FirstLight Forward Model Observations/Validation

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Overview

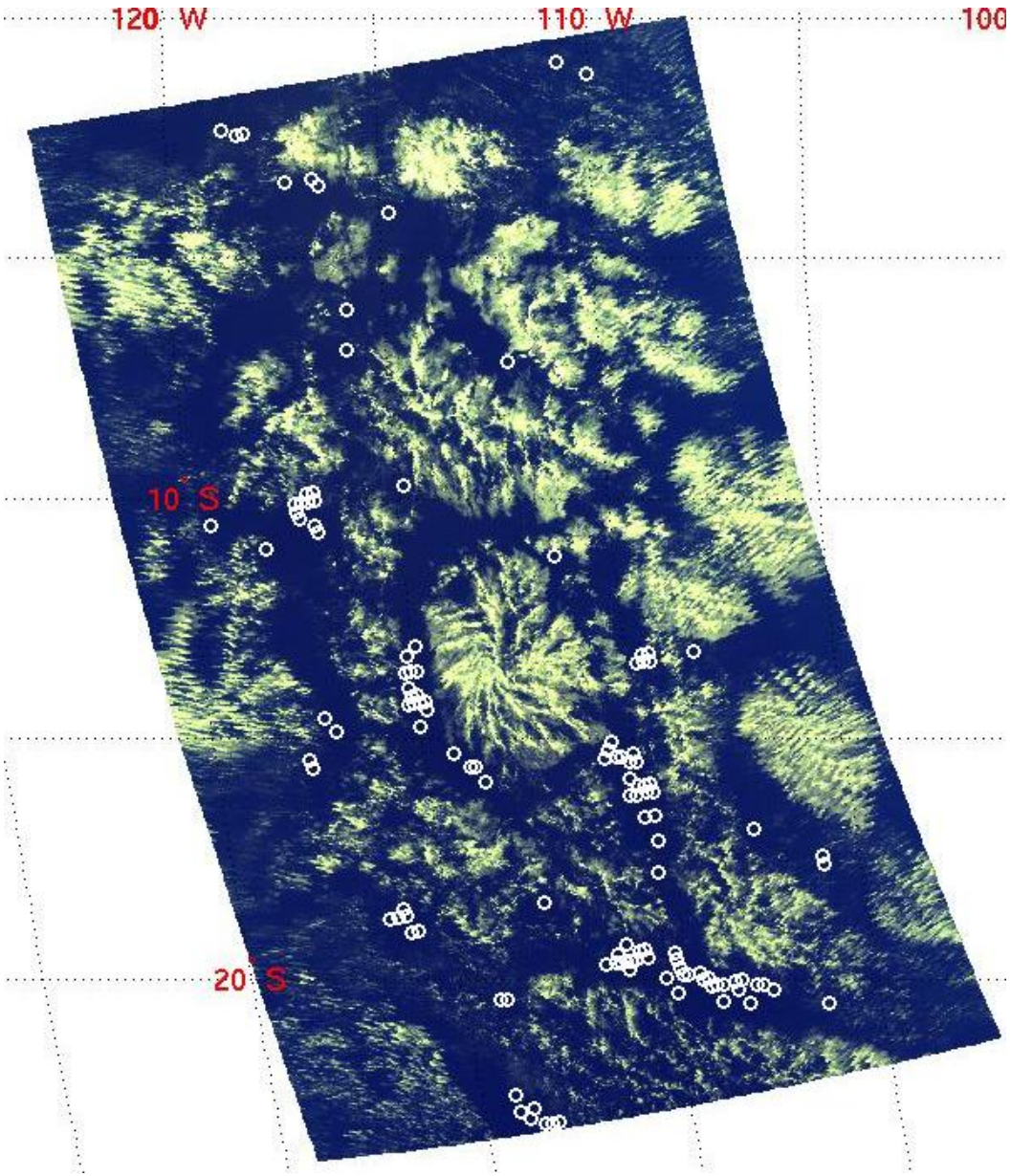
- Overall results are fantastic! Congratulations to the many people who designed, built, and tested AIRS!
- Obs-Calcs with both ECMWF and NCEP *below* 0.5K in mid-, lower-trop temperature (CO_2) channels, except for a few regions where spectroscopy needs some adjustments.
- Concentrated on ECMWF since NCEP water Obs-Calcs much larger.
- ECMWF Obs-Calcs in water region range from 1-2K. Suspect these are mostly model errors, some spectroscopy.
- Redundancy of channels is already helping validation
- kCARTA runs use Cont-V5.1 and sometimes CO_2 modification. We are working on re-fitting laboratory data.
- Non-LTE may be a major issue during daylight.
- Clear detection is mostly uniformitivity test, and split-window agreement. Also force $\pm$3K agreement with SST for outliers, uniform clouds.

Absolute Radiometry; Comparisons with SST's, Night/Ocean

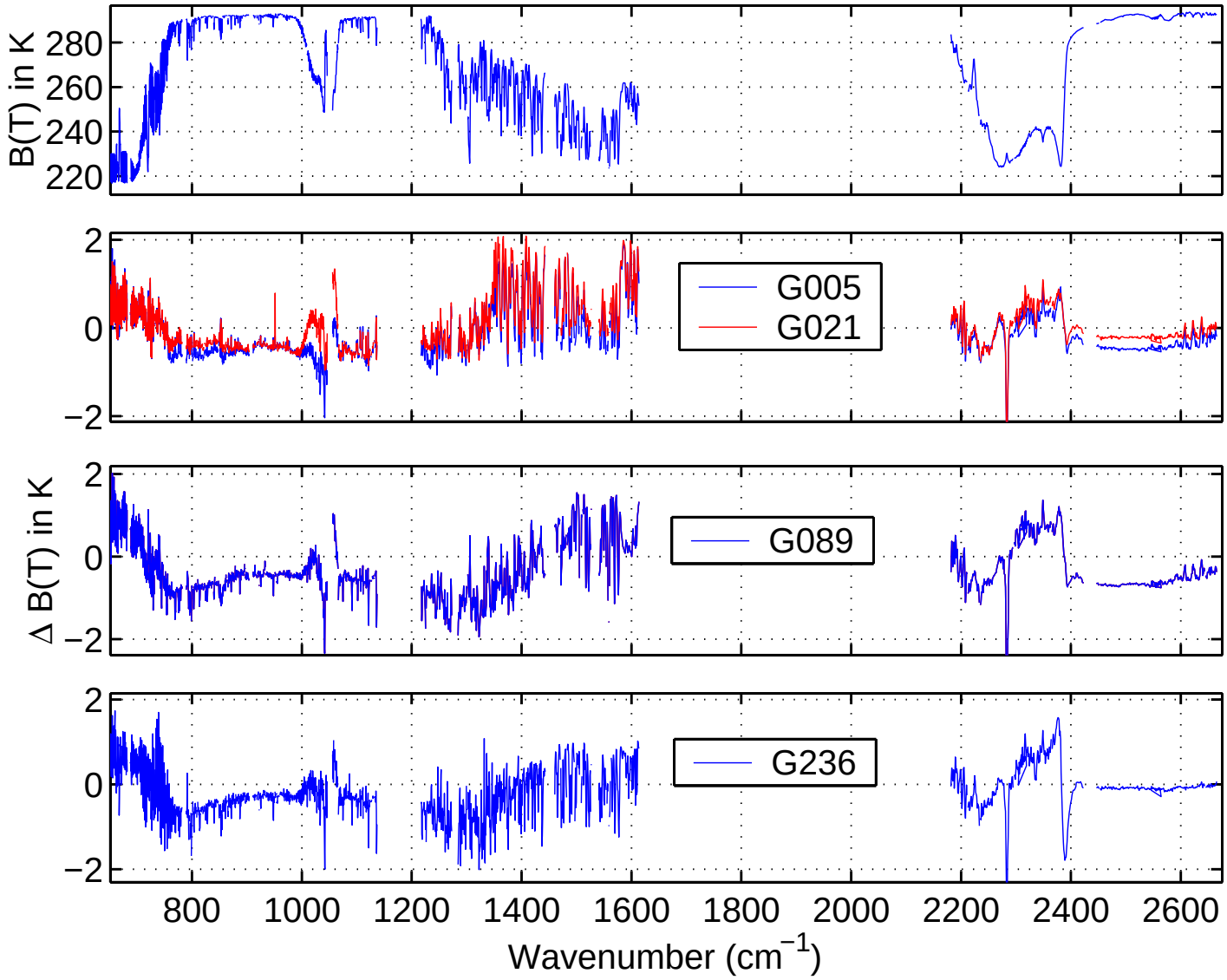
Find clear by demanding uniform B(T) in 3x3 cell of FOVS (0.25K)
Discard uniform low clouds with |B_SST - B_obs| < 5K. Not robust but apparently OK for data studied so far.

granule	# uniform	#clear	2616 cm-1	960 cm-1
5	686	582	-0.52	-0.43
21	122	101	-1.02	-1.03
89	164	106	-0.75	-0.65
90	60	51	-0.31	-0.17
236	369	307	-0.15	-0.24

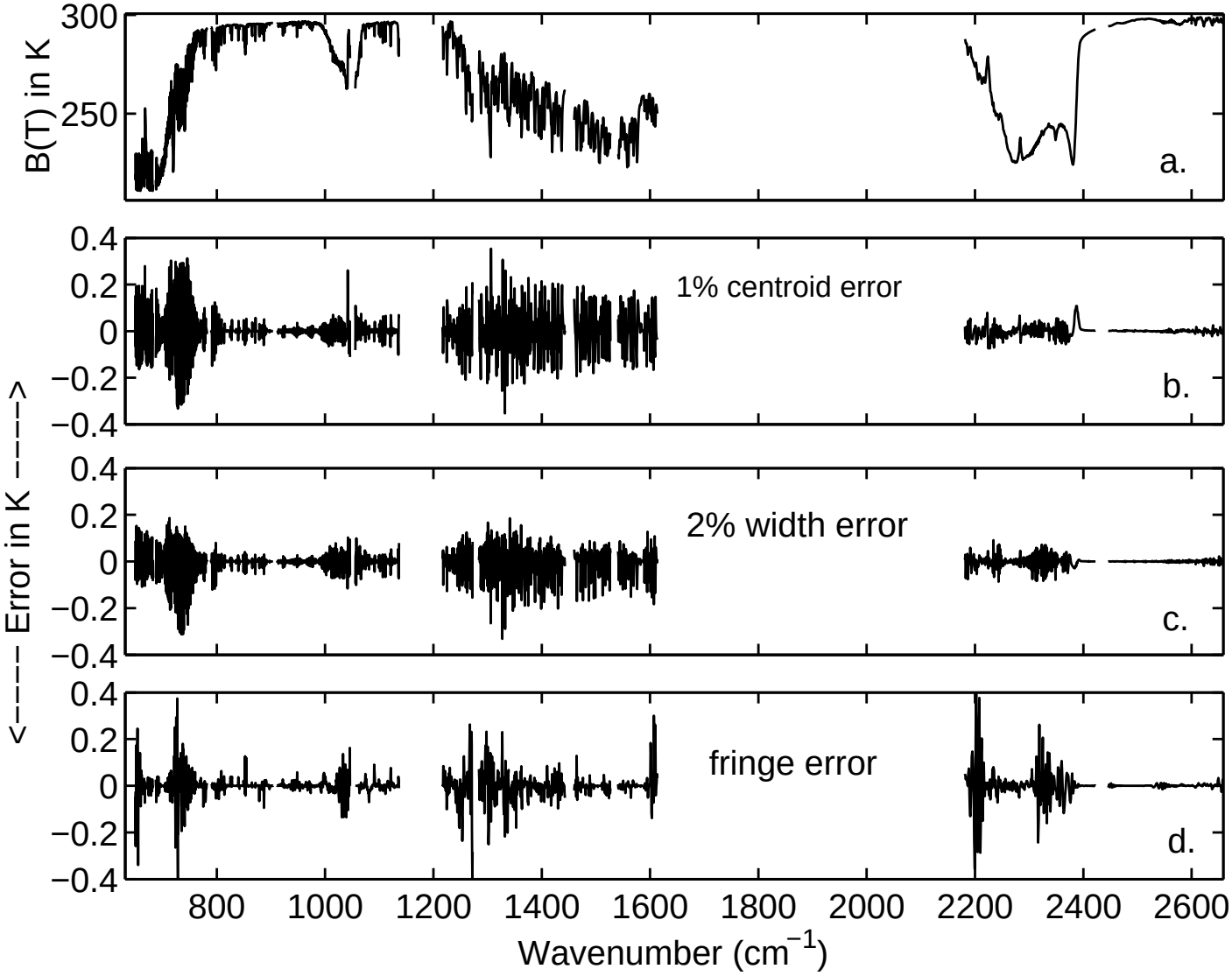
Mean ~ -0.55K +- 0.35K


120 W
110 W
100
10 S
20 S

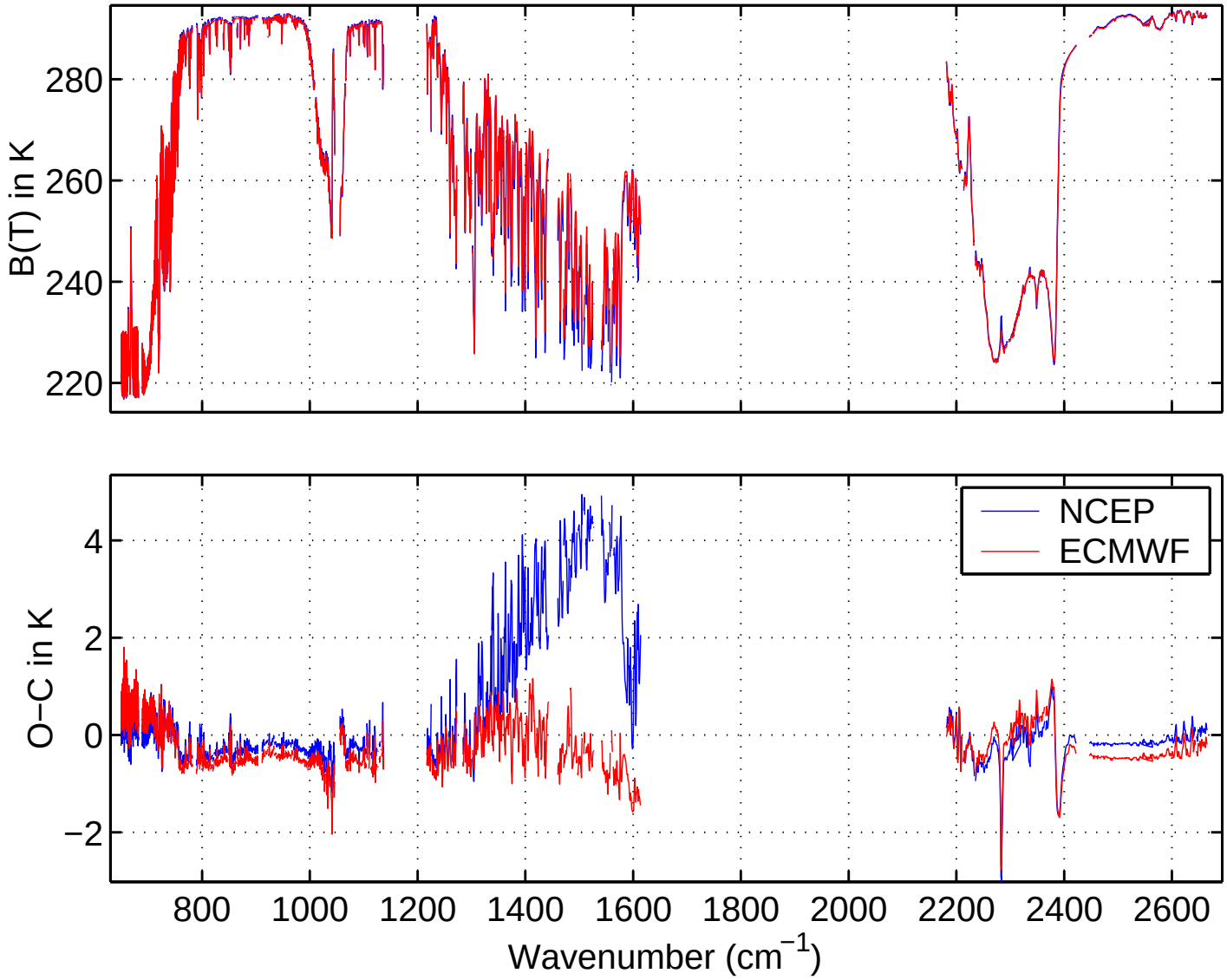
AIRS Bias with ECMWF for Various Geographic Locations



