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STABILITY INDEX CRITERIA FOR COASTAL B.C. STATIONS

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INTRODUCTION

IN AN EARLIER TECHNICAL NOTE (78-003), THE REVIEW OF STABILITY INDICES WAS ACCOMPANIED BY TABLES GIVING GENERAL INDEX CRITERIA FOR CONVECTIVE ACTIVITY. THESE TABLES WERE EITHER ARRIVED AT THEORETICALLY AND/OR EMPIRICALLY FROM VARIOUS LOCATIONS IN NORTH AMERICA OUTSIDE B.C. AT THE PACIFIC WEATHER CENTRE RESEARCH HAS BEEN PROCEEDING TO DETERMINE THE BEST INDEX FOR SPECIFIC AREAS OF B.C. THE AIM IS TO THEN LOCALIZE THE INDEX SCALES TO THE PROBABILITY OF CONVECTIVE CLOUD OCCURENCE. DYNAMIC PARAMETERS SUCH AS CONTOUR HEIGHTS, WIND SPEED AND DIRECTION WERE ALSO EXAMINED FOR THEIR INFLUENCE UPON THE OCCURENCE OF CONVECTIVE CLOUD.

METHOD

THE RESULTS OF THIS REPORT ARE BASED ON THE COMPUTER ANALYSIS OF DATA FROM THE UPPER AIR STATIONS ANN, YZT AND UIL. EACH STATION'S DATA SET CONTAINS UP TO 93 DAILY OBSERVATIONS TAKEN OVER THE PERIOD JUNE 15 - SEPT 15,1977.

THE FOLLOWING STABILITY INDICES WERE COMPUTED FOR EACH DAY AT EACH STATION.

TOTALS INDEX(850)	TI(850) = TD850+T700-2T500
TOTALS INDEX(700)	TI(700) = TD700+T700-2T500
K-INDEX	K = (T850-T500)+TD850-(T700-TD700)
SLY INDEX	Y = 1.60W(21M)-T500-11

WHERE

T850	= 850MB TEMP AT 00Z
T700	= 700MB TEMP AT 00Z
T500	= 500MB TEMP AT 00Z
TD850	= 850MB DEWPT. AT 00Z
TD700	= 700MB DEWPT. AT 00Z
W(21M)	= WET BULB POTENTIAL TEMP COMPUTED FROM MAX TEMP AND REPRESENTATIVE AFTERNOON DEWPT (21Z)

THE FOLLOWING DYNAMIC PARAMETERS WERE EXAMINED FOR EACH DAY AT EACH STATION

500MB HEIGHTS
500MB WIND SPEED AND DIRECTION
700MB WIND SPEED AND DIRECTION
850MB WIND SPEED AND DIRECTION

FOR EACH DAY AT EACH RADIOSONDE STATION THE COMPUTED INDICES AND DYNAMIC PARAMETERS WERE COMPARED WITH THE OCCURRENCES OF AFTERNOON CB, SUBSTANTIAL TCU OR ACC; ALSO THE OCCURRENCE OF R-, RW- AND TRW- OVER AN AREA SURROUNDING THE REFERENCE STATIONS.

RESULTS

GENERAL COMMENTS

1. ALL THE COMPUTED INDICES FOR THE COASTAL STATIONS WERE FOUND TO BE POOR DESCRIMINATORS OF CONVECTIVE CLOUD DAYS FROM NON CONVECTIVE CLOUD DAYS.
2. IN CERTAIN INSTANCES SOME OF THE DYNAMIC PARAMETERS WERE FOUND TO BE SLIGHTLY BETTER DESCRIMINATORS OF CONVECTIVE CLOUD DAYS FROM NON CONVECTIVE CLOUD DAYS THAN THE COMPUTED INDICES.
3. BOTH INDICES AND DYNAMIC PARAMETERS WERE UNABLE TO DISTINGUISH CB DAYS FROM TCU DAYS.
4. IT IS FELT THAT DECISIONS BASED BOTH ON THE STABILITY INDICES AND CERTAIN DYNAMIC PARAMETERS MAY PROVE USEFUL FOR DESCRIMINATING CONVECTIVE CLOUD DAYS FROM NON CONVECTIVE CLOUD DAYS.

