AIRS Version 6
Retrieval Channel Sets

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http://airs.jpl.nasa.gov/ask_airs

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1 Introduction

The AIRS spectrum consists of 2378 channels spanning 3.7 μm to 15.4 μm with a spectral resolution of $\Delta\lambda/\lambda$ = 1/1200. Listed here by function are the channels that are used in the Level 2 Neural Net regression and physical retrieval.

2 Channel Sets

2.1 Neural Network

2.1.1 Number of channels: 573

2.1.2 Channels (cm^{-1}):

655.39 664.51 666.26 666.51 666.77 667.27 667.77 668.28 668.53 668.79
669.04 669.55 669.80 670.06 670.31 670.57 672.10 674.41 674.67 674.93
675.19 675.45 675.71 675.97 676.23 676.49 676.75 677.00 677.26 677.53
677.79 678.05 678.31 678.57 678.83 679.09 679.36 680.14 680.40 680.67
680.93 681.19 681.46 681.72 681.99 687.60 688.68 688.95 689.22 689.49
689.76 690.03 690.30 690.58 690.85 691.12 691.39 691.66 691.94 692.21
692.48 692.75 693.03 693.30 693.58 693.85 694.12 694.40 694.67 694.95
695.23 695.50 695.78 696.05 696.33 696.60 696.88 697.16 697.43 697.71
697.99 698.27 698.54 698.82 699.10 699.38 699.66 699.94 700.22 700.50
700.78 701.06 701.34 701.62 701.90 702.18 702.46 702.74 703.02 703.31
703.59 703.87 704.15 704.44 704.72 705.00 705.28 705.57 705.85 706.14
706.42 706.71 706.99 707.28 707.56 707.85 708.13 708.42 708.71 708.99
709.28 709.57 709.85 710.14 710.43 710.72 711.00 711.29 711.58 711.87
712.16 712.45 712.74 713.03 713.32 713.61 713.90 714.19 714.48 714.77
715.07 715.36 715.65 715.94 716.23 716.53 716.82 717.11 717.41 717.99
718.29 718.58 718.88 719.17 719.47 719.76 720.06 720.35 720.65 720.95
721.24 721.54 721.84 722.13 722.43 722.73 723.03 723.33 723.63 723.92
724.22 724.52 724.82 725.12 725.42 725.72 726.33 726.63 726.93 727.23
728.05 728.14 728.44 729.87 730.18 730.48 731.39 731.70 732.62 733.54
734.15 734.76 735.07 735.69 736.31 737.55 737.86 738.17 738.48 739.10
740.03 740.66 740.97 741.29 741.60 741.91 742.54 745.38 746.01 746.97
747.60 749.20 749.84 750.48 753.06 755.33 757.61 759.57 790.33 801.10
804.75 807.33 811.78 820.83 843.91 917.31 918.75 937.91 965.43 979.13
997.11 998.39 999.67 1001.38 1003.53 1005.26 1006.56 1008.30 1010.48 1011.79
1013.11 1014.87 1016.63 1018.41 1020.63 1021.97 1023.31 1024.21 1024.66 1025.11