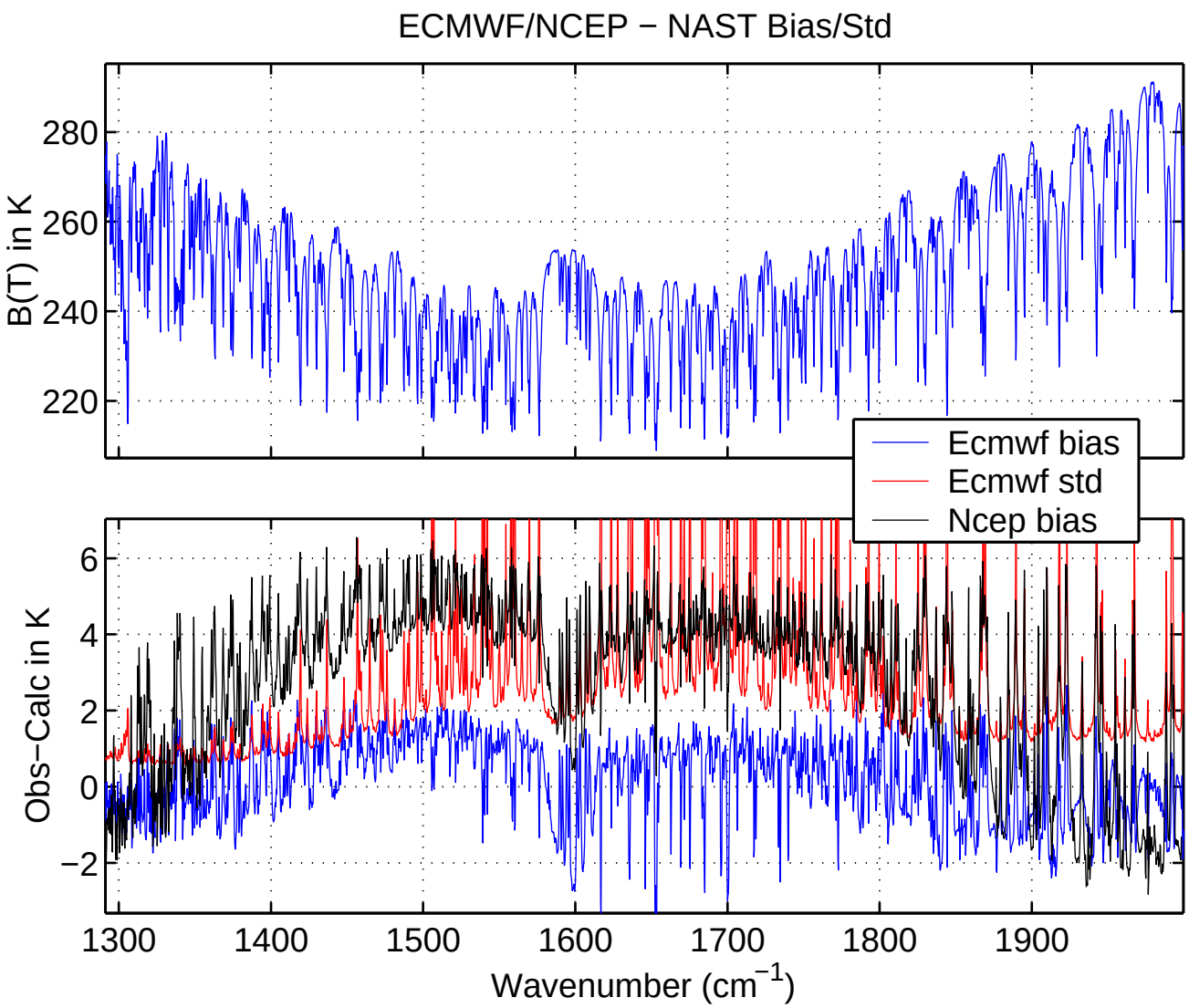
Forward Model Sensitivity to SRF Parameters



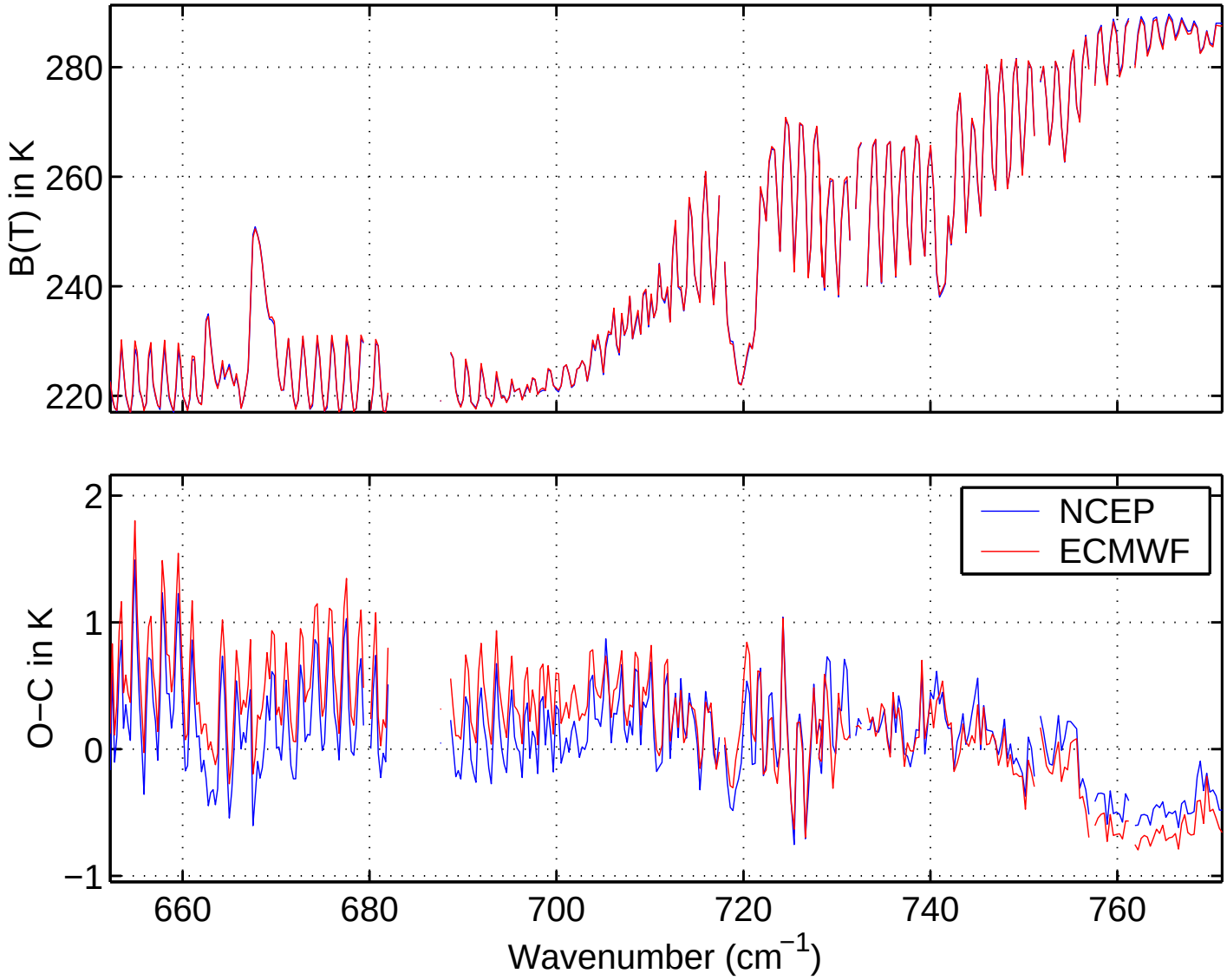
AIRS Bias with ECMWF and NCEP, Original H_2O and CO_2



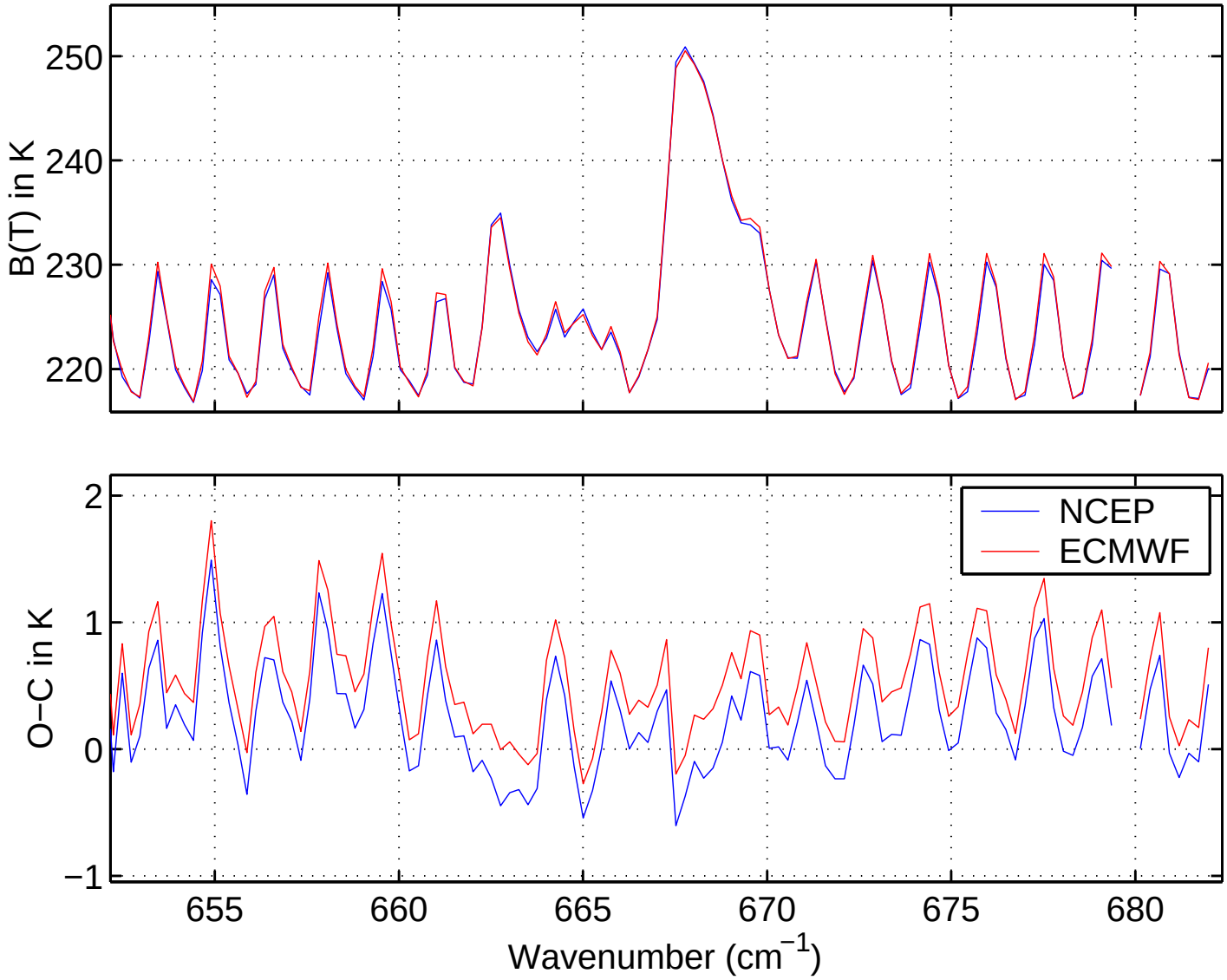
CLAMS S-HIS vs ECMWF/NCEP Calcs



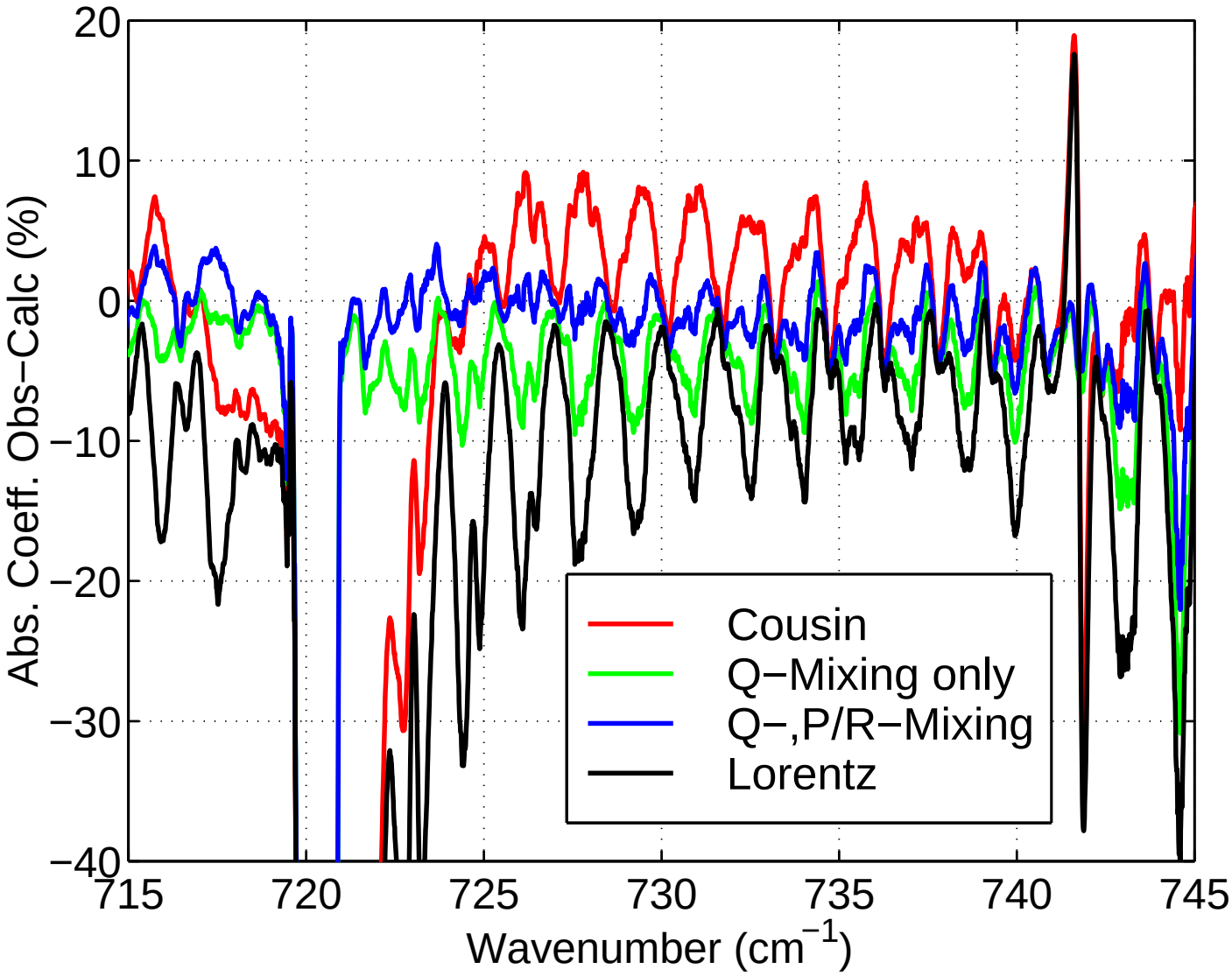
AIRS Bias with ECMWF and NCEP, Original H_2O and CO_2



