APPENDIX I TO CHAPTER 13

Explanation of Errors and Output of Hourly Data Checking Program U520

Error output from U520 is written to one file and contains 7 columns. They are as follows:

1. Station ICAO
2. Date of error.
3. Observation instrument type.
4. Error code ("Nerr").
5. Old data value to be changed due to error.
6. New data value.
7. English explanation of error.

The tables below indicate the quality control checks, actions taken, and error code for each subroutine of u520.

SUBROUTINE TMPQC

Temperature	Report error	Nerr
Consistency check over 3 hours. If there are 2 consecutive hours of an increase/decrease in temperature by 10 degrees, check difference between the average of temperatures 1 and 3 and temperature 2. If +/- 10 degrees.	Change temperature to 9999.	9901
If the reported synoptic 6-h max (min) is out of tolerance (tolerance is 6+(2*the number of hours missing)).	Change 6-h max (min) to 9999.	9915 (max) 9925 (min)

If the 6-h max (min) calculated from the hourlies is greater (less) than the reported 6-h max (min) by 2 degrees or more and this occurred more than once during the synoptic period.	Change 6-h max (min) to 9999.	9911 (max) 9921 (min)
If the 6-h max (min) calculated from the hourlies is greater (less) than the reported 6-h max (min) by only one degree and this occurred more than once during the synoptic period or if same but occurred only once during the period (with the exception of the first or last hour).	Error is a rounding problem, change the hourly temperatures that reflect this to the correct temperature.	9902
If the 6-h max (min) calculated from the hourlies is greater (less) than the reported 6-h max (min) and this occurred only once during the period on either the first or last hour of the synoptic period.	Change the 6-h max (min) to reflect the correct temperature.	9912/ 9913; (max) 9922/ 9923 (min)
If the 6-h max (min) calculated from the hourlies is greater(less) than the reported 6-h max (min) by 2 degrees or more on any hour with the exception of first or last hour of the synoptic period.	Change the 6-h max (min) to 9999.	9914 (max) 9924 (min)

If the 6-h max is less than the 6-h min.	Change the 6-h max and min to 9999.	9930
If the 24-h max is less than the 24-h min.	Change the 24-h max and min to 9999.	9931

Dewpoint	Report error	Nerr
If the dewpoint is less than -30 degrees F, and the dewpoint depression is greater than 15 degrees.	Change dewpoint to 9999.	9800
Consistency check over 3 hours. If there are 2 consecutive hours of an increase/decrease in dewpoint by 10 degrees, check difference between the average of dewpoints 1 and 3 and dewpoint 2. If +/- 10 degrees.	Change dewpoint 2 to 9999.	9802
If an hourly temperature was changed due to rounding, cross check the temperatures with the dewpoints to assure that the dewpoint will not exceed the temperature. If it does,	Change the dewpoint to the new temperature so that the dewpoint depression is 0.	9803

SUBROUTINE PCPNQC

Precipitation amount	Report error	Nerr
Out of range 1-, 3-, 6-, and 24-h amounts. (1-h > 3.75 in, 3-h > 9 in, 6-h > 12 in, and 24-h > 24 in)	Change to 9999.	9700

If present weather was reported, but no 1-h precip amount was reported.	Change 1-h precip to 9999.	9705
If present weather was reported, but no 3-h precip amount was reported (MANU, AO2, AO2A).	Change 3-h precip to 9999.	9706
If present weather was reported, but no 6-h precip amount was reported (MANU, AO2, AO2A).	Change 6-h precip to 9999.	9707
If 3-h precipitation amount is greater than 6-h amount.	Change both to 9999.	9710
If 3-h precipitation amount reported and 6-h report is missing and no additional precipitation occurred in the last three hours of the synoptic period.	Change the 6-h amount to equal the 3-h amount.	9711

For ASOS, if 6-h precipitation was reported (amount must be .01 or .02), the dewpoint depression was less than 2, FG (visibility less than ½ mile) was reported, no precipitation was observed and the sky was either partially or totally obscured then, ASOS dew.	Change the 1-, 3-, and 6-h amounts to 0. Keep track of the amount of precipitation eliminated for one day.	9720
For ASOS, if 6-h precipitation amount was reported, no weather observed, sky was clear at least 4 of the hours during the period, and the temperature rose from lower or equal to 30 to a temperature greater than or equal to 35 (unless the temperature has remained above freezing allowing for additional snowmelt from earlier periods, max of 4 unless the temperature falls below freezing again), then ASOS snowmelt.	Change the 1-, 3-, and 6-h amounts to 0. Keep track of the amount of precipitation eliminated for one day.	9730
If precipitation amounts have been eliminated due to dew or snow melt and no other precip was reported.	Change 24-h precip to 0.	9740
If precipitation amounts have been eliminated due to dew or snow melt and other precip was reported.	Subtract the amounts eliminated from the 24-h period ending 12z	9741

SCD snowfall amount reported without a 6-h liquid equivalent.	Change 6-h precip amount to 9999.	9750
SCD snowfall amount out of range (> 20 inches).	Change snowfall to 9999.	9760
Indeterminant precip amount (-9) reported.	Change to 9999. **DOES NOT WRITE ANYTHING TO ERROR FILE.**	Nothing

