



# PACIFIC REGION TECHNICAL NOTES

83-013  
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## Verification of 3-5 Day Forecasts

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### INTRODUCTION

There is always considerable interest expressed in the forecast quality of various forecast products. The 3-5 Day forecast as issued by the Pacific Weather Centre (see Attachment) has not been verified for any lengthy period. A.E.S. now verifies selected stations across Canada for Day-1 and Day-2. This verification study is an attempt to shed some light on PWC's performance in forecasting the occurrence of precipitation in the 3-5 Day range, and allow for some comparison in the Day-1 and Day-2 range. The statistics are presented in a similar manner as the AES Day-1 and Day-2 verifications. However, this study deals with an attempt at areal verification while the AES verifications are point verifications.

### PROCEDURE

1. One year's (1981) data for B.C. was examined and compared to the 3-5 Day forecasts for the same period.
2. A forecast was considered a forecast of precipitation if any precipitation term was used.
3. A station was considered as reporting precipitation if measurable precipitation was recorded for the climate day.
4. The following stations were used in the study:  
  
South Coast - Vancouver, Victoria, Abbotsford, Comox.  
North Coast - Sandspit, Prince Rupert, Terrace.  
Southern Interior - Kamloops, Penticton, Kelowna, Castlegar.  
Central Interior - Williams Lake, Quesnel, Prince George, Smithers.
5. In order for an area (i.e. South Coast) to be considered as having received measurable rain, two out of four stations had to report measurable rain (for the North Coast 2 out of 3).
6. The results of the study are presented.
7. For some comparison data for day 1 and day 2 occurrence of precipitation compiled for the first 7 months of 1982 and are also presented.

COMMENTS

1. There appears to be no evidence that the Day-3 forecasts are consistently better than those for Day-4 or Day-5.
2. The Heidke Skill Scores from the B.C. Interior are lower than for coastal areas suggesting a different precipitation regime (i.e. results are dependent on criteria used in verification study) or lower skill.

Sample Forecast

3-5 Days

FPCN52 CWVR 111200

WEATHER OUTLOOK FOR SUNDAY MONDAY AND TUESDAY  
FOR BRITISH COLUMBIA ISSUED BY ENVIRONMENT CANADA AT 4AM PST  
MARCH 11 1983.

SOUTH COAST.

SUNDAY..PERIODS OF RAIN. HIGHS NEAR 10.

MONDAY..SHOWERS. HIGHS NEAR 10.

TUESDAY..RAIN.HIGHS NEAR 10.

NORTH COAST.

SUNDAY..RAIN. HIGHS NEAR 9.

MONDAY..SHOWERS. HIGHS NEAR 9.

TUESDAY..RAIN.HIGHS NEAR 9.

SOUTHERN INTERIOR.

SUNDAY..SHOWERS. HIGHS NEAR 9.

MONDAY..MAINLY CLOUDY. HIGHS NEAR 9.

TUESDAY..MAINLY CLOUDY.HIGHS NEAR 9.

CENTRAL INTERIOR.

SUNDAY..A FEW SHOWERS..HIGHS NEAR 6.

MONDAY..A FEW SHOWERS. HIGHS NEAR 6.

TUESDAY..MAINLY CLOUDY.HIGHS NEAR 6.

3-5 DAY OCCURRENCE OF PRECIPITATION  
1981

SOUTH COAST

	DAY 3			DAY 4			DAY 5		
	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.
JAN.	58	.82	-.06	48	1.17	-.07	65	1.17	.27
FEB.	71	.73	.36	68	.67	.36	61	.80	.21
MAR.	61	.67	.14	52	.92	-.07	58	.75	.00
APR.	57	.81	.13	57	.71	.07	47	.67	-.07
MAY	52	.48	.11	42	.43	.00	48	.43	.11
JUNE	53	.81	.00	53	.81	.00	47	.76	.07
JULY	71	.10	.10	52	.50	-.36	52	.70	-.25
AUG.	81	1.42	.50	81	1.28	.50	84	.86	.50
SEPT.	77	.94	.53	70	.81	.40	67	.75	.27
OCT.	74	.88	.50	71	.94	.44	71	1.00	.40
NOV.	87	1.10	.67	77	1.15	.42	77	1.25	.30
DEC.	77	1.03	-.17	81	1.03	.00	77	1.03	-.17

Stations used: Vancouver, Victoria, Abbotsford, and Comox.

Note: 2 out of 4 stations must report measurable precipitation.

