	619	-0.10	2.00	0.08	2.48	-0.16	36.40	175	220
SP91	24	561	-0.16	2.82	0.22	2.80	1.19	41.17	231	288
SP91	36	513	0.11	3.61	0.40	3.10	4.81	48.26	286	354
SP91	48	441	0.31	4.27	0.49	3.39	4.58	52.80	321	399

AVN errors for surface anticyclones, Spring 1991

Month	Fcst	Number	Pressure (mb)		Temp 850 (K)		Thickness (m)		Distance (km)	
			mean	RMS	mean	RMS	mean	RMS	mean	RMS
SP91	12	497	0.69	1.45	-0.32	1.64	-7.14	28.25	167	218
SP91	24	476	1.08	1.93	-0.55	2.06	-12.63	34.82	216	268
SP91	36	421	1.18	2.32	-0.61	2.33	-13.98	37.96	247	302
SP91	48	394	1.30	2.63	-0.58	2.64	-13.92	46.15	320	418
SP91	60	369	1.08	2.89	-0.68	2.87	-14.74	50.53	366	476
SP91	72	301	0.94	3.12	-0.79	3.03	-16.12	55.35	409	518

Fig. 3