1025.56 1026.46 1026.91 1027.36 1027.81 1028.26 1028.71 1029.62 1030.07 1030.53
1030.98 1031.44 1061.36 1061.84 1062.32 1063.29 1064.25 1064.73 1065.22 1068.61
1069.10 1092.45 1103.20 1114.67 1122.63 1131.23 1228.22 1229.78 1230.29 1232.89
1235.49 1236.02 1236.54 1237.06 1237.59 1238.11 1238.63 1239.16 1240.74 1241.26
1241.79 1242.32 1242.85 1244.96 1247.09 1247.62 1248.15 1249.75 1251.36 1252.97
1253.50 1254.04 1254.58 1255.12 1256.73 1259.98 1261.07 1261.61 1262.16 1267.63
1268.18 1268.73 1270.93 1271.48 1285.47 1287.73 1288.30 1288.87 1291.14 1292.28
1293.99 1294.56 1296.85 1297.43 1298.00 1302.62 1303.19 1303.77 1304.35 1304.93
1305.52 1306.10 1310.18 1315.47 1316.65 1321.99 1322.58 1326.77 1330.98 1332.79
1334.61 1340.20 1341.22 1341.73 1343.26 1345.83 1346.86 1347.37 1347.89 1348.40
1350.99 1351.51 1352.54 1353.58 1355.15 1355.67 1356.19 1367.25 1376.89 1381.21
1392.15 1397.13 1407.77 1419.15 1427.23 1432.47 1436.58 1468.83 1471.91 1476.25
1483.74 1493.21 1498.96 1502.17 1519.07 1521.05 1524.35 1541.77 1544.48 1547.20
1554.04 1556.10 1563.02 1572.09 1576.32 1586.26 1605.05 2181.49 2182.40 2183.31
2184.21 2185.12 2186.03 2186.94 2187.85 2188.76 2189.67 2190.59 2191.50 2192.41
2193.33 2194.24 2195.16 2196.07 2196.99 2197.91 2198.83 2199.75 2200.67 2201.59
2202.51 2203.44 2204.36 2205.29 2206.21 2207.14 2208.06 2208.99 2210.85 2212.71
2213.64 2214.57 2215.51 2216.44 2217.37 2218.31 2219.24 2220.18 2221.12 2222.06
2223.00 2223.94 2224.88 2225.82 2226.76 2227.70 2228.65 2229.59 2230.54 2231.48
2232.43 2233.38 2235.28 2236.22 2237.18 2238.13 2239.08 2240.03 2240.99 2241.94
2242.90 2243.85 2244.81 2245.77 2246.73 2247.69 2248.65 2249.61 2250.57 2251.53
2252.50 2253.46 2254.43 2255.39 2256.36 2257.33 2258.30 2259.26 2260.23 2261.20
2262.18 2263.15 2264.12 2265.10 2266.07 2267.05 2268.02 2269.00 2269.98 2270.96
2271.94 2272.92 2273.90 2274.88 2276.85 2277.83 2278.82 2279.80 2280.79 2281.78
2282.77 2283.76 2284.75 2285.74 2291.71 2297.70 2299.71 2301.72 2305.74 2307.76
2309.78 2310.70 2312.53 2314.36 2316.20 2318.03 2319.87 2321.71 2327.26 2340.31
2342.18 2344.06 2345.95 2347.83 2349.72 2351.61 2353.51 2357.30 2358.26 2359.21
2360.16 2361.12 2362.07 2363.03 2363.98 2364.94 2365.90 2366.86 2367.82 2368.78
2369.74 2370.70 2371.66 2372.63 2373.59 2374.56 2375.52 2376.49 2377.46 2378.43
2379.39 2380.36 2382.31 2383.28 2384.25 2385.23 2386.20 2387.18 2388.15 2389.13
2390.11 2391.09 2392.07 2393.05 2394.03 2395.01 2395.99 2397.96 2399.94 2456.48
2492.08 2531.98 2561.13 2603.66 2607.89 2616.38 2622.79 2632.47 2637.87 2643.30
2648.75 2656.42 2658.62

2.2 Cloud Clearing (Physical Retrieval)

2.2.1 Number of channels: 57

2.2.2 Channels (cm^{-1}):

701.06 702.74 703.87 704.44 706.14 706.99 707.85 708.71 709.57 711.00,
712.74 714.19 714.48 715.94 717.41 717.99 718.29 718.58 718.88 719.17,
719.47 719.76 720.95 721.54 721.84 723.03 723.33 724.52 726.33 732.62,
734.15 738.48 740.04 742.86 746.01 747.60 749.20 750.48 752.09 753.38,
755.33 758.26 773.28 790.32 801.10 804.75 811.78 820.83 847.14 880.41,
917.31 937.91 979.13 1072.00 1128.50 1216.97 1227.71

Some of these channels are also used for other purposes in the physical retrieval, and those have been identified below when that is the case.