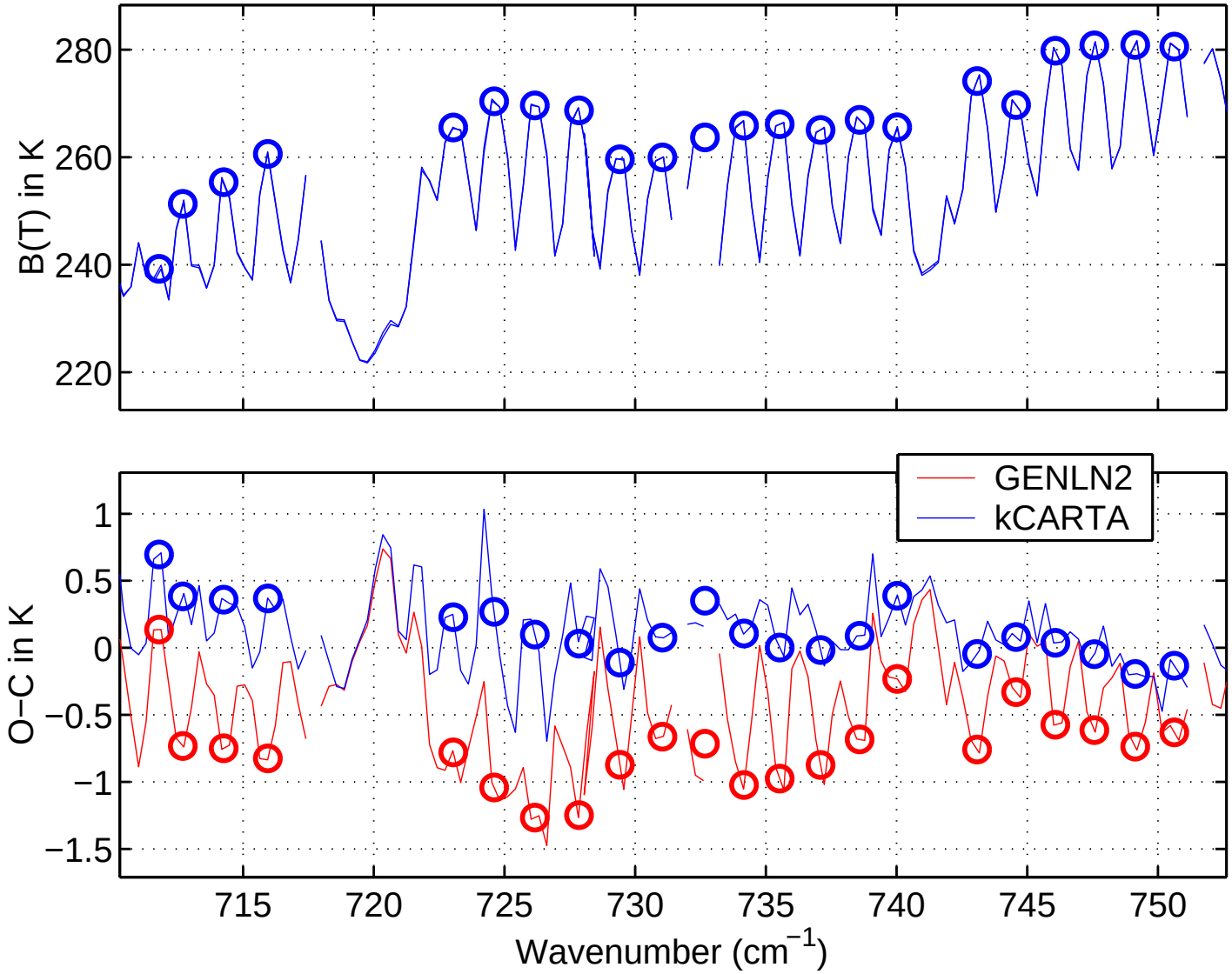
AIRS Bias with ECMWF and NCEP, Original H_2O and CO_2



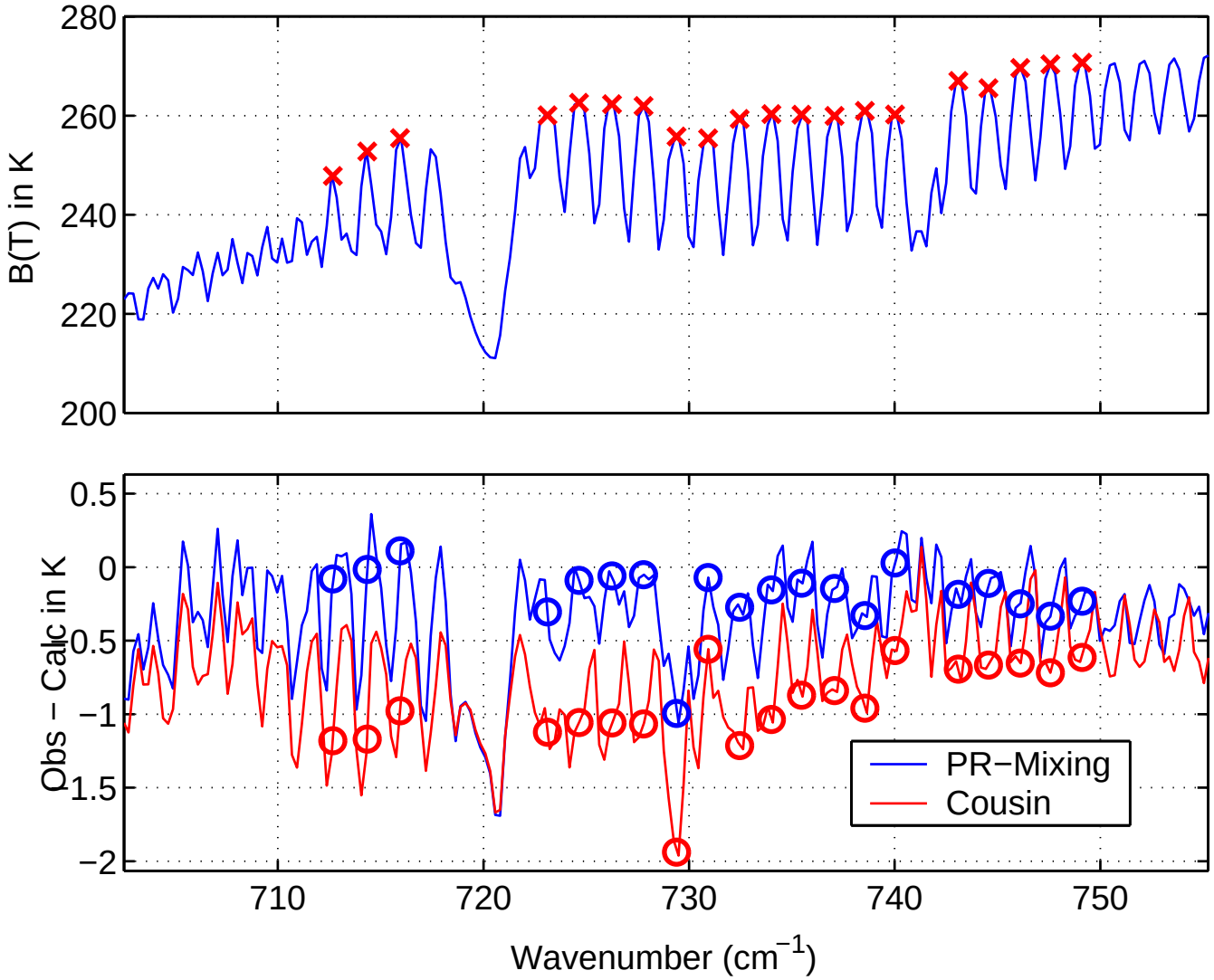
15 Micron Laboratory Data of CO_2



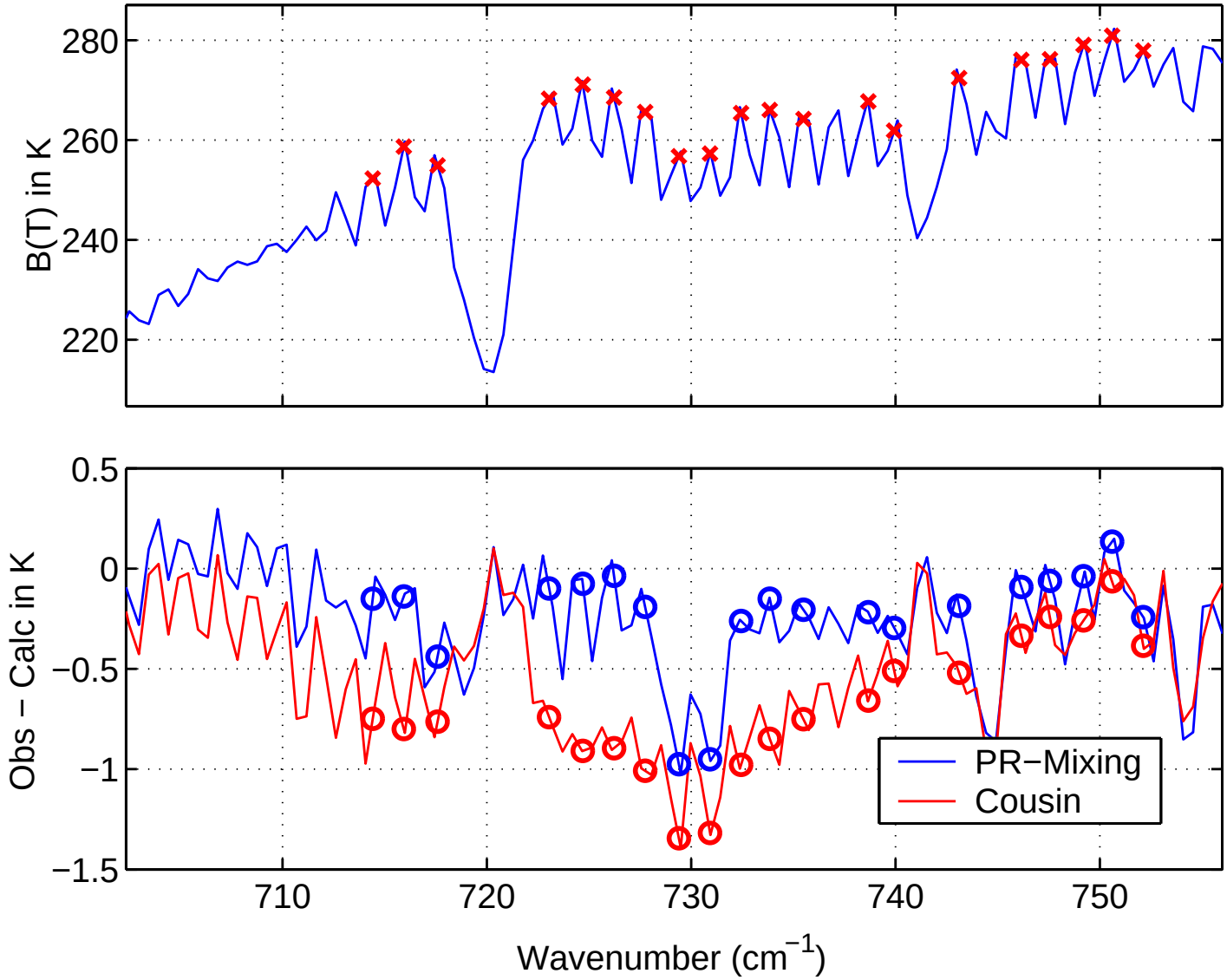
AIRS: kCARTA versus GENLN2 AIRS Bias with ECMWF