SUBROUTINE PRESQC

Pressure	Report error	Nerr
Out of range, MSL > 1075 mb or < 875 mb.	Change pressure to 9999.	9601
Out of range, altimeter > 32.00 in or < 24.00 in.	Change altimeter to 9999.	9602
Consistency check over 3 hours. If there is a decrease/increase of barometric pressure in MSL of 3.4 mb for 2 consecutive hours then, compare the average of pressures 1 and 3 against pressure 2. If +/- 3.4 mb.	Change pressure 2 to 9999.	9603
Consistency check over 3 hours. If there is a decrease/increase of barometric pressure in ALT of 0.10 in for 2 consecutive hours then, compare the average of pressures 1 and 3 against pressure 2. If +/- 0.10 in.	Change altimeter 2 to 9999.	9604

SUBROUTINE CLDSQC

13.6

Cloud height and amount	Report error	Nerr

Cloud height out of range (>45,000 ft).	Change cloud height and amount at all layers to 9999.	9500
Invalid cloud height reported. (Not checked at Canadian stations.)	Change cloud height and amount at all layers to 9999.	9501
Cloud height not increasing though groups.	Change cloud height and amount at all layers to 9999.	9510
Cloud amounts not increasing through groups.	Change cloud height and amount at all layers to 9999.	9511
Missing cloud height but amount present or missing amount but height present occurring at any level. (This will not check those cases fixed by 9521).	Change cloud height and amount at all layers to 9999.	9520

Cloud report contains 4 or more layers and the first cloud height was set to 9999 due to a BUFR problem (only happened in data through Nov. 1997).	Change cloud heights at all layers to 9999.	9521
CLR or SKC reported.	Change cloud height at layer 1 to 888 and all others to 9999. **DOES NOT WRITE ANYTHING TO ERROR FILE.**	9530
POB reported in first group. (After 11/10/97 this is done in the program that creates the hourly tables.)	Change cloud height at layer 1 to 0.	9531
KMWN or KMWS report POB in first and second cloud amounts (represents fog in the valley below the station).	Delete the cloud height (POB) and amount (0) for the first layer. Move the data for the remaining layers down one layer and set the height and amount for layer 6 to 9999	9540

Any station (except KMWN or KMWS) reports POB in any cloud amount besides layer 1.	Change cloud height and amount at all layers to 9999.	9541

SUBROUTINE WNDQC

Wind speed, direction, and gusts	Report error	Nerr
Wind direction not to the nearest 10 degrees.	Change wind speed, direction and gust to 9999.	9401
Wind gust not greater than or equal to 10 kts and not between (wind speed + 3 kts) and (wind speed + 40 kts).	Change wind gust to 9999.	9402
Calm report does not have 0 for all three wind components	Change wind speed, direction, and gust to 9999.	9403
Variable wind direction (-9) reported.	Change wind direction to 990. **DOES NOT WRITE ANYTHING TO ERROR FILE.**	Nothing

SUBROUTINE VISWXQC

Visibility and present weather	Report error	Nerr
Invalid visibility value reported. (Not checked at Canadian and Mexican stations.)	Change the visibility to 9999.	9300
If the visibility is between 7 and 10 miles and the present weather group is an obstruction to vision.	Change the visibility to 6 miles.	9310
If the visibility is greater than 10 miles and the present weather is something that would reduce the visibility.	Change the visibility and all present weather groups to 9999.	9312/ 9212
If visibility is greater than ½ mile and the present weather is FG.	Change the present weather group to BR.	9210
If visibility is less than or equal to ½ mile and the present weather is BR.	Change the present weather group to FG.	9211
MANU or AO2 reports visibility less than or equal to 6 miles but doesn't report present weather. (Not checked at Canadian and Mexican stations.)	Change the present weather groups to 9999.	9213

Intensity of snow/drizzle reported does not match visibility reported, and no other weather was reported.	Change the present weather to the proper intensity as dictated by the visibility.	9214
Intensity of ice pellets reported does not match visibility reported, and no other weather was reported.	Change the present weather to the proper intensity as dictated by the visibility.	9215
If the order of the present weather groups is incorrect.	Correct order.	9220
If VCSH is reported with any other precipitation occurring.	Eliminate VCSH.	9221
If thunderstorm with precipitation is reported and is accompanied by thunderstorm with hail.	Change groups so that they indicate just one thunder qualifier.	9222
If duplicate reports of the same precipitation type.	Keep the first report and change all other present weather groups to 9999.	9223
If liquid precipitation is reported and temperature is below 30 degrees.	Change present weather groups to 9999.	9230
If freezing precipitation or ice crystals reported with temperature greater than 40 degrees.	Change present weather groups to 9999.	9231
If frozen precipitation or ice pellets reported with temperature greater than 44 degrees.	Change present weather groups to 9999.	9232
Blowing phenomenon is reported, but there isn't enough wind to blow things around (wind less than 9 knots without a gust reported).	Change blowing present weather group and any after that to 9999.	9240
MANU or AO2 reports OB but does not report any present weather.	Change present weather groups to 9999.	9250
MANU reports clear sky but also reports present weather (except for IC).	Change present weather groups and cloud amount layer 1 to 9999.	9251

SUBROUTINE CNVTWX

Present weather, station type, and cloud amount	Report error	Nerr
Weather element not recognized.	Change present weather group to 9999.	9101
Station type not recognized.	Change station type to 9.	9102
Cloud amount not recognized.	Change cloud amount to 9999.	9103