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COMPARATIVE VERIFICATION OF LOCAL AND GUIDANCE CLOUD AMOUNT FORECASTS--NO. 2

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We have computed comparative verification scores for TDL's automated guidance forecasts and National Weather Service (NWS) local forecasts of cloud amount made during April through September 1975. The guidance forecasts for April through July were based on the cool season (October-March) regression equations described in the NWS Technical Procedures Bulletin No. 124 (NWS, 1974a), and for August and September on the warm season (April-September) equations described in NWS Technical Procedures Bulletin No. 133 (NWS, 1975). The Technical Procedures Branch of the Office of Meteorology and Oceanography furnished the local forecasts which had been prepared at Weather Service Forecast Offices (WSFO's). This verification study was made in conjunction with the NWS combined aviation/public weather verification system (NWS, 1973). Table 1 shows the 94 stations which were verified. Opaque sky cover observations were obtained from the National Climatic Center in Asheville.

We transformed the local forecasts and the sky cover observations into categories of clear (1), scattered (2), broken (3), and overcast (4) in the manner shown below.

<u>Category Number</u>	<u>Cloud Amount</u> tenths
1	0-1
2	2-5
3	6-9
4	10

The transformed subjective forecasts and the objective best category estimates (NWS, 1974b) were used to prepare four-category, forecast-observed contingency tables. Percent correct, skill score, and bias by category (i.e., the number of forecasts in a particular category divided by the number of observations in that category) were computed from these tables.

Tables 2-6 show the comparative verification scores for April through September 1975 for three different projections. The guidance forecasts were made from 0000 GMT data, and projections were 18, 30, and 42 hours except during August and September when 0600 GMT surface observations were used for the 18-hr forecast. The local forecasts were issued about 1000 GMT and may have been based on data as much as nine hours later than those used in the guidance forecasts.

Table 2 is a summary of the verification scores for all the stations combined. The percents correct and skill scores indicate that the local estimates of cloud amount were substantially better than guidance for the 18-hr projection. However, the guidance was better at 30 hours. Both systems were nearly equal in skill for the 42-hr forecasts. The bias by category results show the local forecasts strongly over-estimated the occurrence of scattered conditions (i.e., category 2).

Tables 3-6 give the results for the NWS Eastern, Southern, Central, and Western Regions, respectively. These scores have the same general characteristics as we noted for all 94 stations combined.

We also computed comparative verification scores for August and September 1975, since these were the only two months in which the guidance was based on warm season equations. Table 7 shows the overall results, and Tables 8-11 give the scores for each of the four NWS regions. In general, these results are similar to those for the full (6-month) sample, except the guidance now has the edge at 42 hours as well as at the 30-hr projection.

ACKNOWLEDGMENT

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REFERENCES

- National Weather Service, 1973: Combined aviation/public weather forecast verification. National Weather Service Operations Manual, Chapter C-73, 15 pp.
- National Weather Service, 1974a: Cloud amount forecasts based on model output statistics (MOS). Technical Procedures Bulletin, No. 124, 9 pp.
- National Weather Service, 1974b: Cloud amount forecasts based on model output statistics (MOS)--No. 2. Technical Procedures Bulletin, No. 125, 6 pp.
- National Weather Service, 1975: Warm season cloud amount forecasts based on MOS--No. 3. Technical Procedures Bulletin, No. 133, 4 pp.

Table 1. Ninety-four stations used in comparative verification of guidance and local cloud amount forecasts.