RESULTS FOR YPR

THE RESULTS OBTAINED HERE ARE BASED ON THE ANNETTE RADIOSONDE SOUNDING CORRELATED TO CONVECTIVE DAYS AT YPR. NO STABILITY INDEX WAS FOUND COMPLETELY SATISFACTORY HOWEVER THE TI(850) USED WITH THE 700MB WIND DIRECTION HAS SOME MERIT. FIGURE 1 SUMMARIZES THE RESULTS.

RESULTS FOR YXT

THE RESULTS OBTAINED HERE ARE BASED ON THE ANNETTE SOUNDING CORRELATED TO CONVECTIVE DAYS AT YXT. NO STABILITY INDEX WAS FOUND COMPLERELY SATISFACTORY HOWEVER THE TI(850) WAS BETTER THAN THE OTHERS. THE TI(850) USED WITH THE 700MB WIND FLOW SHOWED SOME MERIT. FIGURE 2 SUMMARIZES THE RESULTS.

RESULTS FOR YZT

ALL THE COMPUTED INDICES WERE FOUND TO BE POOR HOWEVER THE TI(850) USED WITH 700MB WIND DIRECTION SHOWED SOME ADVANTAGE. IT WAS ALSO FOUND THAT NO CONVECTIVE ACTIVITY WAS ASSOCIATED WITH DAYS WITH 500MB HTS OVER 574 DM. HTS LESS THAN 560 DM WERE ALMOST ALWAYS ASSOCIATED WITH CONVECTIVE ACTIVITY. RESULTS ARE SUMMARIZED IN FIGURE 3.

RESULTS FOR YVR, YVI, YYJ AND UIL

THE RESULTS OBTAINED HERE ARE BASED ON THE QUILLAYUTE RADIOSONDE SOUNDING CORRELATED TO CONVECTIVE DAYS OVER THE EXTREME SOUTHWEST CORNER OF B.C. THE TI(850) AND SLY INDICES WERE FOUND TO BE THE BEST HOWEVER NEITHER WERE CONSIDERED GOOD ENOUGH TO BE USED ALONE. THE TI(850) WITH THE 700MB WIND DIRECTION AND 500MB HTS WERE FOUND TO HAVE SOME VALUE. RESULTS ARE SUMMARIZED IN FIGURE 4.

CONCLUDING REMARKS

THE RESULTS OF THIS STUDY ARE BASED ON ONE YEARS DATA AND THEREFORE SHOULD BE USED CAUTIOUSLY. THE RESULTS ARE GENERALLY FOR AIMASS CONVECTIVE SITUATIONS. FRONTAL CONVECTIVE ACTIVITY DAYS MAY NOT BE RELEVANT TO THIS STUDY. THE RESULTS FOR PRINCE RUPERT ARE BASED ON A VERY SMALL SAMPLE OF CONVECTIVE DAYS THEREFORE SHOULD BE USED WITH EXTRA CAUTION. RESULTS FOR TERRACE SHOULD BE USED ONLY FOR ITS LOCAL VICINITY DUE TO TERAIN CONSIDERATIONS AND BECAUSE CORRELATIONS DEVELOPED WERE BASED UPON THE COMPUTED AND DYNAMIC PARAMETERS FROM ANNETTE WHICH IS LOCATED IN A MUCH DIFFERENT PHYSICAL LOCATION. RESULTS FOR PORT HARDY MAY HAVE APPLICATION TO THE NORTHERN THIRD OF VANCOUVER ISLAND. RESULTS FOR THE EXTREME SOUTHWESTERN CORNER OF B.C. WERE COMPLICATED DUE TO THE MANY POSSIBLE MARINE STRATUM OCCURENCES ALONG THE OUTER COAST BUT NOT PENETRATING THE INLAND PORTIONS WHERE YVR,YVI AND YYJ ARE LOCATED. THEREFORE IN OUTER COAST MARINE STRATUS SITUATIONS EXTRA CAUTION SHOULD BE ADHERED TO WHEN RELATING STABILITY VALUES COMPUTED AT UIL WITH INNER COASTAL STATIONS.