2.3 Surface Temperature/Shortwave Emissivity/Solar Reflectivity (Physical Retrieval)

2.3.1 Number of channels: 60

2.3.2 Channels (cm^{-1}):

2396.00 2396.98 2397.96 2398.95 2399.93 2400.92 2401.91 2402.90 2403.89 2404.88,
2405.87 2406.86 2407.86 2408.85 2409.85 2410.84 2411.84 2412.83 2413.83 2415.83,
2416.83 2417.83 2418.83 2419.83 2420.83 2421.84 2448.24 2449.27 2456.48 2464.76,
2472.06 2474.15 2482.56 2492.08 2496.33 2500.60 2503.81 2505.96 2510.26 2516.74,
2519.99 2522.16 2528.70 2529.79 2542.97 2555.18 2560.11 2568.29 2583.77 2595.25,
2603.66 2610.00 2615.31 2616.38 2627.09 2631.39 2633.55 2646.57 2653.13 2664.14

2.4 Temperature Profile (Physical Retrieval)

2.4.1 Number of channels: 123

2.4.2 Channels (cm^{-1}):

662.02 664.51 666.26 666.77 667.27 667.78 668.28 668.54 668.79 669.04,
669.55 669.81 670.06 670.57 672.10 673.65 675.20 676.75 677.01 678.32,
678.58 681.46 681.73 689.49 689.76 691.12 691.39 692.76 693.03 694.12,
694.40 694.67 695.78 696.05 697.43 697.71 698.82 699.10 699.38 699.66,
700.78 **701.06 702.74 703.87 704.44 706.14 706.99 707.85 708.71 709.57,**
711.00 711.29 **712.74** 2358.26 2359.21 2360.16 2361.12 2362.07 2363.03 2363.98,
2364.94 2365.90 2366.86 2367.82 2368.78 2369.74 2370.70 2371.66 2372.63 2373.59,
2374.56 2375.52 2376.49 2377.46 2378.43 2379.40 2382.31 2383.28 2384.25 2385.23,
2386.20 2387.18 2388.15 2389.13 2390.11 2391.09 2392.07 2393.05 2394.03 2395.01,
2396.00 2396.98 2397.96 2398.95 2399.93 2400.92 2401.91 2402.90 2403.89 2404.88,
2405.87 2406.86 2407.86 2408.85 2409.85 2410.84 2411.84 2412.83 2413.83 2415.83,
2416.83 2417.83 2418.83 2419.83 *1239.16 1251.36 1285.48 1330.98 1334.61 1340.20,*
1367.25 1376.89 1381.21

Note that the last nine channels (red and *italicized*) are used only on the second pass temperature retrieval following the first pass water retrieval. These channels are also sensitive to water vapor. The channels in **bold** are also used for cloud clearing.

2.5 Moisture Profile (Physical Retrieval)

2.5.1 Number of channels: 41

2.5.2 Channels (cm^{-1}):

1310.18 1315.47 1340.20 1367.25 1376.88 1381.21 1392.15 1397.13 1407.77 1419.15,
1427.23 1432.47 1436.58 1468.83 1471.91 1476.25 1483.74 1493.21 1498.96 1502.17,
1519.07 1521.05 1524.35 1541.77 1544.48 1547.20 1554.04 1556.10 1563.01 1572.09,
1576.32 1586.26 1605.05 2607.89 2616.38 2622.79 2632.47 2637.87 2643.30 2648.75,
2656.42

2.6 Longwave Emissivity (Physical Retrieval)

2.6.1 Number of channels: 77

2.6.2 Channels (cm^{-1}):

758.26 759.57 761.22 762.54 764.20 765.53 771.59 **773.28** 780.84 **790.32,**
801.10 810.67 **811.78** 817.80 **820.83** 830.08 833.99 837.93 843.91 **847.14**,
857.36 861.11 863.63 869.04 872.58 877.46 **880.41** 885.38 890.75 895.50,
899.62 903.08 913.01 **917.31** 919.47 923.83 927.86 931.93 **937.91** 951.66,
957.12 961.46 965.43 972.67 976.67 **979.13** 984.91 988.25 990.76 993.71,
997.53 1001.38 1043.86 1076.92 1080.38 1083.86 1087.37 1092.92 1097.00 1103.69,
1109.40 1114.64 1118.87 1123.13 **1128.49** 1131.20 **1216.97** 1217.48 1219.51 1221.04,
1222.57 1223.60 **1227.71** 1231.33 1234.45 1242.32 1250.82

The channels in **bold** are also used for cloud clearing.