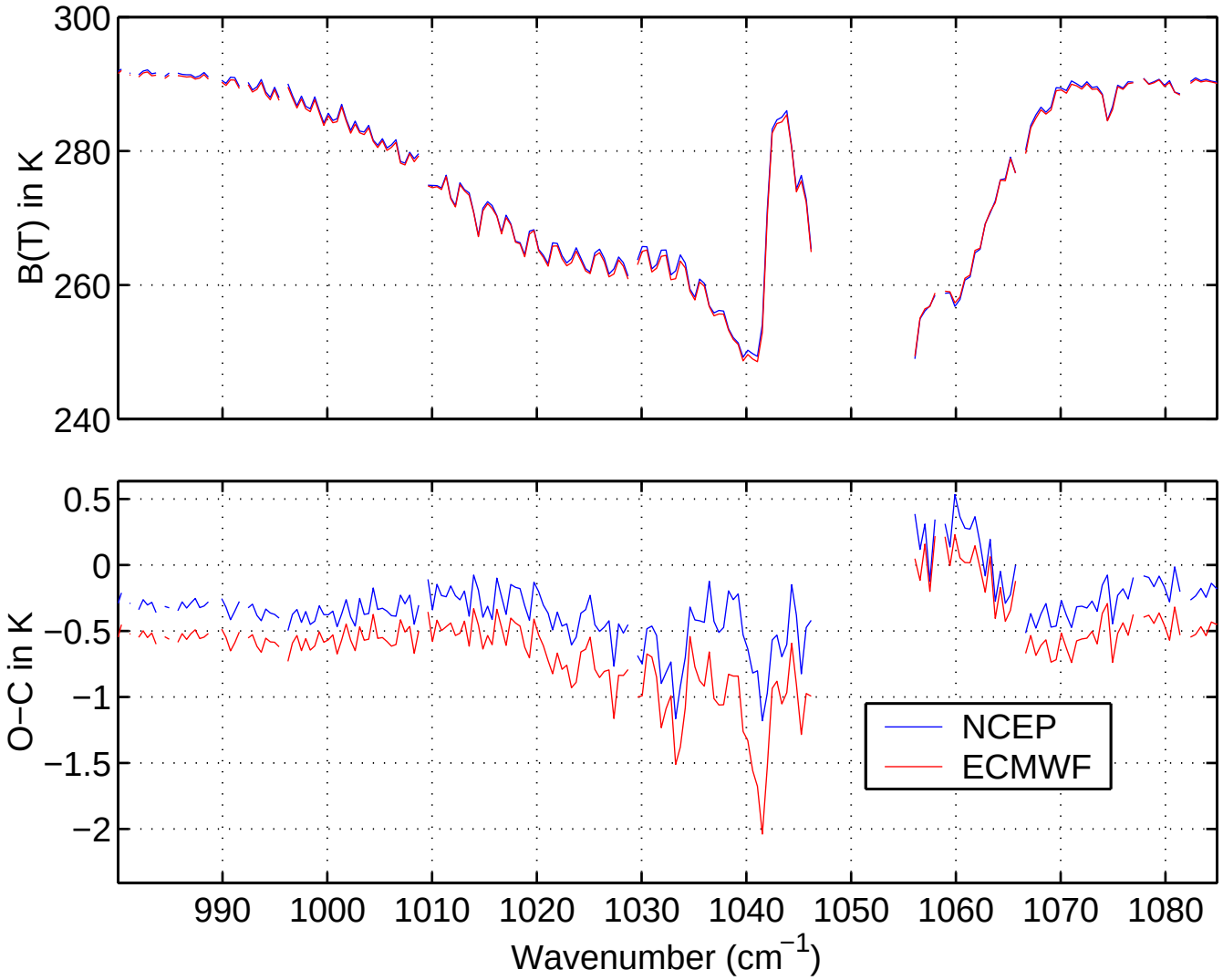
WINTEX: O-C With and Without P/R Mixing



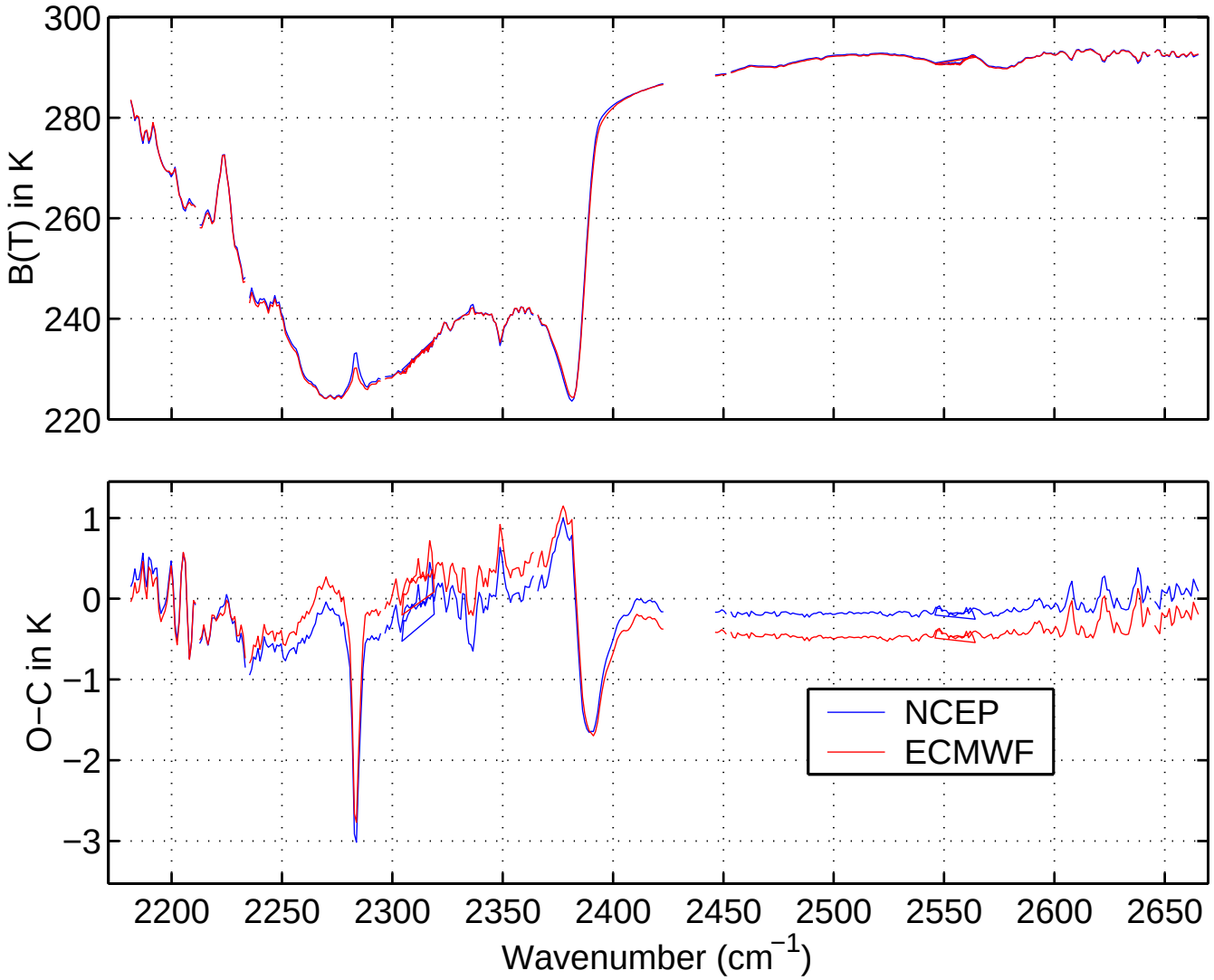
ECMWF vs S-HIS during CLAMS



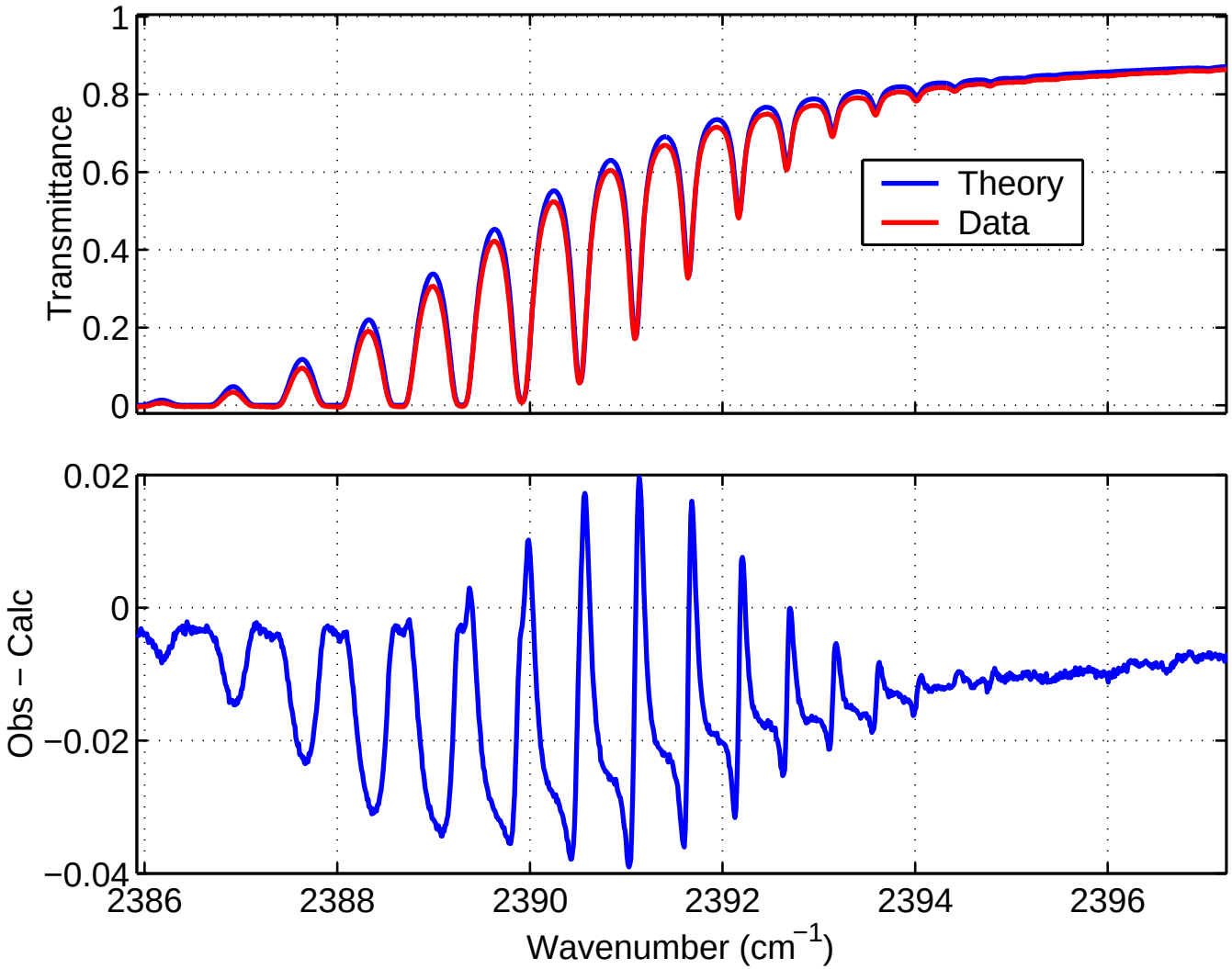
AIRS Bias with ECMWF and NCEP, Original H_2O and CO_2



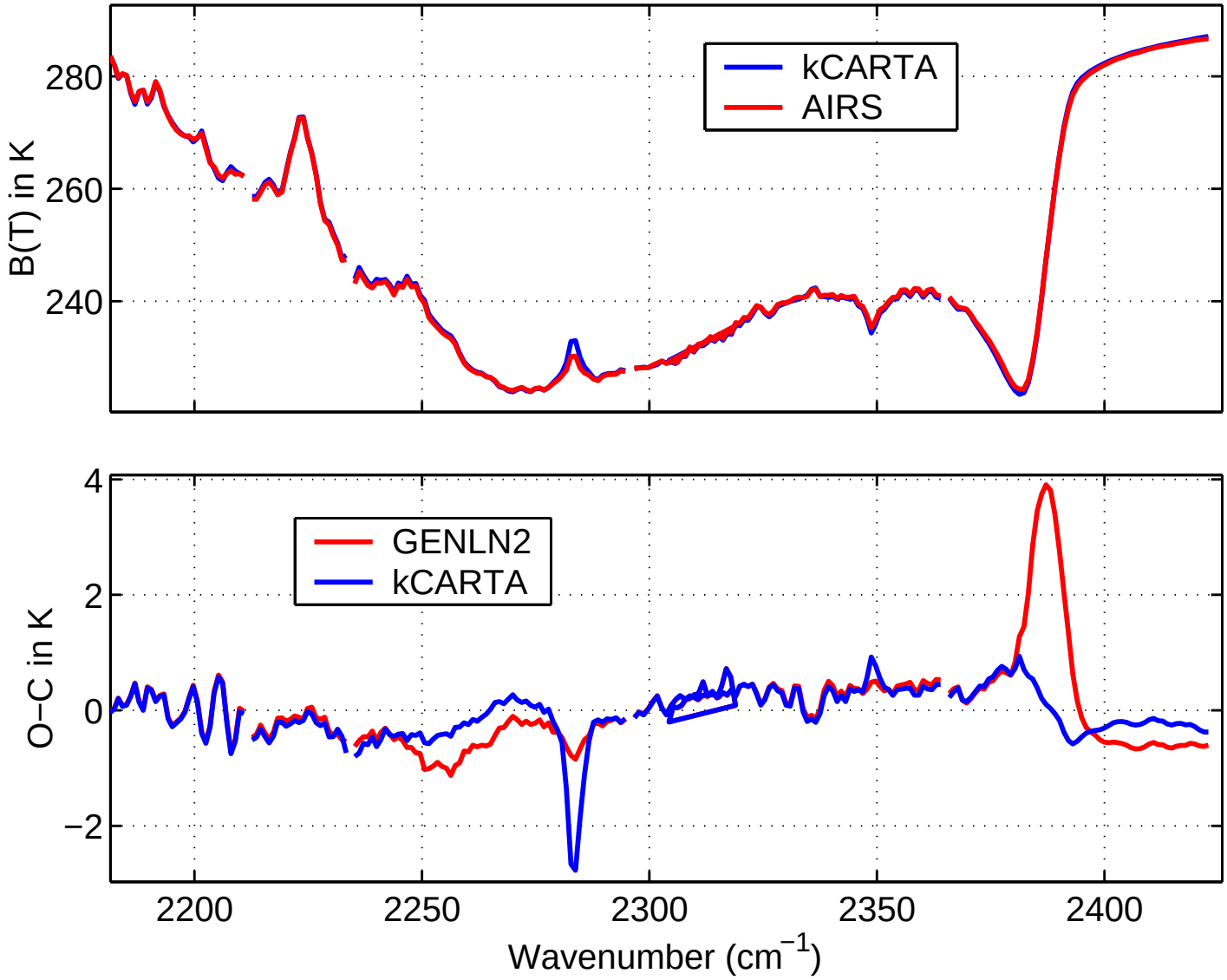
AIRS Bias with ECMWF and NCEP, Original H_2O and CO_2