THE STABILITY INDEX ANALYSIS PROGRAM WILL BE EXPANDED AND CONTINUED THIS SUMMER THROUGH THE FORESTRY SEASON. ANALYSIS OF THIS SUMMERS DATA SHOULD PROVIDE MORE STATISTICALLY SIGNIFICANT RESULTS FOR THE 1979 SUMMMER SEASON.

ACKNOWLEDGEMENT

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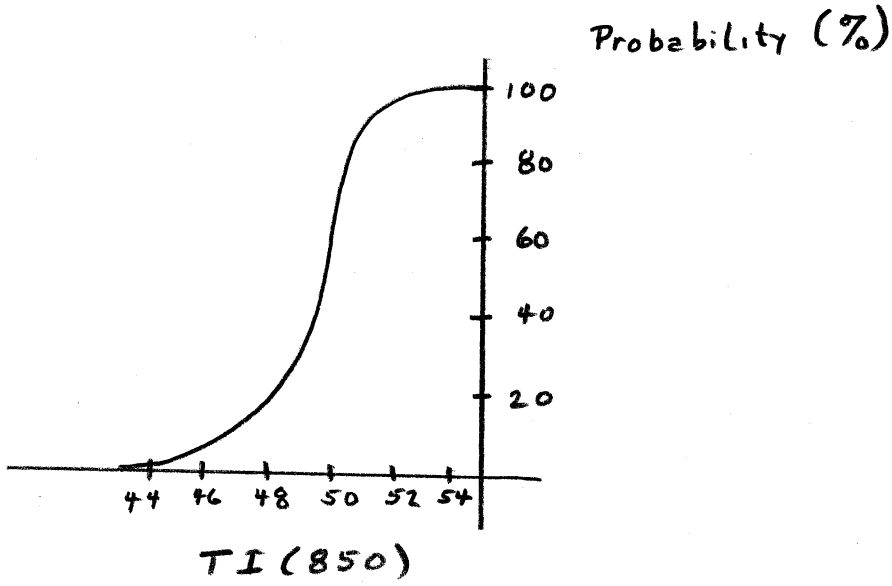
FIGURE 1

PROBABILITY OF AFTERNOON CONVECTIVE CLOUD* AT YPR VS. TI(850) COMPUTED AT ANN



- for indeterminate range (TI(850): 45-49) use following criteria

1. 700 mb WIND DIRECTION

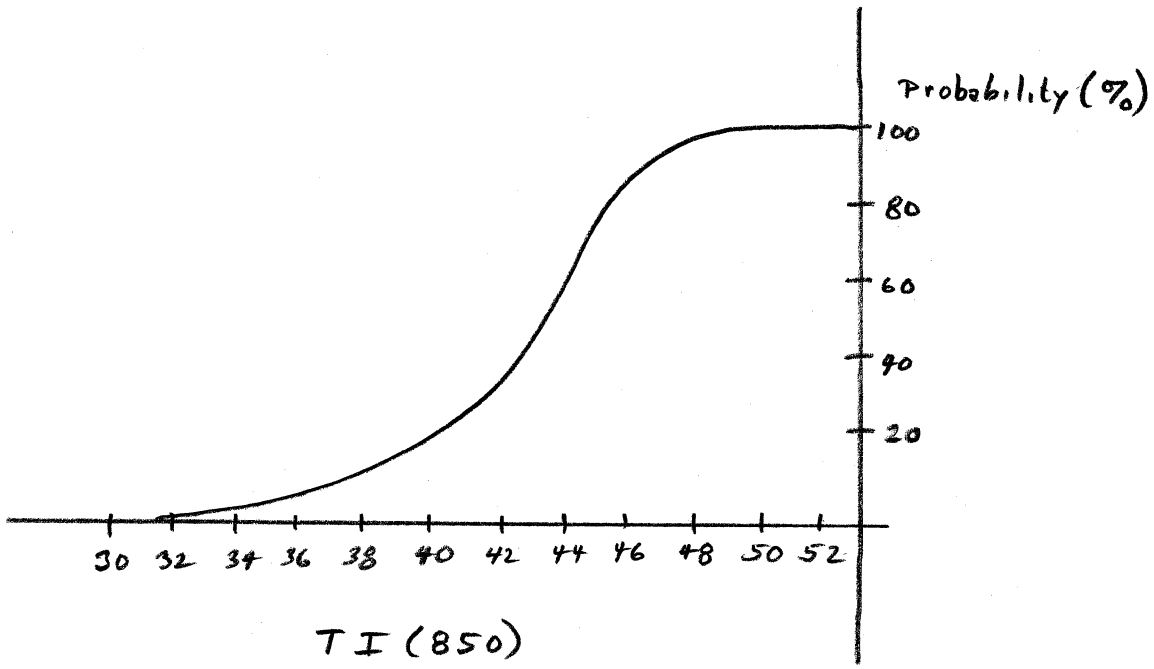
320 → 160	NO CONVECTIVE CLOUD
160 → 220	USE TI(850) = 48 AS CUTOFF
220 → 260	USE TI(850) = 45 AS CUTOFF
260 → 320	USE TI(850) = 50 AS CUTOFF