2.7 Ozone Profile (Physical Retrieval)

2.7.1 Number of channels: 41

2.7.2 Channels (cm^{-1}):

997.11 998.39 999.67 1001.38 1003.53 1005.26 1006.56 1008.30 1010.48 1011.79,
1013.11 1014.87 1016.64 1018.41 1020.63 1021.97 1023.31 1024.21 1024.66 1025.11,
1025.56 1026.46 1026.91 1027.36 1027.81 1028.26 1028.71 1029.62 1030.07 1030.53,
1030.98 1031.44 1061.33 1061.81 1062.29 1063.26 1064.22 1064.70 1065.19 1068.58,
1069.07

2.8 Carbon Monoxide Profile (Physical Retrieval)

2.8.1 Number of channels: 36

2.8.2 Channels (cm^{-1}):

2181.49 2182.40 2183.31 2184.21 2185.12 2186.03 2186.94 2187.85 2188.76 2189.67, 2190.58 2191.50 2192.41 2193.33 2194.24 2195.16 2196.07 2196.99 2197.91 2198.83, 2199.75 2200.67 2201.59 2202.51 2203.44 2204.36 2205.29 2206.21 2207.14 2208.99, 2212.71 2213.64 2214.57 2215.50 2216.44 2221.12,

2.9 Methane Profile (Physical Retrieval)

2.9.1 Number of channels: 58

2.9.2 Channels (cm^{-1}):

1220.02 1228.22 1229.78 1236.02 1236.54 1237.06 1237.58 1238.10 1238.63 1240.74, 1241.26 1241.80 1242.32 1242.85 1245.50 1246.03 1247.09 1247.62 1248.15 1249.75, 1252.96 1253.50 1254.04 1254.58 1255.12 1256.73 1261.07 1261.61 1262.16 1267.63, 1268.18 1268.73 1270.93 1287.73 1288.30 1288.87 1294.56 1296.85 1298.00 1299.73, 1302.04 1302.61 1303.20 1303.77 1304.35 1304.93 1306.68 1332.18 1332.79 1337.04, 1341.73 1342.24 1342.75 1346.34 1346.85 1347.37 1355.67 1356.20

2.10 Cirrus Cloud Retrieval (Physical Retrieval)

2.10.1 Number of channels: 59

2.10.2 Channels (cm^{-1}):

692.76 **702.74 707.85 712.74 717.99 719.47 723.03 734.15 747.60** 757.61
800.01 802.19 803.66 811.41 814.03 816.29 818.18 821.60 825.82 828.91
830.47 835.17 839.92 843.12 865.20 869.67 876.14 878.76 884.04 887.71
890.40 899.61 902.03 921.64 924.55 926.38 928.96 930.801 934.15 936.40
938.28 939.79 941.68 944.35 947.80 949.34 952.82 958.69 963.04 965.43
1093.95 1101.11 1103.69 1109.40 1113.07 1115.70 1122.07 **1128.50** 1133.92

The channels in **bold** are also used for cloud clearing.

2.11 Cloud Phase Determination (Physical Retrieval)

2.11.1 Number of channels: 9

2.11.2 Channels (cm^{-1}):

929.70 930.07 930.44 960.66 961.06 **1227.71** 1228.22 1231.33 1231.85

The channel in **bold** is also used for cloud clearing.