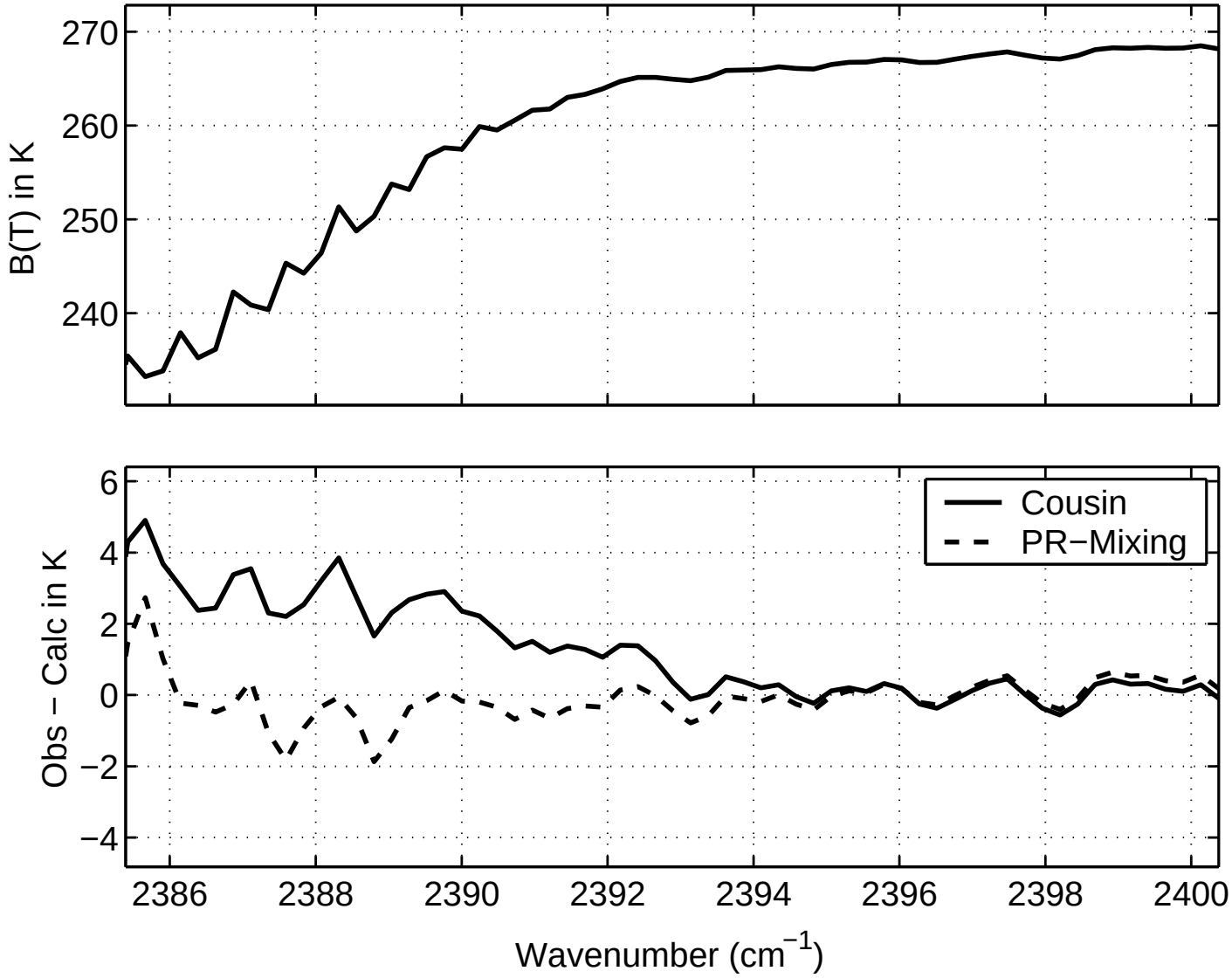
4.3 Micron Laboratory Data of CO_2



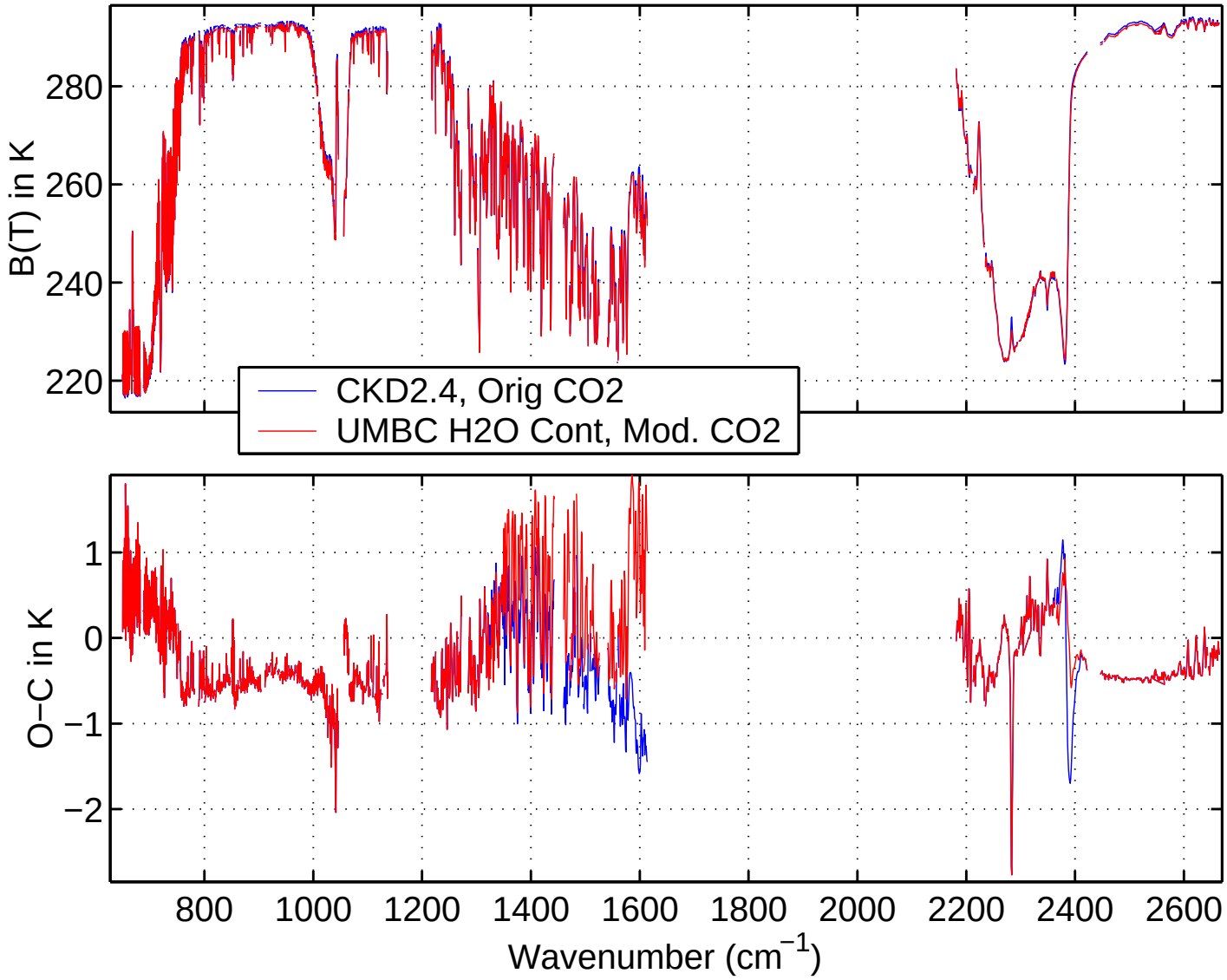
AIRS:kCARTA versus GENLN2 AIRS Bias with ECMWF



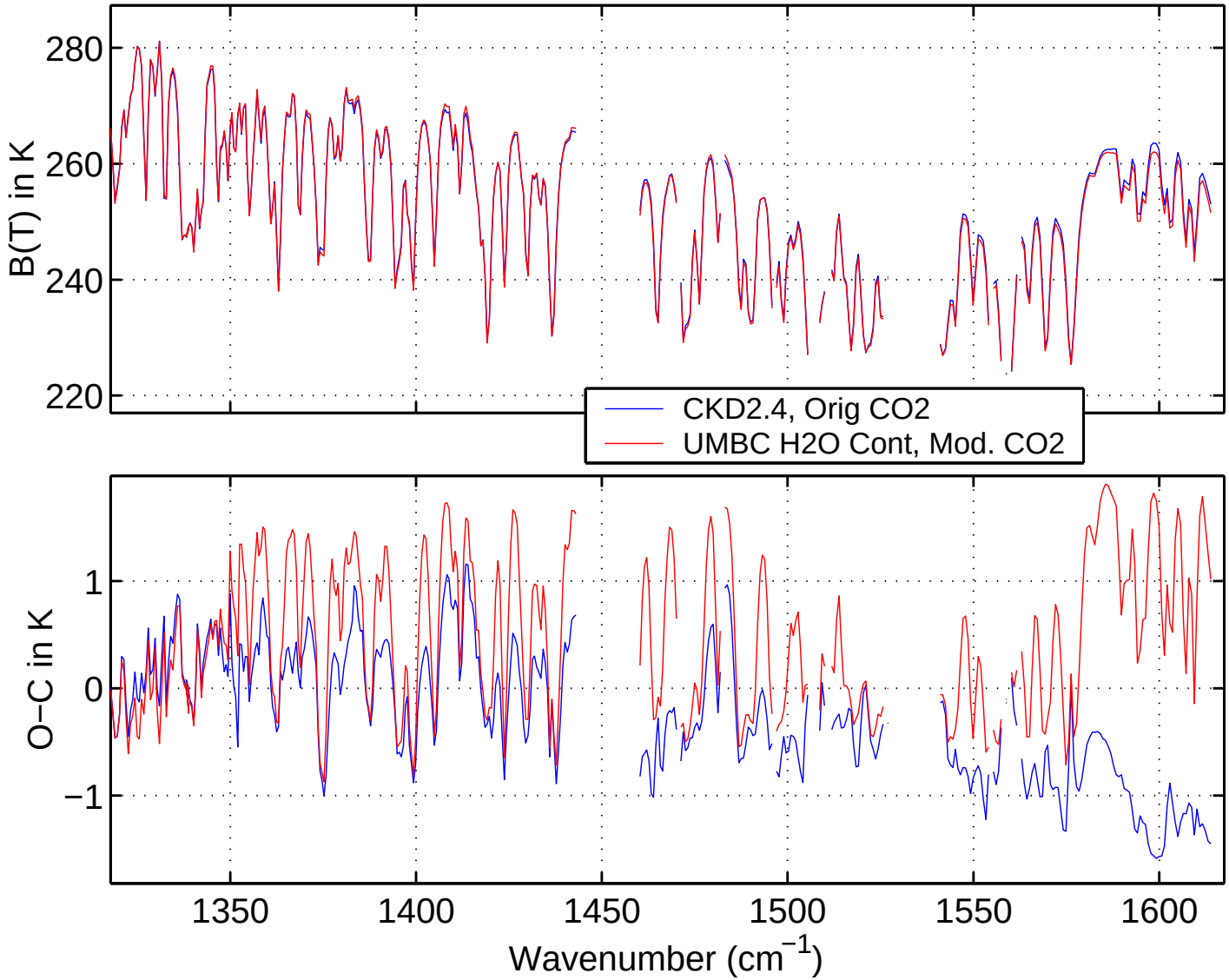
Sonde vs NAST-I during WINTEX



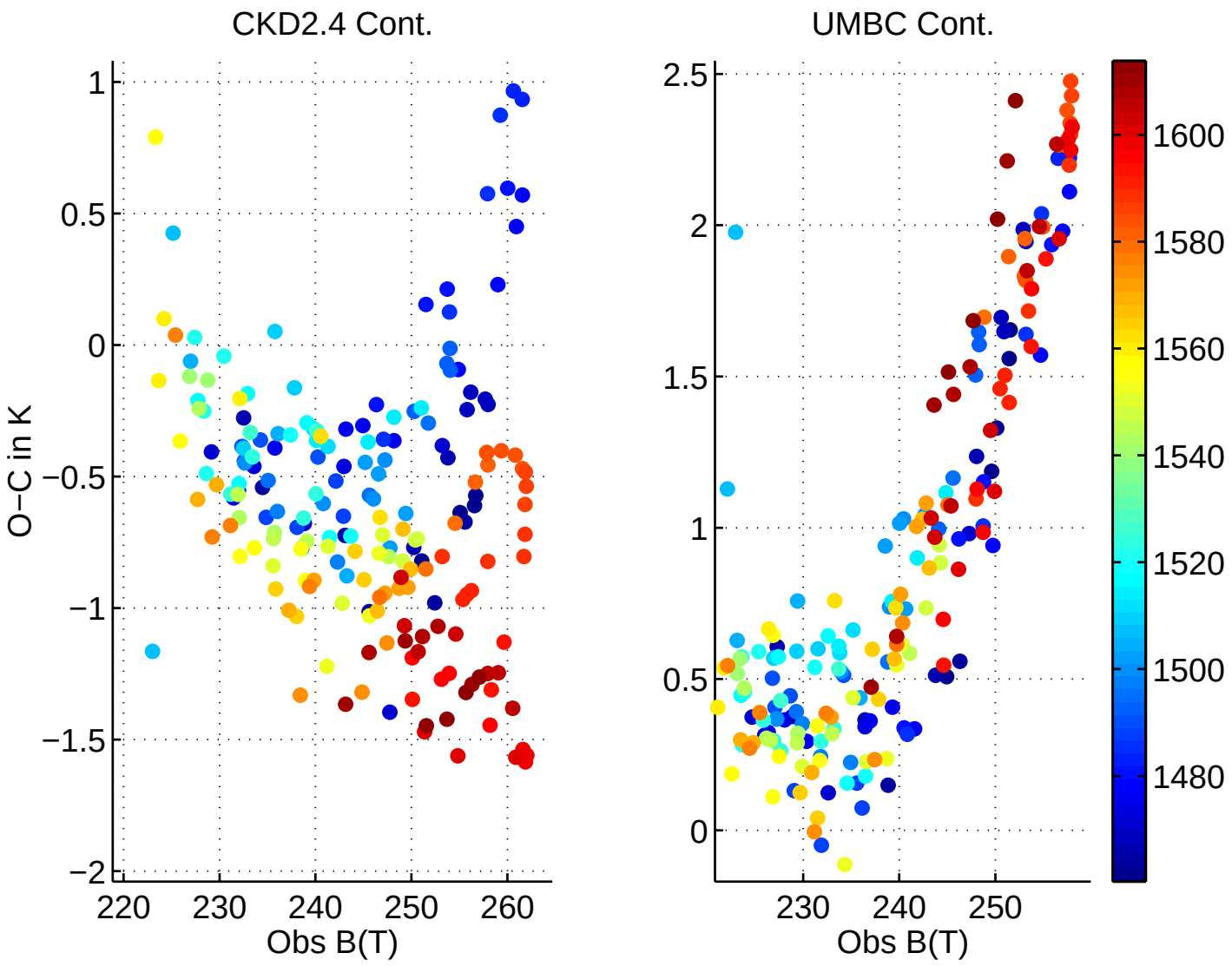
AIRS Bias with ECMWF, CO_2 Corrected Using Laboratory Data



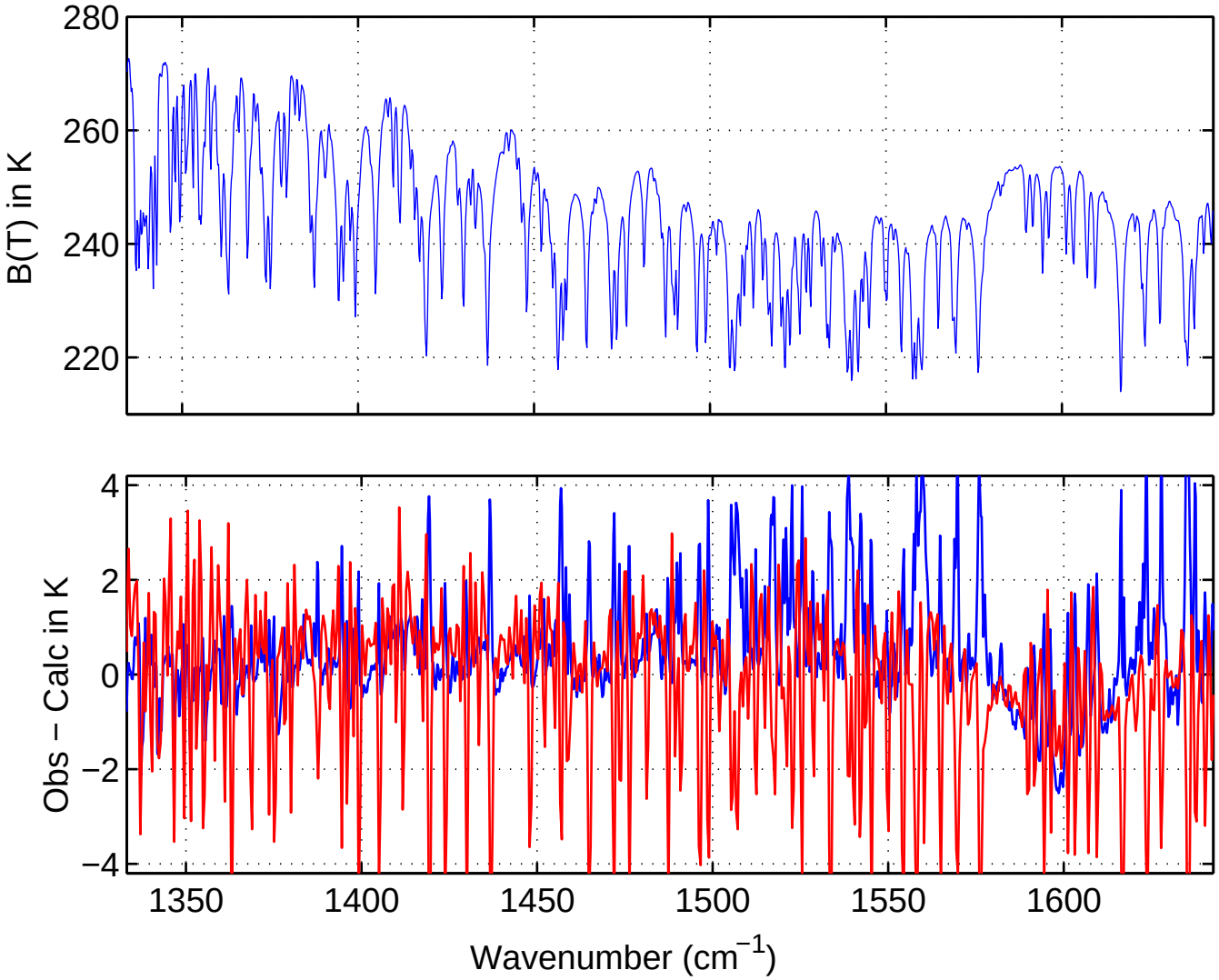
AIRS Bias with ECMWF, CO_2 Corrected Using Laboratory Data