2. 500MB HTS > 570 NO COVECTIVE CLOUD

*Probability derived from frequency of occurrence
Convective Cloud = occurrence of CB or substantial Tcu or Acc

FIGURE 2

PROBABILITY OF AFTERNOON CONVECTIVE CLOUD* AT YXT VS. TI(850) COMPUTED AT ANN



- for indeterminate range (TI(850): 40-49) use following criteria

1. 700 mb WIND DIRECTION

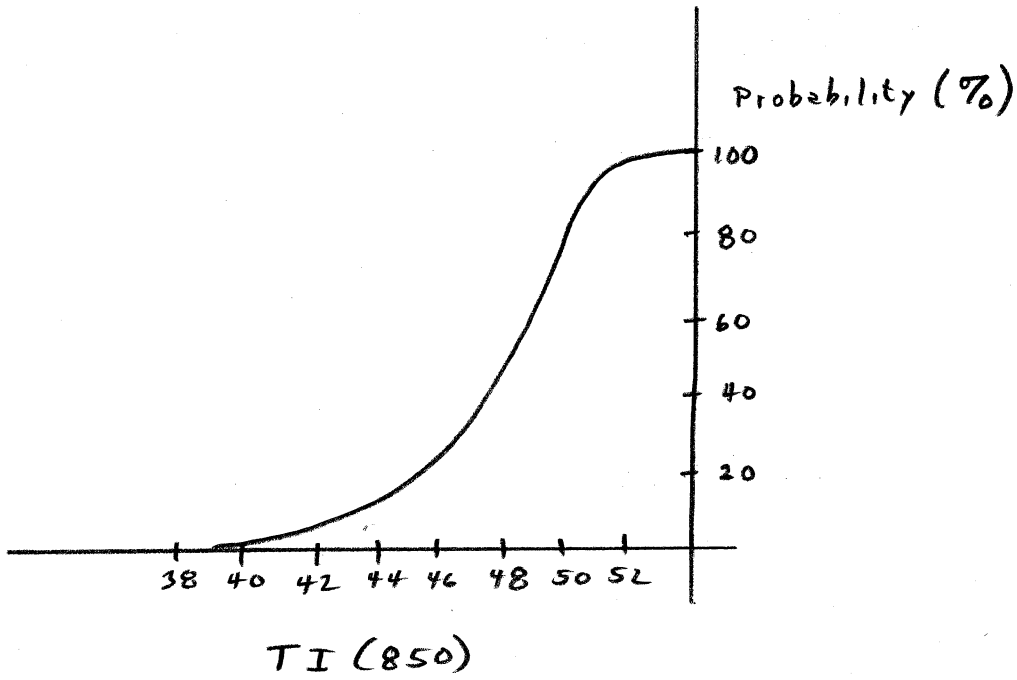
340 → 100	NO CONVECTIVE CLOUD
100 → 180	USE TI(850) = 45 AS CUTOFF
180 → 250	USE TI(850) = 40 AS CUTOFF
250 → 300	USE TI(850) = 49 AS CUTOFF
300 → 340	USE TI(850) = 43 AS CUTOFF