2.11.3 Cloud Phase Tests

The channels are arranged into 4 groups:

BT930: 929.70 930.07 930.44
BT960: 960.66 961.06
BT1227: 1227.71 1228.22
BT1231: 1231.33 1231.85

The mean brightness temperatures of the good channels for each group are calculated and then the following threshold tests are applied:

IF(BT960 LT 235.0 K) THEN cold_cloud_test = 1
IF((BT1231 – BT960) GT 0.0 K) THEN ice_test2 = 1
IF((BT1231 – BT960) GT 1.75 K) THEN ice_test3 = 1
IF((BT1227 – BT960) GT -0.5 K) THEN ice_test4 = 1
IF((BT1231 – BT960) LT -1.0 K) THEN water_test1 = 1
IF((BT1231 – BT930) LT -0.6 K) THEN water_test2 = 1
IF(BT960 GT 280.0 K) THEN warm_test = 1

Cloud phase is set to the number of cold/ice tests passed minus the number of water/warm tests passed i.e.

(cold_cloud_test + ice_test2 + ice_test3 + ice_test4)
– (water_test1 + water_test2 + warm_test)

Cloud phase is set to the fill value (-9999) in cases with too little cloud or with low emissivity at 8 μm.

2.12 SO_2 Flag (Level 1B Radiances)

2.12.1 Number of channels: 2

2.12.2 Channels (cm^{-1}):

1361.44 1433.06

2.12.3 SO2 Flag Test

SO2 flag is set if the brightness temperature difference meets the criterion:

$$BT(1361.44) – BT(1433.06) < -6 K$$

2.12.4 Important Note Concerning Contamination due to Volcanic Ash

Physical retrievals can be seriously compromised if the AIRS field of regard is contaminated by dust volcanic ash. **We recommend that users filtering to select high quality data should avoid AIRS Level 2 retrievals for which BT_dif_SO2 ≤ 6 K. Those retrievals are likely contaminated by volcanic ash**.

2.13 Dust Flag Determination (Level 1B Radiances)

The dust flag is valid **ONLY OVER OCEAN** and fails if thin cirrus or other clouds are present ABOVE the dust. Version 6 uses the same channels as Version 5:

2.13.1 Number of channels: 5

2.13.2 Channels (cm^{-1}):

822.36 900.31 961.06 1129.03 1231.33 cm^{-1}

2.13.3 Dust Flag Tests

Convert radiances of the channels to brightness temperature i.e.,

```
a = BT(822.36)    b = BT(900.31)    c = BT(961.06)    d = BT(1129.03)
e = BT(1231.33)
```

Compute 9 scores according to the following tests:

```
Initialize dust0=dust1=…=dust8=0
IF((b-d) GT -0.5 AND (b-d) LT 1.00) THEN dust0 = 1
IF((d-e) LT -1.25) THEN dust1 = 2
IF((d-a) LT -0.75) THEN dust2 = 4
IF((c-d) GT -0.2  AND (c-d) LT 1.0) THEN dust3 = 8
IF((b-e) GT -4.5  AND (b-e) LT -0.3) THEN dust4 = 16
IF((b-a) LT 0.115) THEN dust5 = 32
IF((b-c) GT 0.05 AND (b-c) LT 1.5) THEN dust6 = 64
IF((c-e) LT -0.15) THEN dust7 = 128
IF((c-a) LT 0.40) THEN dust8 = 256
```

The dust flag is set true if the summation dust0+dust1+…+dust8 ≥ 380

In Version 5 the threshold value was 362. It has been increased to 380 in Version 6 to reduce false positives.

2.13.4 Important Note Concerning Contamination due to Dust

Physical retrievals can be seriously compromised if the AIRS field of regard is contaminated by dust and/or volcanic ash. Users should always include the **dust_flag** and **dust_score** in their quality control filtering of data. Despite being valid only over ocean the dust detection algorithm should be useful for filtering data contaminated by dust in the Saharan Air Layer (SAL). **We recommend that users filtering to select high quality data over oceans should avoid AIRS Level 2 retrievals for which *dust_score ≥ 380 or dust_flag = 1, regardless of the values of other QA indicators*.**