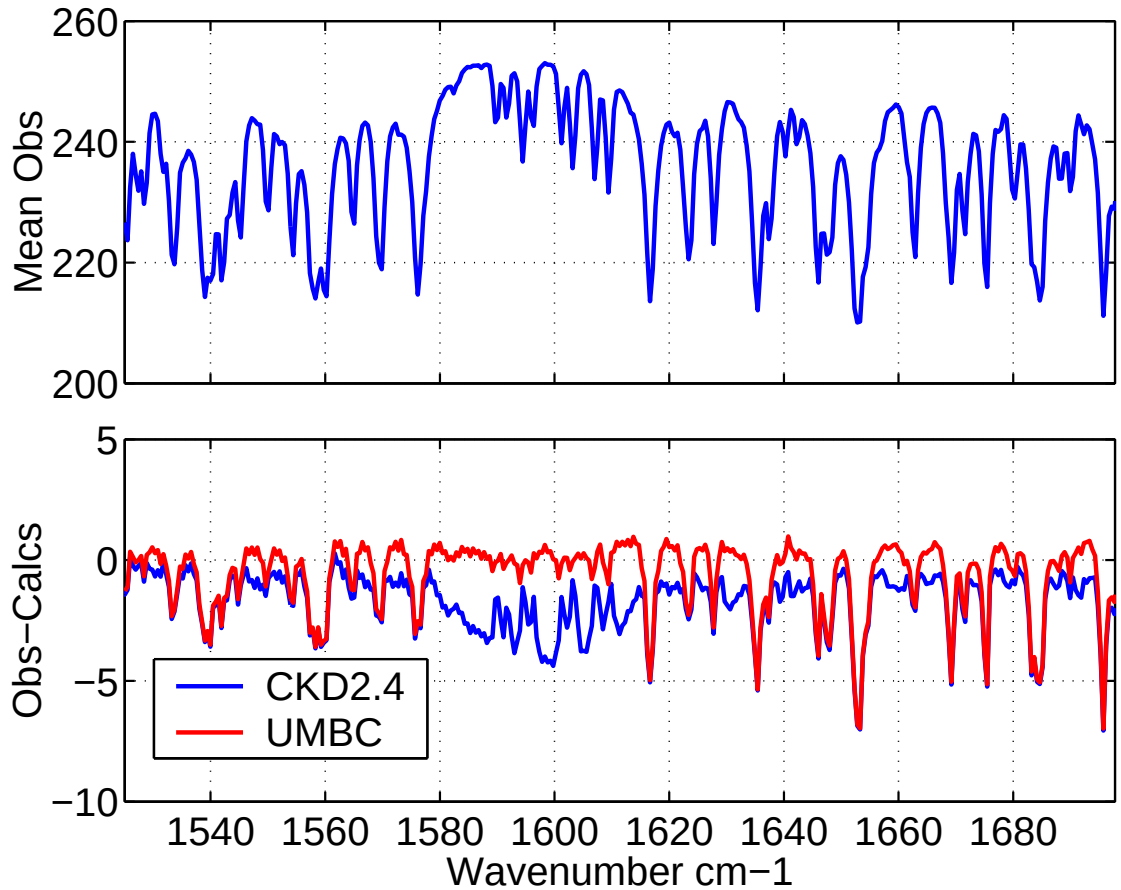
Internal Consistency vs Accuracy, Water Vapor Continuum



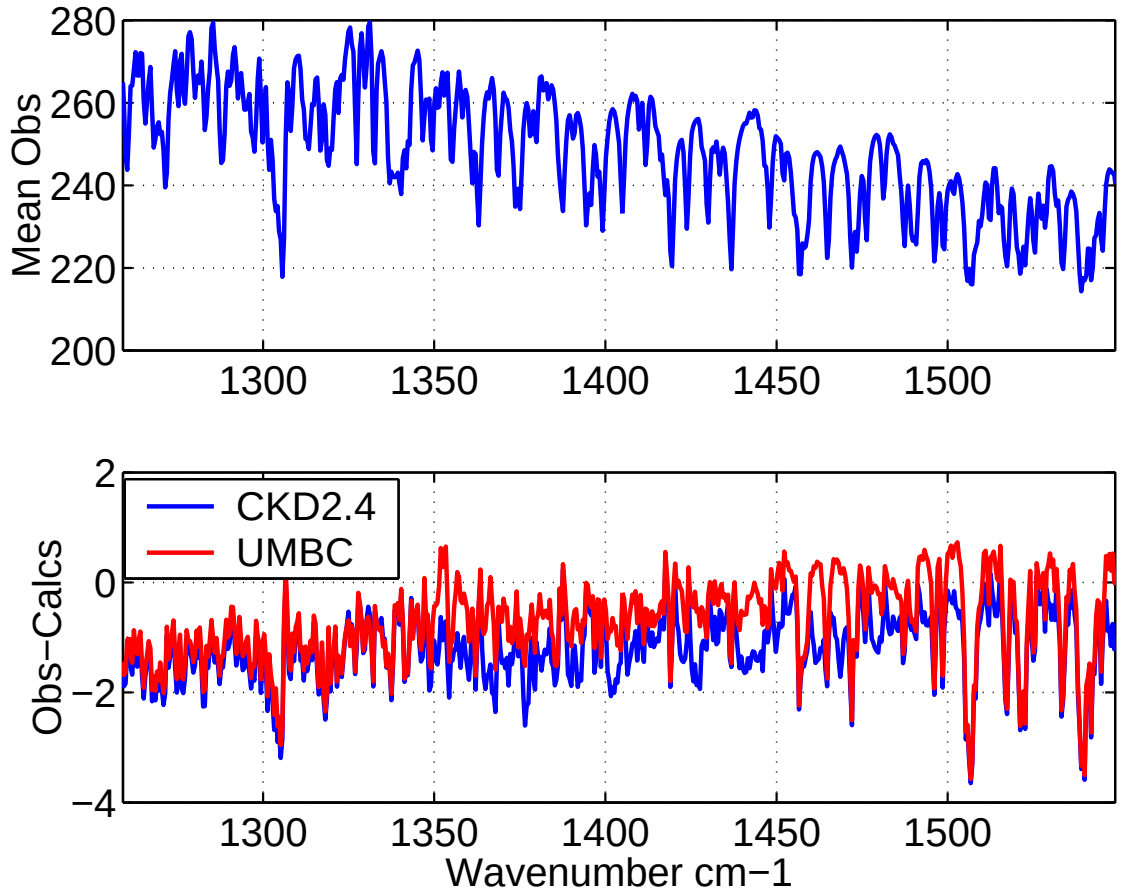
CAMEX-1, WINTEX H_2O Obs-Calcs using Sondes