PWM	Portland, Maine	TCC	Tucumcari, New Mexico
BTW	Burlington, Vermont	SSM	Sault Ste Marie, Michigan
CON	Concord, New Hampshire	DTW	Detroit, Michigan
BOS	Boston, Massachusetts	SBN	South Bend, Indiana
PVD	Providence, Rhode Island	IND	Indianapolis, Indiana
BUF	Buffalo, New York	LEX	Lexington, Kentucky
SYR	Syracuse, New York	SDF	Louisville, Kentucky
ALB	Albany, New York	MSN	Madison, Wisconsin
JFK	New York, New York	MKE	Milwaukee, Wisconsin
ACY	Atlantic City, New Jersey	ORD	Chicago, Illinois
EWR	Newark, New Jersey	SPI	Springfield, Illinois
ERI	Erie, Pennsylvania	STL	St. Louis, Missouri
PIT	Pittsburgh, Pennsylvania	MCI	Kansas City, Missouri
PHL	Philadelphia, Pennsylvania	TOP	Topeka, Kansas
CLE	Cleveland, Ohio	DDC	Dodge City, Kansas
CMH	Columbus, Ohio	DEN	Denver, Colorado
BKW	Beckley, West Virginia	GJT	Grand Junction, Colorado
CRW	Charleston, West Virginia	SHR	Sheridan, Wyoming
DCA	Washington, D.C.	CYS	Cheyenne, Wyoming
ORF	Norfolk, Virginia	BIS	Bismarck, North Dakota
RDU	Raleigh-Durham, North Carolina	FAR	Fargo, North Dakota
CLT	Charlotte, North Carolina	RAP	Rapid City, South Dakota
CAE	Columbia, South Carolina	FSD	Sioux Falls, South Dakota
GSP	Greenville, South Carolina	BFF	Scottsbluff, Nebraska
ATL	Atlanta, Georgia	OMA	Omaha, Nebraska
SAV	Savannah, Georgia	MSP	Minneapolis, Minnesota
MIA	Miami, Florida	DSM	Des Moines, Iowa
JAX	Jacksonville, Florida	BRL	Burlington, Iowa
BHM	Birmingham, Alabama	INL	International Falls, Minnesota
MOB	Mobile, Alabama	FLG	Flagstaff, Arizona
TYS	Knoxville, Tennessee	PHX	Phoenix, Arizona
MEM	Memphis, Tennessee	CDC	Cedar City, Utah
MEI	Meridian, Mississippi	SLC	Salt Lake City, Utah
JAN	Jackson, Mississippi	LAS	Las Vegas, Nevada
MSY	New Orleans, Louisiana	RNO	Reno, Nevada
SHV	Shreveport, Louisiana	SAN	San Diego, California
IAH	Houston, Texas	LAX	Los Angeles, California
SAT	San Antonio, Texas	FAT	Fresno, California
DFW	Forth Worth, Texas	SFO	San Francisco, California
ABI	Abilene, Texas	PDX	Portland, Oregon
LBB	Lubbock, Texas	PDT	Pendleton, Oregon
ELP	El Paso, Texas	SEA	Seattle, Washington
LIT	Little Rock, Arkansas	GEG	Spokane, Washington
FSM	Fort Smith, Arkansas	BOI	Boise, Idaho
TUL	Tulsa, Oklahoma	PIH	Pocatello, Idaho
OKC	Oklahoma City, Oklahoma	MSO	Missoula, Montana
ABQ	Albuquerque, New Mexico	GTF	Great Falls, Montana

Table 2. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 94 stations across the United States during April through September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	0.87	1.07	1.10	0.98	44	0.25	15120
		0.69 (4301)	1.50 (4123)*	1.10 (3657)	0.64 (3039)	49	0.31	
30	GUIDANCE LOCAL	1.05	0.85	1.10	0.97	48	0.24	14975
		0.68 (6685)	1.87 (2826)	1.73 (1821)	0.54 (3643)	43	0.23	
42	GUIDANCE LOCAL	0.93	1.11	1.06	0.86	41	0.21	15094
		0.57 (4303)	1.76 (4150)	1.09 (3635)	0.47 (3006)	40	0.19	

Table 3. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 24 stations in the Eastern Region of the NWS during April through September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO, FCST/NO, OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	0.72	1.14	0.99	1.04	41	0.19	3766
		0.68 (656)	1.41 (1105)	1.17 (1022)	0.57 (974)	46	0.26	
30	GUIDANCE LOCAL	1.11	0.75	1.11	0.99	48	0.27	3783
		0.80 (1293)	1.69 (708)	1.86 (458)	0.52 (1324)	43	0.24	
42	GUIDANCE LOCAL	0.87	1.10	1.02	0.95	38	0.16	3764
		0.53 (677)	1.63 (1106)	1.14 (1005)	0.47 (976)	38	0.15	

Table 4. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 24 stations in the Southern Region of the NWS during April through September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE	0.67	1.02	1.29	0.90	45	0.24	3879
	LOCAL	0.68 (906)	1.49 (1218)	1.02 (1139)	0.46 (616)	49	0.29	
30	GUIDANCE	0.98	0.91	1.20	0.99	44	0.18	3874
	LOCAL	0.69 (1799)	1.87 (840)	1.44 (531)	0.41 (704)	42	0.20	
42	GUIDANCE	0.70	1.18	1.22	0.66	43	0.20	3871
	LOCAL	0.55 (904)	1.71 (1233)	0.98 (1143)	0.24 (591)	43	0.19	

Table 5. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 28 stations in the Central Region of the NWS during April through September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	0.87	0.92	1.12	1.15	41	0.21	4510
		0.57 (1303)	1.62 (1246)	1.08 (1027)	0.69 (934)	46	0.27	
30	GUIDANCE LOCAL	1.04	0.63	1.23	1.10	47	0.22	4354
		0.56 (2001)	2.04 (804)	2.01 (484)	0.59 (1065)	40	0.20	
42	GUIDANCE LOCAL	1.00	0.92	1.03	1.07	39	0.18	4492
		0.39 (1284)	1.87 (1257)	1.11 (1024)	0.53 (927)	37	0.14	