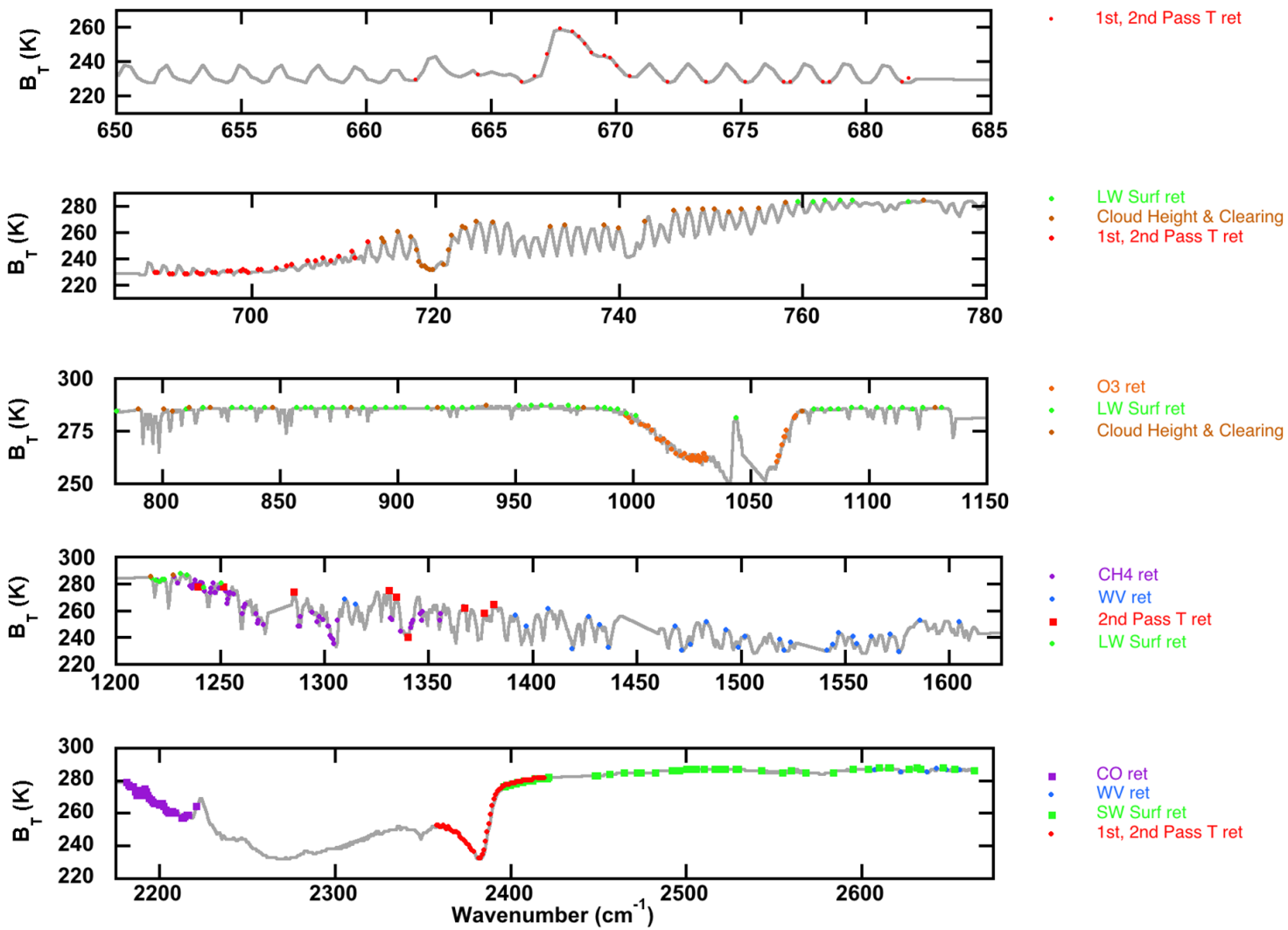

Figure 1: US Standard Atmosphere Tb of AIRS channels used in L2 physical retrieval by function