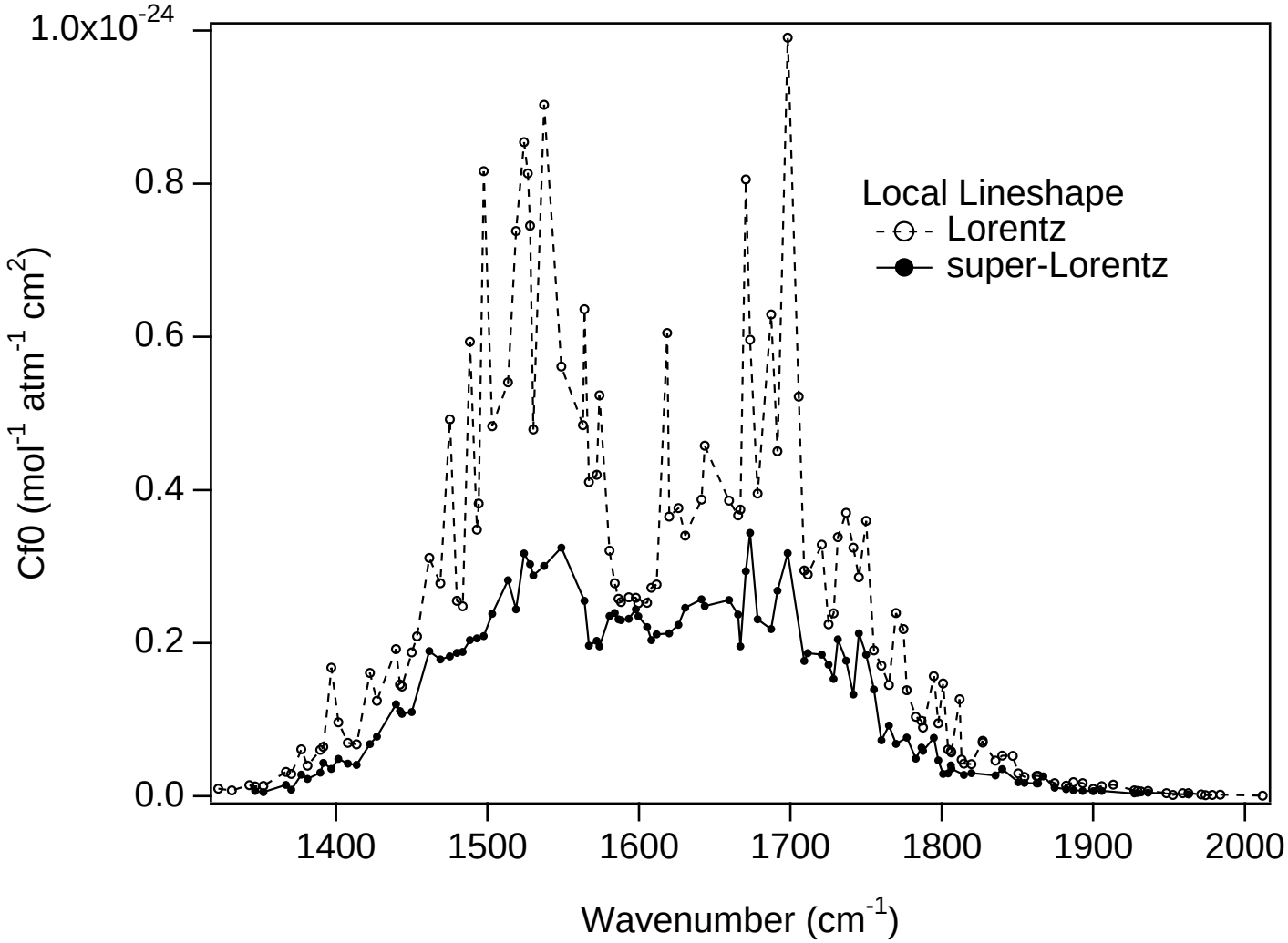
ECMWF SHIS in the 1600 cm^{-1} region



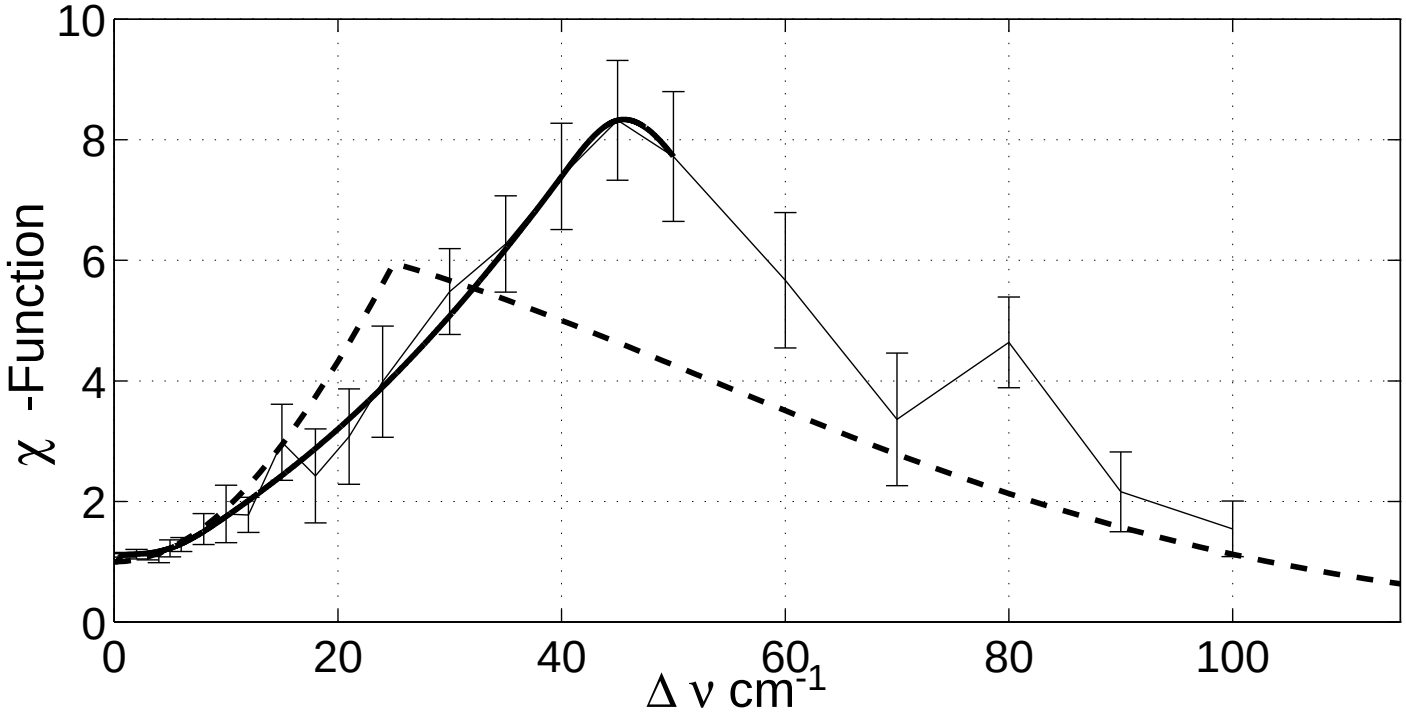
ECMWF SHIS in the 1400 cm^{-1} region



Water Continuum Using Super-Lorentz Near-Wing Lineshape

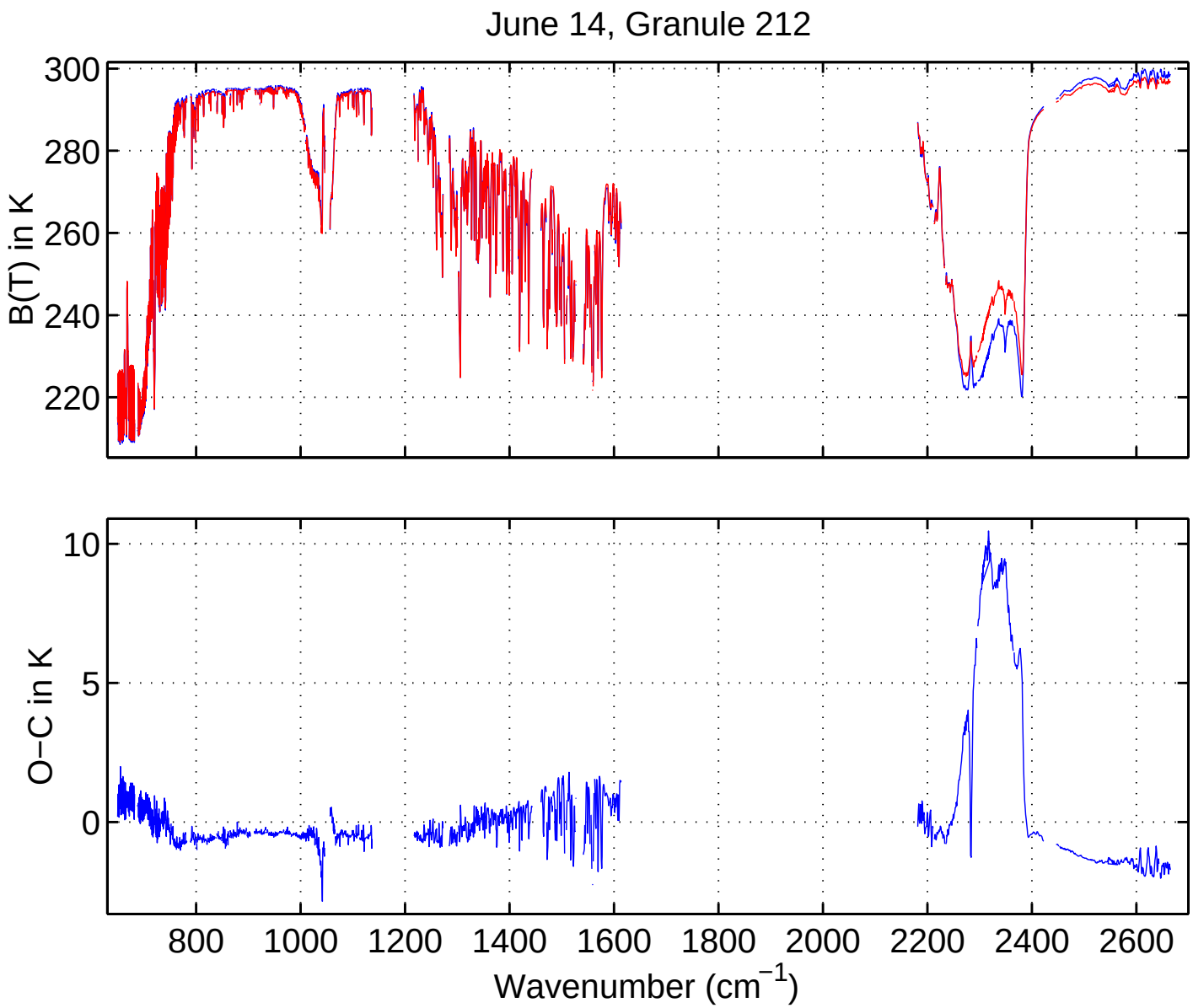


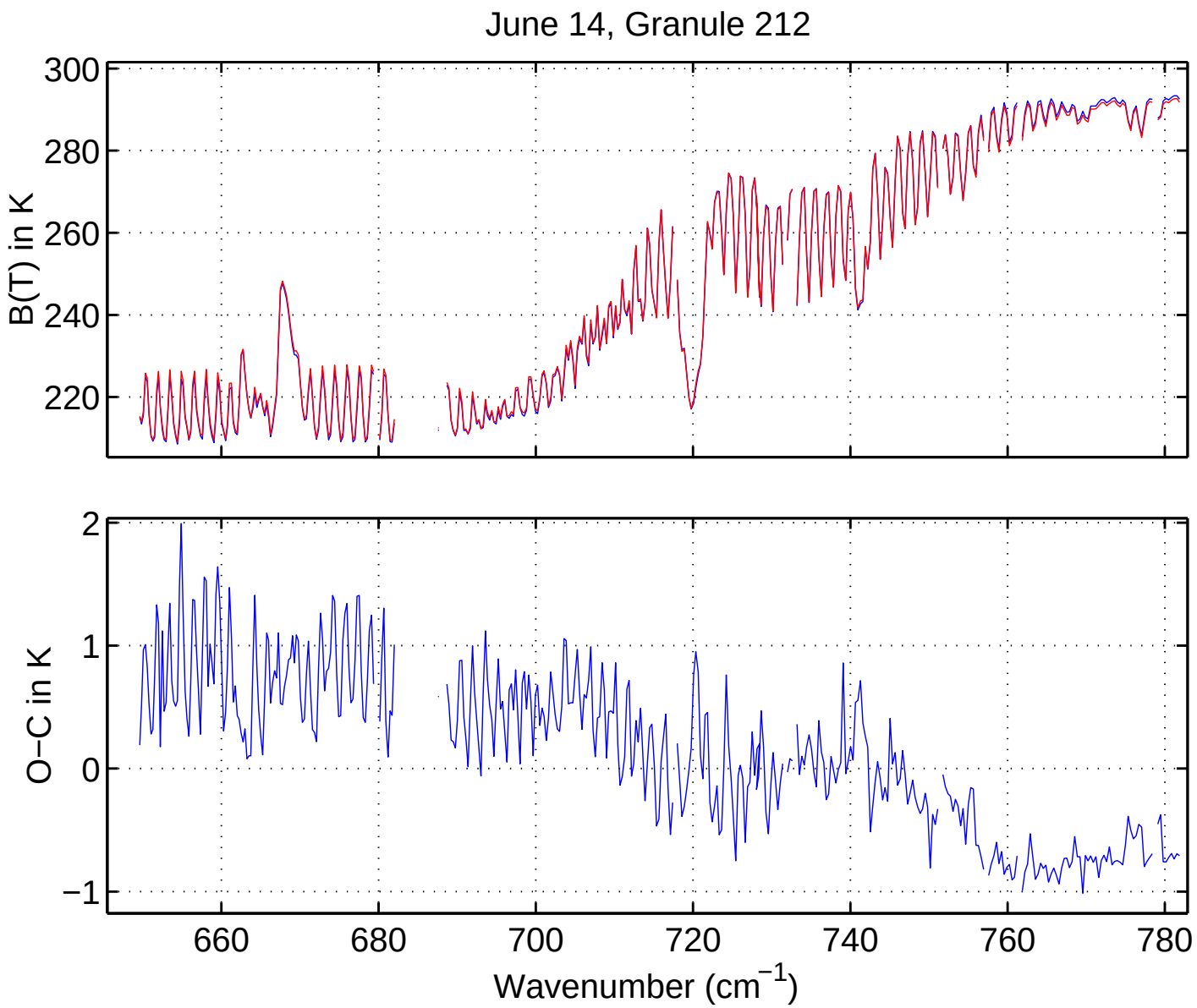
Super-Lorentz Water Lineshape (χ-function)