FORECAST

Rain No Rain

OBSERVED

Rain

No Rain

a	b	J
c	d	K
M	N	T

$$\% \text{ CORRECT} = \frac{a + d}{T} \times 100\%$$

$$\text{BIAS} = \frac{M}{J} \quad \begin{matrix} > 1 \text{ Over Forecast} \\ < 1 \text{ Under Forecast} \end{matrix}$$

$$\text{H.S.S.} = (a + d) - \frac{(JM + KN)}{\left(\frac{T}{T}\right)}$$

$$T - \frac{(JM + KN)}{\left(\frac{T}{T}\right)}$$

H.S.S. = Heidke Skill Score  
 a + d = No. of Correct Forecasts  
 T = Total Number of Forecasts  
 $\frac{JM + KN}{T}$  = No. of Forecasts expected to be correct by chance.

3-5 DAY OCCURRENCE OF PRECIPITATION  
1981

NORTH COAST

	DAY 3			DAY 4			DAY 5		
	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.
JAN.	74	1.23	.33	71	1.33	.18	68	1.19	.17
FEB.	75	.87	.50	75	.87	.50	71	1.00	.43
MAR.	52	.85	.00	48	1.00	-.14	52	.85	.00
APR.	83	.88	.40	90	.80	.75	77	.80	.42
MAY	84	.75	.67	71	.65	.44	74	.80	.47
JUNE	67	1.18	.00	67	1.27	-.11	63	1.13	-.10
JULY	68	1.16	.33	71	1.41	.44	68	1.16	.33
AUG.	77	1.70	.56	71	1.60	.44	61	1.60	.25
SEPT.	73	1.14	.20	67	1.05	.09	67	1.00	.16
OCT.	65	1.14	.08	61	1.18	-.09	58	1.14	-.08
NOV.	83	1.04	.00	87	1.07	.00	87	1.07	.00
DEC.	77	1.08	.28	68	1.08	.00	77	1.12	.12

Stations used: Sandspit, Prince Rupert, and Terrace.

Note: 2 out of 3 stations must report measurable precipitation.

FORECAST

		Rain	No Rain	
OBSERVED	Rain	a	b	J
	No Rain	c	d	K
		M	N	T

$$\% \text{ CORRECT} = \frac{a + d}{T} \times 100\%$$

$$\text{BIAS} = \frac{M}{J} \quad \begin{array}{l} > 1 \text{ Over Forecast} \\ < 1 \text{ Under Forecast} \end{array}$$

$$\text{H.S.S.} = \frac{(a + d) - \frac{(JM + KN)}{T}}{T - \frac{(JM + KN)}{T}}$$

H.S.S. = Heidke Skill Score  
 $\frac{a + d}{T}$  = No. of Correct Forecasts  
 $\frac{JM + KN}{T}$  = No. of Forecasts expected to be correct by chance.

3-5 DAY OCCURRENCE OF PRECIPITATION

1981

SOUTHERN INTERIOR

	DAY 3			DAY 4			DAY 5		
	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.
JAN.	71	.44	.18	55	1.00	-.08	55	1.00	-.08
FEB.	64	.33	.23	57	.50	.08	54	.42	.00
MAR.	74	.40	.27	71	.30	.25	71	.10	.10
APR.	57	.91	.07	47	.64	-.23	53	.73	-.08
MAY	48	.22	.06	52	.28	.12	48	.22	.06
JUNE	43	.48	.00	53	.70	.07	57	.74	.07
JULY	52	1.40	.00	39	1.30	-.27	42	1.40	-.20
AUG.	48	3.80	.11	42	4.20	.05	35	3.80	-.11
SEPT.	67	.91	.29	60	1.27	.20	60	1.18	.14
OCT.	81	.87	.56	71	.93	.40	74	.87	.47
NOV.	50	1.16	.00	47	1.16	-.07	53	.83	.00
DEC.	58	1.21	.07	55	1.31	-.08	58	1.26	.07

Stations used: Kamloops, Penticton, Kelowna, and Castlegar.  
Note: 2 out of 4 stations must report measurable precipitation.

FORECAST

Rain    No Rain

OBSERVED

Rain	a	b	J
No Rain	c	d	K
	M	N	T

$$\% \text{ CORRECT} = \frac{a + d}{T} \times 100\%$$

$$\text{BIAS} = \frac{M}{J} \quad \begin{matrix} > 1 \text{ Over Forecast} \\ < 1 \text{ Under Forecast} \end{matrix}$$

$$\text{H.S.S.} = \frac{(a + d) - \frac{(JM + KN)}{T}}{T - \frac{(JM + KN)}{T}}$$

- H.S.S. = Heidke Skill Score
- a + d = No. of Correct Forecasts
- T = Total Number of Forecasts
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3-5 DAY OCCURRENCE OF PRECIPITATION  
1981