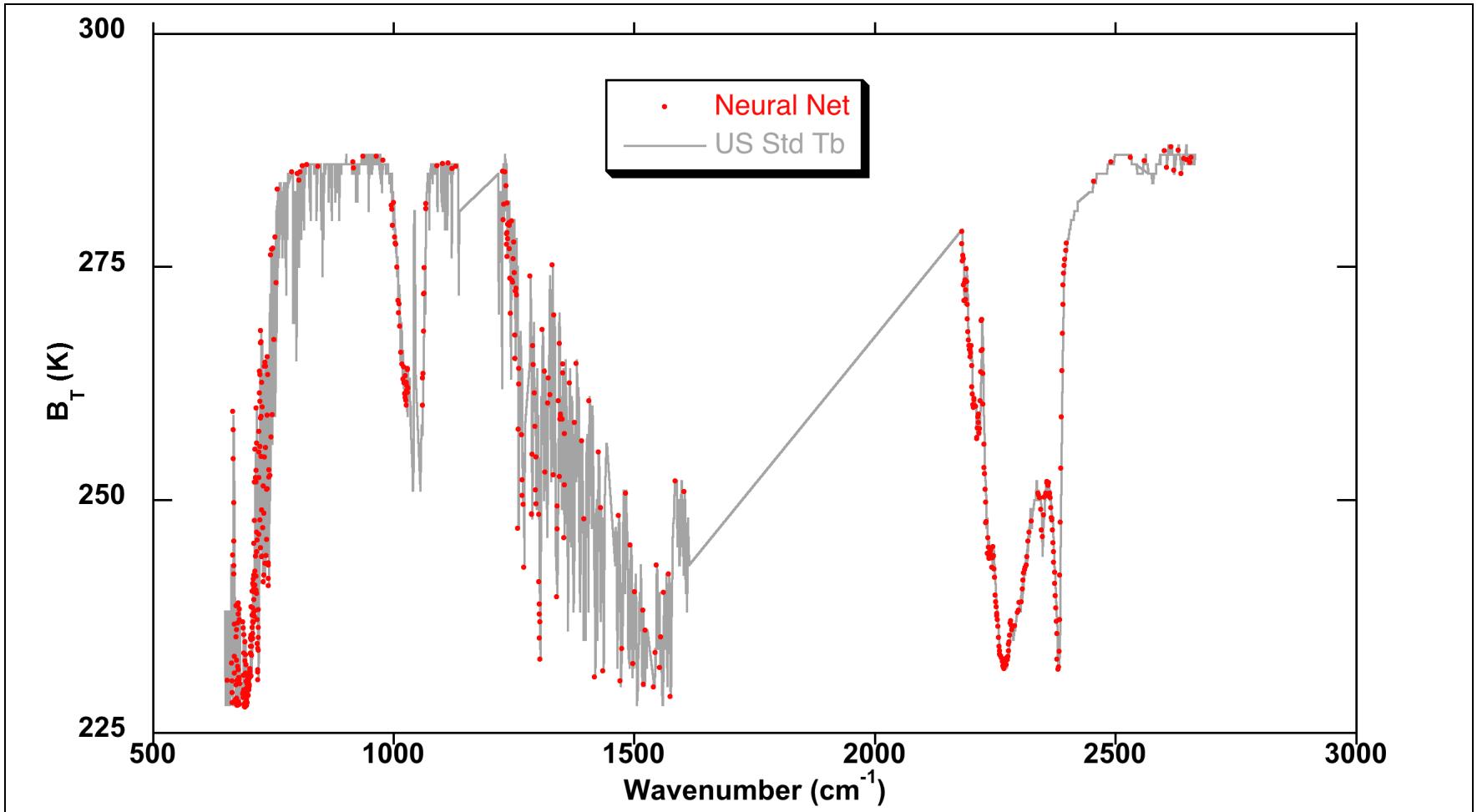

Figure 2: US Standard Atmosphere Tb of AIRS channels used by Neural Net Regression for L2 First Guess