Table 6. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 18 stations in the Western Region of the NWS during April through September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	1.05	1.34	0.84	0.64	52	0.28	2965
		0.81 (1427)	1.45 (554)	1.19 (469)	0.89 (515)	57	0.39	
30	GUIDANCE LOCAL	1.09	1.26	0.74	0.67	55	0.28	2964
		0.74 (1592)	1.86 (474)	1.59 (348)	0.66 (550)	49	0.27	
42	GUIDANCE LOCAL	1.04	1.45	0.82	0.55	48	0.22	2967
		0.75 (1438)	1.86 (554)	1.18 (463)	0.61 (512)	45	0.23	

Table 7. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 94 stations across the United States during August and September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	0.71	1.35	1.21	0.75	48	0.30	5285
		0.73 (1683)	1.56 (1379)	1.08 (1212)	0.59 (1011)			
30	GUIDANCE LOCAL	1.06	0.90	1.15	0.88	51	0.26	5220
		0.73 (2560)	1.91 (920)	1.72 (585)	0.51 (1155)			
42	GUIDANCE LOCAL	0.79	1.24	1.21	0.77	45	0.26	5279
		0.61 (1688)	1.84 (1393)	1.07 (1190)	0.41 (1008)			

Table 8. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 24 stations in the Eastern Region of the NWS during August and September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	0.35	1.46	1.21	0.75	44	0.24	1332
		0.76 (238)	1.42 (384)	1.10 (337)	0.63 (373)	49	0.31	
30	GUIDANCE LOCAL	1.17	0.94	0.90	0.90	48	0.27	1339
		0.82 (463)	1.80 (239)	1.60 (173)	0.54 (464)	45	0.26	
42	GUIDANCE LOCAL	0.52	1.35	1.31	0.65	41	0.19	1327
		0.56 (234)	1.61 (392)	1.16 (328)	0.49 (373)	38	0.15	

Table 9. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 24 stations in the Southern Region of the NWS during August and September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1	CAT 2	CAT 3	CAT 4			
		(No. Obs.)	(No. Obs.)	(No. Obs.)	(No. Obs.)			
18	GUIDANCE	0.57	1.17	1.35	0.58	49	0.29	1362
	LOCAL	0.71 (321)	1.49 (447)	0.93 (403)	0.48 (191)	53	0.33	
30	GUIDANCE	0.99	0.96	1.39	0.74	48	0.21	1361
	LOCAL	0.74 (687)	1.87 (275)	1.34 (187)	0.41 (212)	45	0.22	
42	GUIDANCE	0.55	1.03	1.42	0.82	46	0.25	1363
	LOCAL	0.57 (327)	1.69 (451)	0.95 (398)	0.21 (187)	45	0.22	

Table 10. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 28 stations in the Central Region of the NWS during August and September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE	0.72	1.34	1.11	0.92	44	0.25	1563
	LOCAL	0.64 (507)	1.70 (385)	1.19 (346)	0.53 (325)	46	0.28	
30	GUIDANCE	1.18	0.68	1.04	0.86	51	0.24	1495
	LOCAL	0.64 (722)	1.96 (269)	2.33 (146)	0.47 (358)	42	0.22	
42	GUIDANCE	0.91	1.20	0.99	0.91	43	0.24	1558
	LOCAL	0.48 (497)	2.13 (389)	1.09 (342)	0.35 (330)	35	0.13	

Table 11. Verification of subjective local and objective guidance forecasts of four categories of cloud amount (clear, scattered, broken, and overcast) for 18 stations in the Western Region of the NWS during August and September 1975.

PROJECTION (HOURS)	TYPE OF FORECAST	BIAS - NO. FCST/NO. OBS				PERCENT CORRECT	SKILL SCORE	NO. OF CASES
		CAT 1 (No. Obs.)	CAT 2 (No. Obs.)	CAT 3 (No. Obs.)	CAT 4 (No. Obs.)			
18	GUIDANCE LOCAL	0.92	1.58	1.06	0.57	56	0.27	1028
		0.80 (617)	1.72 (163)	1.22 (126)	0.80 (122)	61	0.39	
30	GUIDANCE LOCAL	0.92	1.12	1.34	1.10	61	0.28	1025
		0.74 (688)	2.11 (137)	1.76 (79)	0.73 (121)	55	0.26	
42	GUIDANCE LOCAL	0.90	1.67	0.90	0.69	52	0.20	1031
		0.75 (630)	2.14 (161)	1.14 (122)	0.65 (118)	49	0.22	