2. 500 MB HTS >579 NO CONVECTIVE CLOUD

* Probability derived from frequency of occurrence
Convective Cloud = occurrence of CB or substantial Tcu or Acc

FIGURE 3

PROBABILITY OF AFTERNOON CONVECTIVE CLOUD* VS. TI(850) AT YZT



- for indeterminate range (TI(850): 42-50) use following criteria

1. 700mb WIND DIRECTION

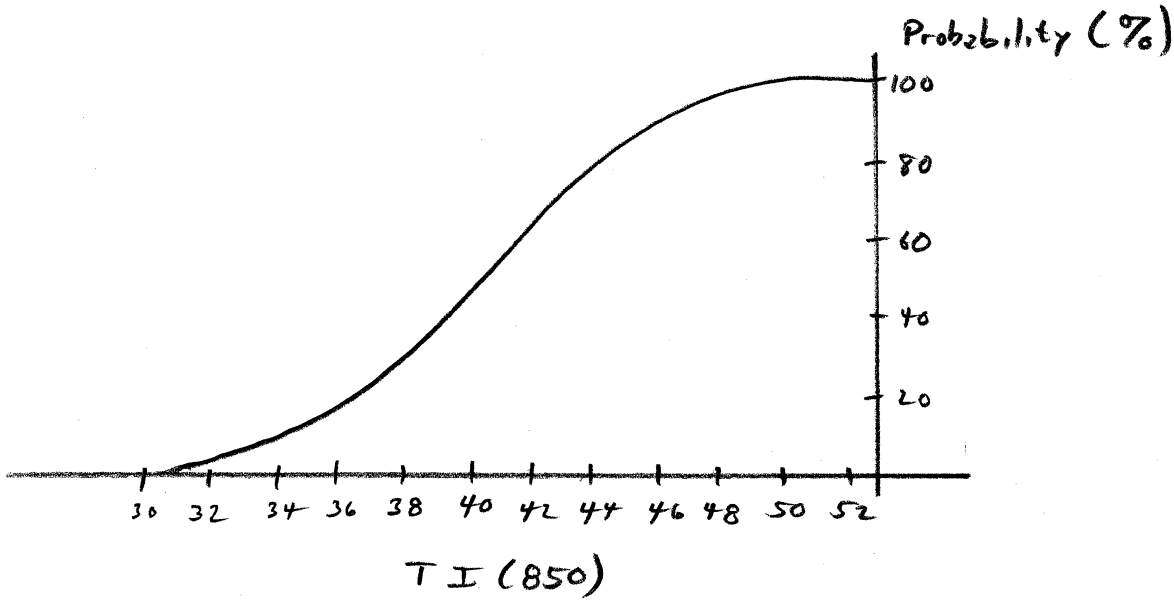
350 → 120	NO CONVECTIVE CLOUD
120 → 200	USE TI(850) = 49 AS CUTOFF
200 → 350	USE TI(850) = 45 AS CUTOFF

2. 500 mb HTS < 560 CONVECTIVE CLOUD
   500mb HTS > 574 NO CONVECTIVE CLOUD

* Probability derived from frequency of occurrence Convective Cloud = Occurrence of CB or substantial TCU or ACC

FIGURE 4

PROBABILITY OF AFTERNOON CONVECTIVE CLOUD* AT YVR, YUL, YYJ AND UIL VS. TI (850) AT UIL



- for indeterminate range (TI(850): 36-46) use following criteria

1. 700 mb WIND DIRECTION
   - 290 → 210 CONVECTIVE CLOUD UNLIKELY
   - 210 → 290 INDETERMINATE

2. 500MB HTS > 574 CONVECTIVE CLOUD UNLIKELY

* Probability derived from frequency of occurrence
Convective Cloud = Occurrence of CB or substantial TCU or ACC