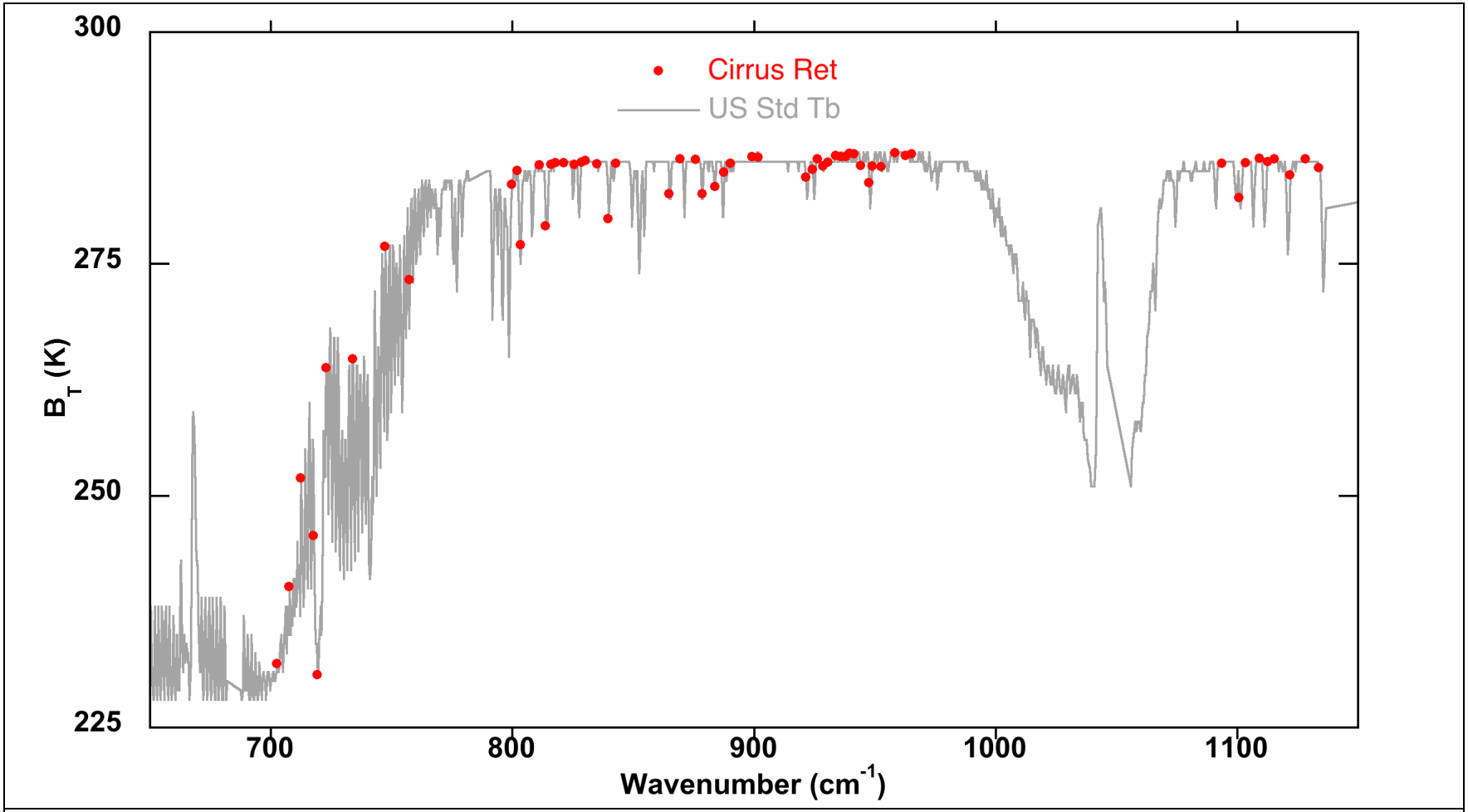

Figure 3: US Standard Atmosphere Tb of AIRS channels used in L2 physical retrieval for Cirrus Cloud Retrieval

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