CENTRAL INTERIOR

	DAY 3			DAY 4			DAY 5		
	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.	% CORRECT	BIAS	H.S.S.
JAN.	74	.43	.13	58	1.14	-.18	65	1.43	.08
FEB.	71	.80	.33	68	.70	.25	61	.90	.15
MAR.	68	.56	.00	68	.34	.00	68	.11	-.11
APR.	47	.70	-.07	44	.55	-.06	43	.35	.15
MAY	32	.28	-.24	32	.33	-.24	39	.28	-.12
JUNE	43	.57	.00	50	.78	-.15	47	.83	-.23
JULY	45	1.21	-.06	48	1.28	.00	48	1.28	.00
AUG.	52	2.75	.16	55	2.75	.26	55	2.75	.26
SEPT.	67	1.13	-.33	63	1.27	.27	63	1.00	.27
OCT.	55	1.00	.07	55	.90	.07	55	1.05	.07
NOV.	43	1.28	-.30	43	1.28	-.30	50	1.28	-.14
DEC.	48	1.56	-.33	48	1.56	-.33	61	1.56	.00

Stations used: Williams Lake, Quesnel, Prince George, and Smithers.

Note: 2 out of 4 stations must report measurable precipitation.

FORECAST

		Rain	No Rain	
<u>OBSERVED</u>	Rain	a	b	J
	No Rain	c	d	K
		M	N	T

$$\% \text{ CORRECT} = \frac{a + d}{T} \times 100\%$$

$$\text{BIAS} = \frac{M}{J} \quad \begin{matrix} > 1 \text{ Over Forecast} \\ < 1 \text{ Under Forecast} \end{matrix}$$

$$\text{H.S.S.} = \frac{(a + d) - \frac{(JM + KN)}{T}}{T - \frac{(JM + KN)}{T}}$$

- H.S.S. = Heidke Skill Score
- $a + d$  = No. of Correct Forecasts
- T = Total Number of Forecasts
- $\frac{JM + KN}{T}$  = No. of Forecasts expected to be correct by chance.

DAY 1 OCCURRENCE OF PRECIPITATION

	VANCOUVER			VICTORIA			PRINCE GEORGE		
	Z CORRECT	BIAS	H.S.S.	Z CORRECT	BIAS	H.S.S.	Z CORRECT	BIAS	H.S.S.
JAN.	68	1.47	.31	58	1.60	.18	58	1.47	.17
FEB.	79	.86	.57	89	.80	.79	75	1.09	.48
MARCH	87	.64	.69	74	1.00	.26	77	1.20	.23
APRIL	87	1.17	.73	77	1.27	.52	73	2.33	.44
MAY	87	1.00	.63	84	.86	.51	71	.93	.41
JUNE	90	1.25	.61	87	1.00	.52	73	1.67	.33
JULY	77	1.88	.54	71	1.71	.34	65	1.67	-.25

FORECAST

Rain	a	b	J
No Rain	c	d	K
<u>OBSERVED</u>	M	N	T

H.S.S. = Heidke Skill Score  
 a + d = No. of Correct Forecasts  
 T = Total Number of Forecasts  
 $\frac{JM + KN}{T}$  = No. of Forecasts expected to be correct by chance.

$$Z \text{ CORRECT} = \frac{a + d}{T} \times 100\%$$

$$\text{BIAS} = \frac{M}{J} > 1 \text{ Over Forecast}$$

$$< 1 \text{ Under Forecast}$$

$$\text{H.S.S.} = (a + d) - \frac{(JM + KN)}{\left(\frac{T}{T}\right)}$$

DAY 2 OCCURRENCE OF PRECIPITATION

	VANCOUVER			VICTORIA			PRINCE GEORGE		
	Z CORRECT	BIAS	H.S.S.	Z CORRECT	BIAS	H.S.S.	Z CORRECT	BIAS	H.S.S.
JAN.	77	1.04	.09	74	1.00	.05	74	1.00	.17
FEB.	89	.95	.75	89	.85	.76	75	.84	.47
MARCH	87	.86	.74	74	1.20	.44	68	1.67	.35
APRIL	80	1.15	.60	70	1.08	.38	53	2.43	.13
MAY	87	.75	.63	77	.86	.32	45	.47	-.05
JUNE	83	.50	.36	90	.50	.62	70	1.14	.20
JULY	71	1.50	.41	61	1.57	.08	74	.89	.47

FORECAST

Rain	a	b	J
No Rain	c	d	K
<u>OBSERVED</u>	M	N	T

H.S.S. = Heidke Skill Score  
 a + d = No. of Correct Forecasts  
 T = Total Number of Forecasts  
 $\frac{JM + KN}{T}$  = No. of Forecasts expected to be correct by chance.

$$Z \text{ CORRECT} = \frac{a + d}{T} \times 100\%$$

$$\text{BIAS} = \frac{M}{J} > 1 \text{ Over Forecast}$$

$$< 1 \text{ Under Forecast}$$

$$\text{H.S.S.} = (a + d) - \frac{(JM + KN)}{\left(\frac{T}{T}\right)}$$