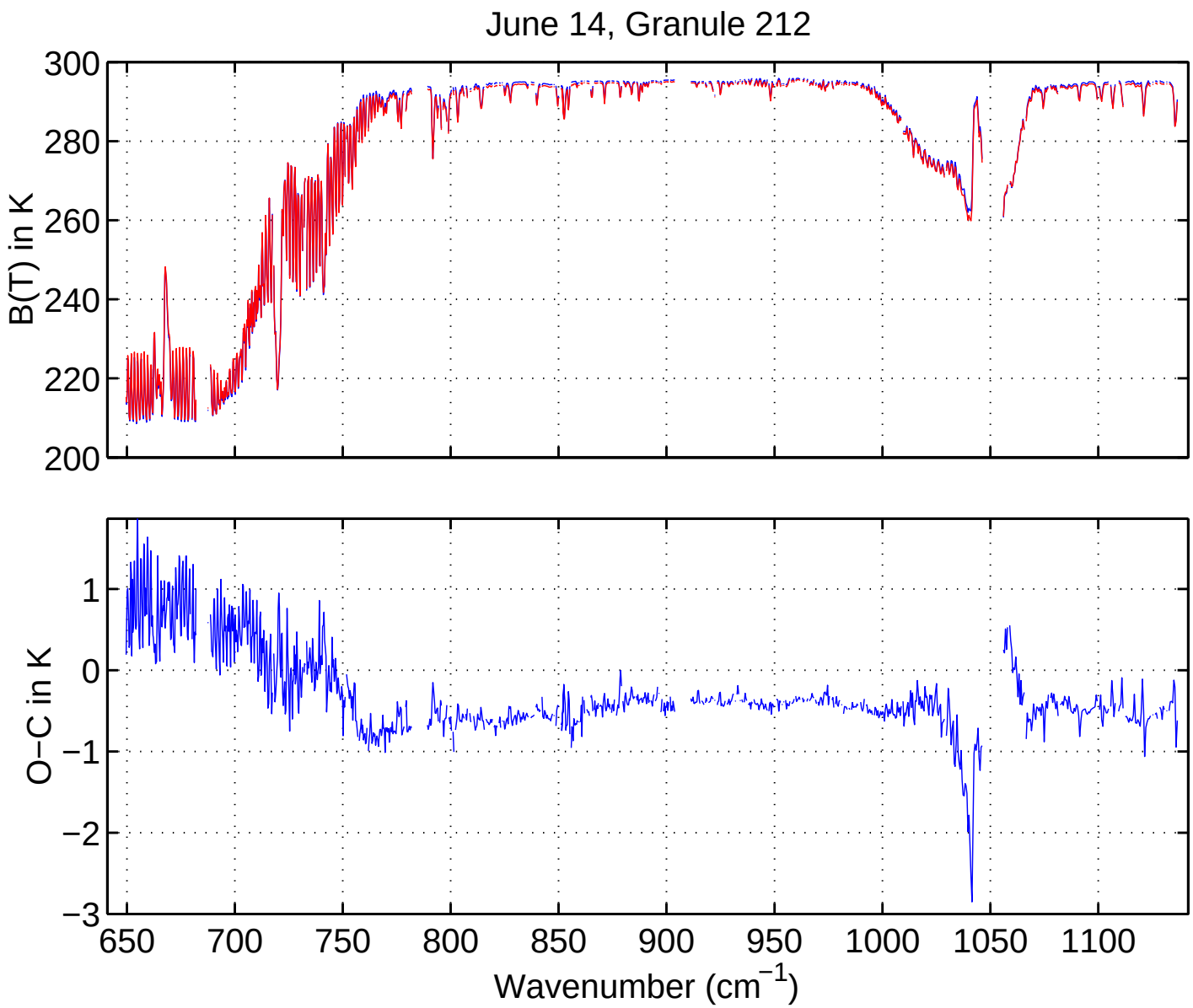


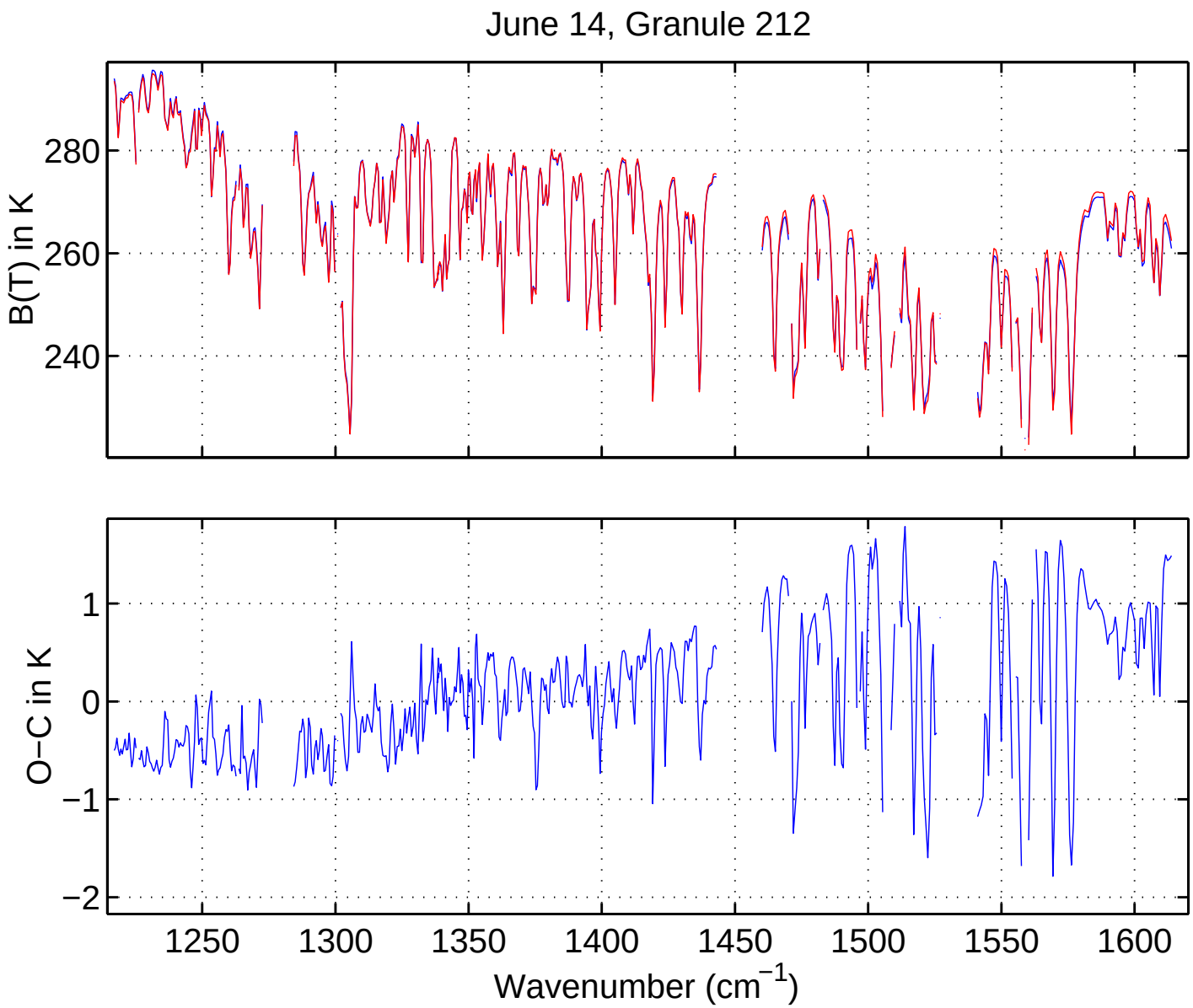
Non-LTE

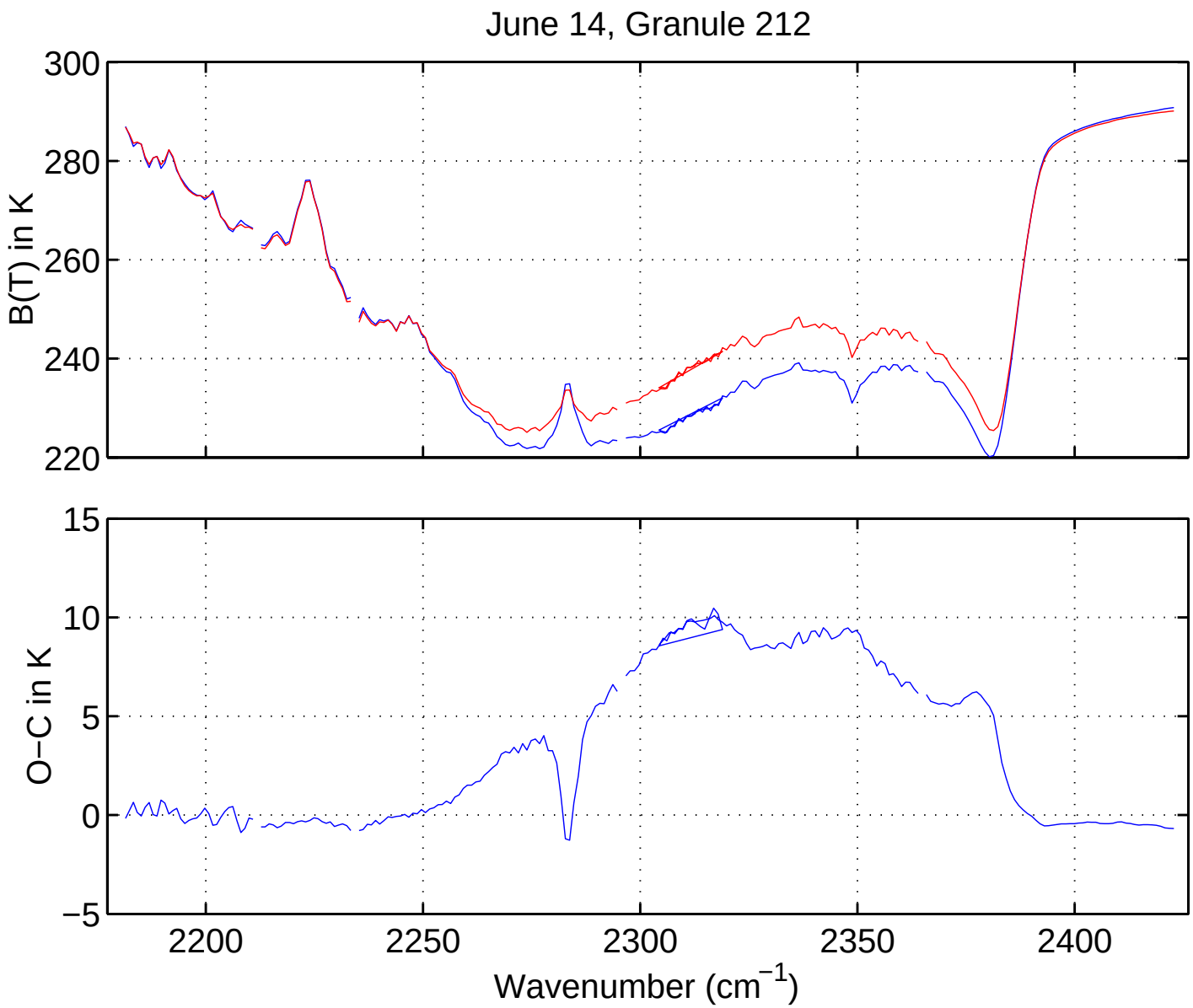
- Non-LTE emission is larger than expected
- Emission is very high in atmosphere, 40 - 90 km
- Cores of 4.3 micron lines peak above the top AIRS layer below about 2380 cm^{-1}
- Non-LTE significantly affects some sounding channels during the day!
- GENLN3 has the best non-LTE emission model. We are starting to work with David Edwards (NCAR), on modeling the non-LTE to verify what is going on and to look for any solutions.

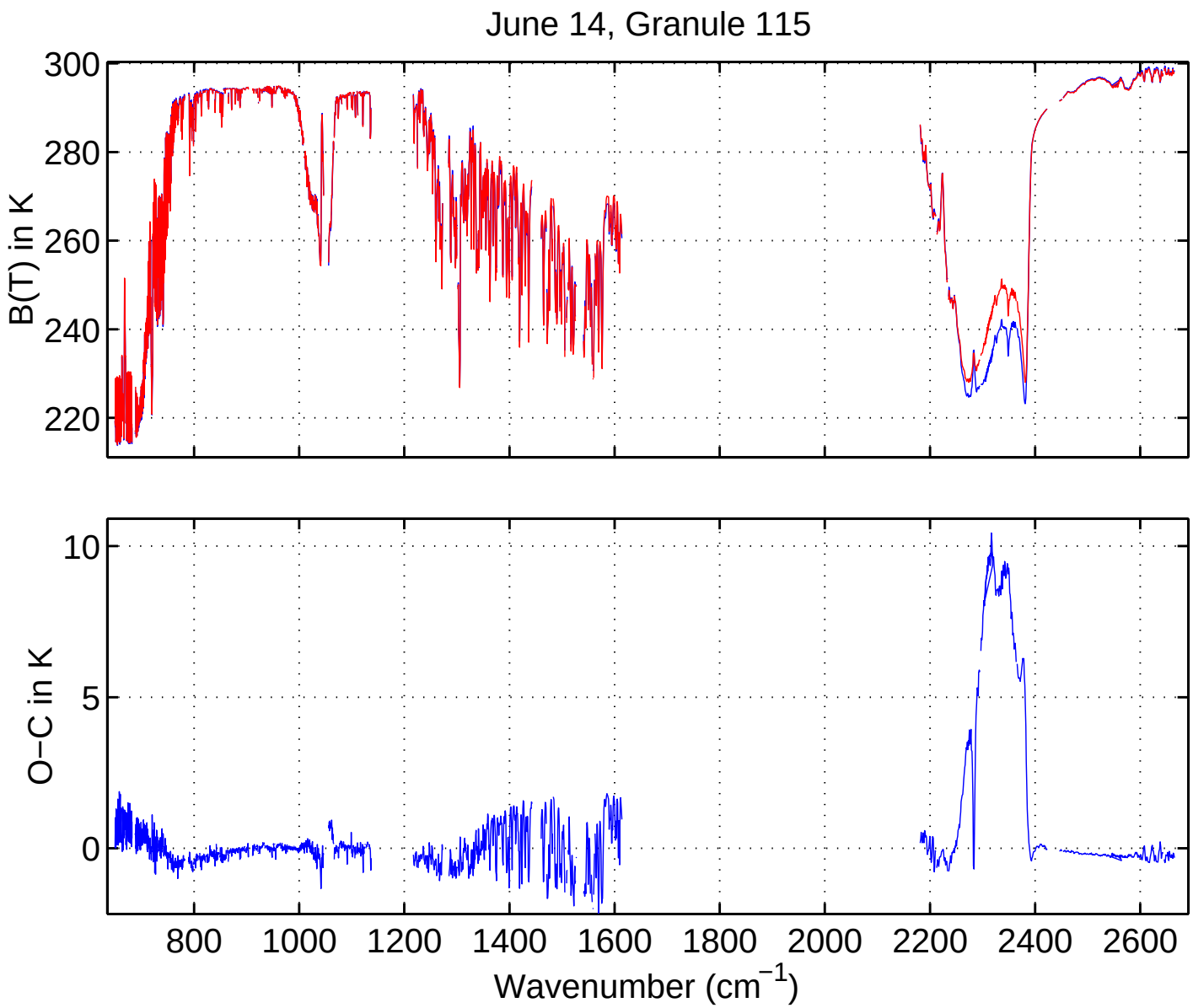

June 14, Granule 212
B(T) in K
300
280
260
240
220
O−C in K
10
5
0
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Wavenumber (cm^{-1})

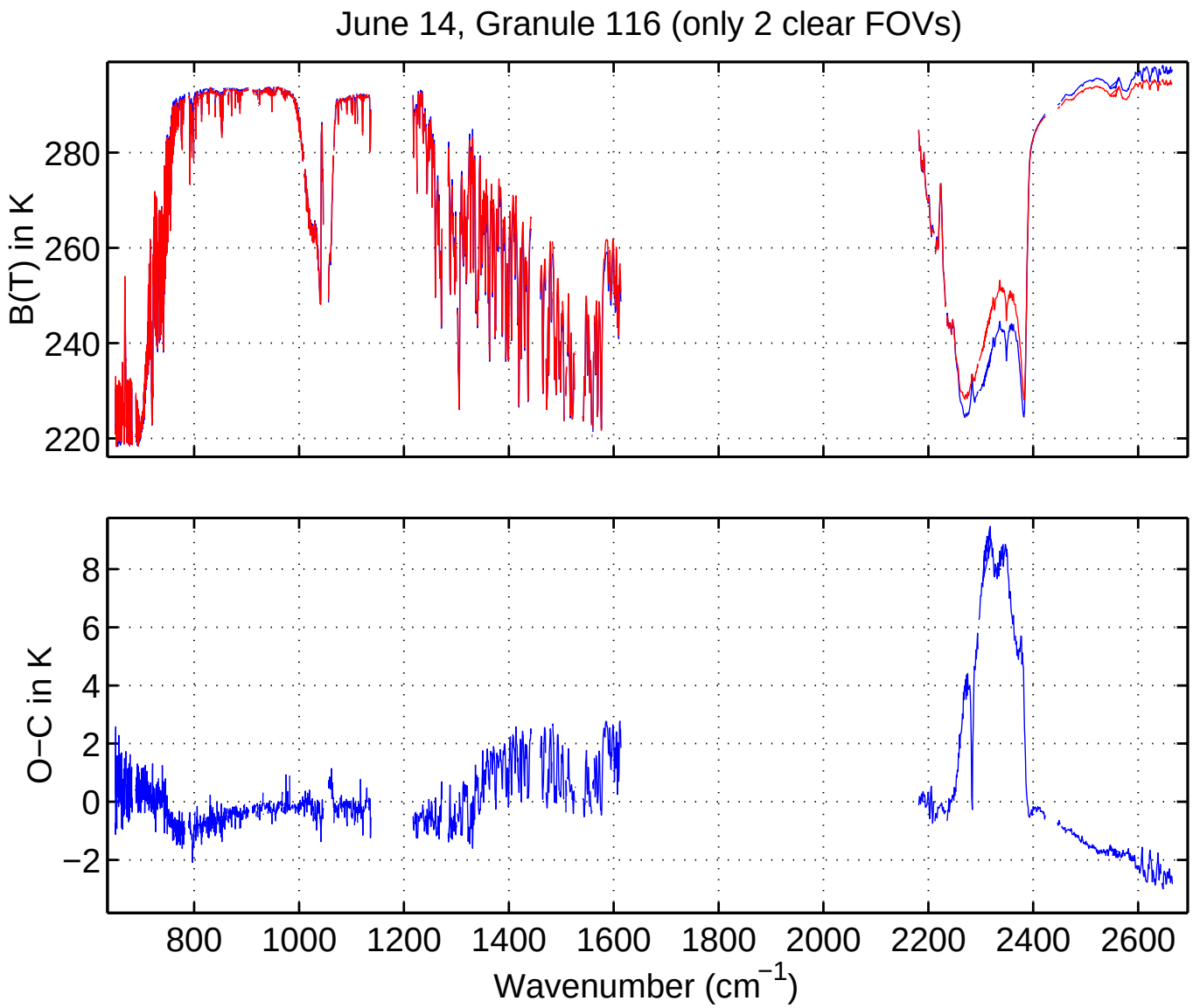

June 14, Granule 212
B(T) in K
300
280
260
240
220
O−C in K
2
1
0
−1
660
680
700
720
740
760
780
Wavenumber (cm^{-1})


June 14, Granule 212
B(T) in K
300
280
260
240
220
200
O−C in K
1
0
−1
−2
−3
650
700
750
800
850
900
950
1000
1050
1100
Wavenumber (cm^{-1})

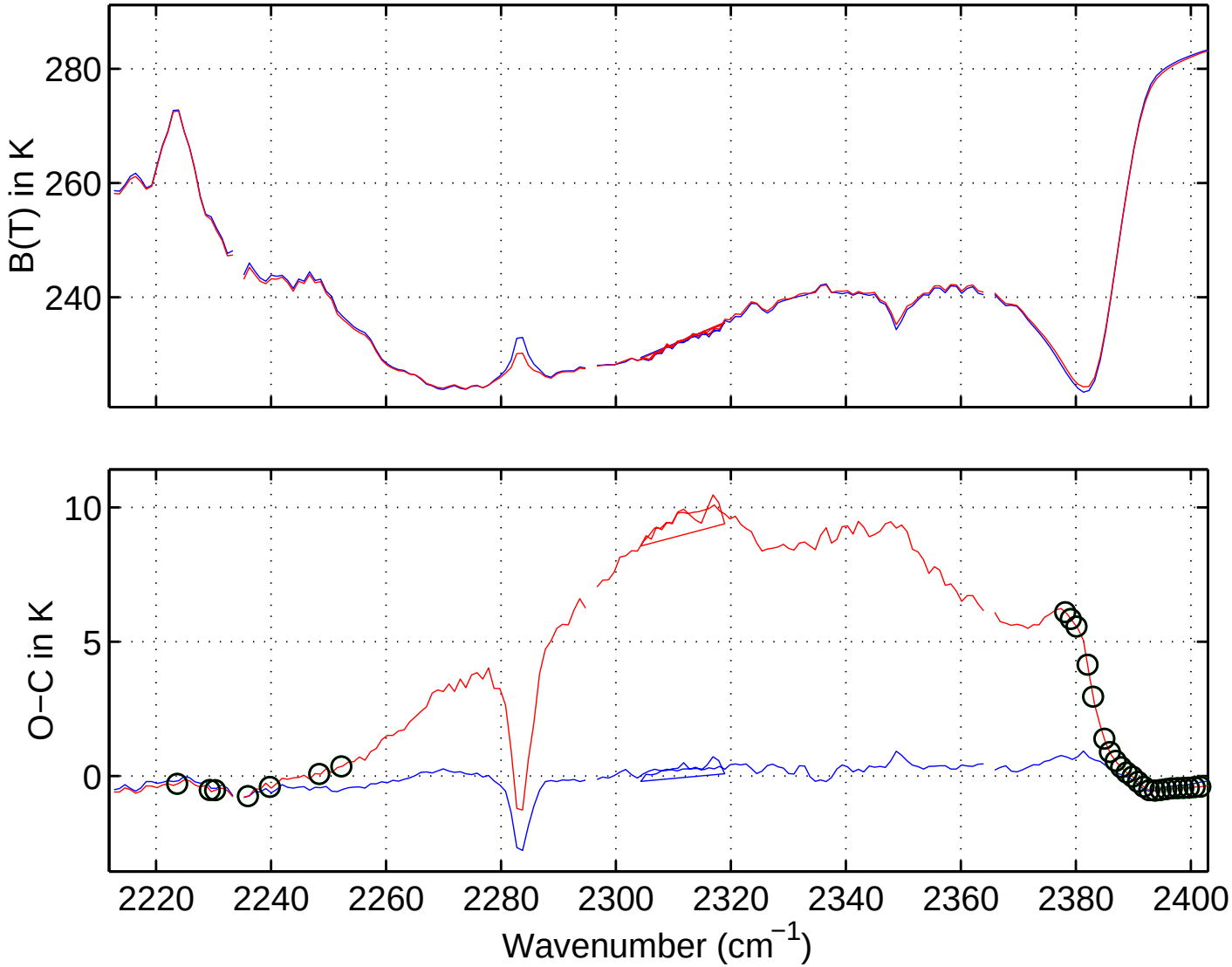
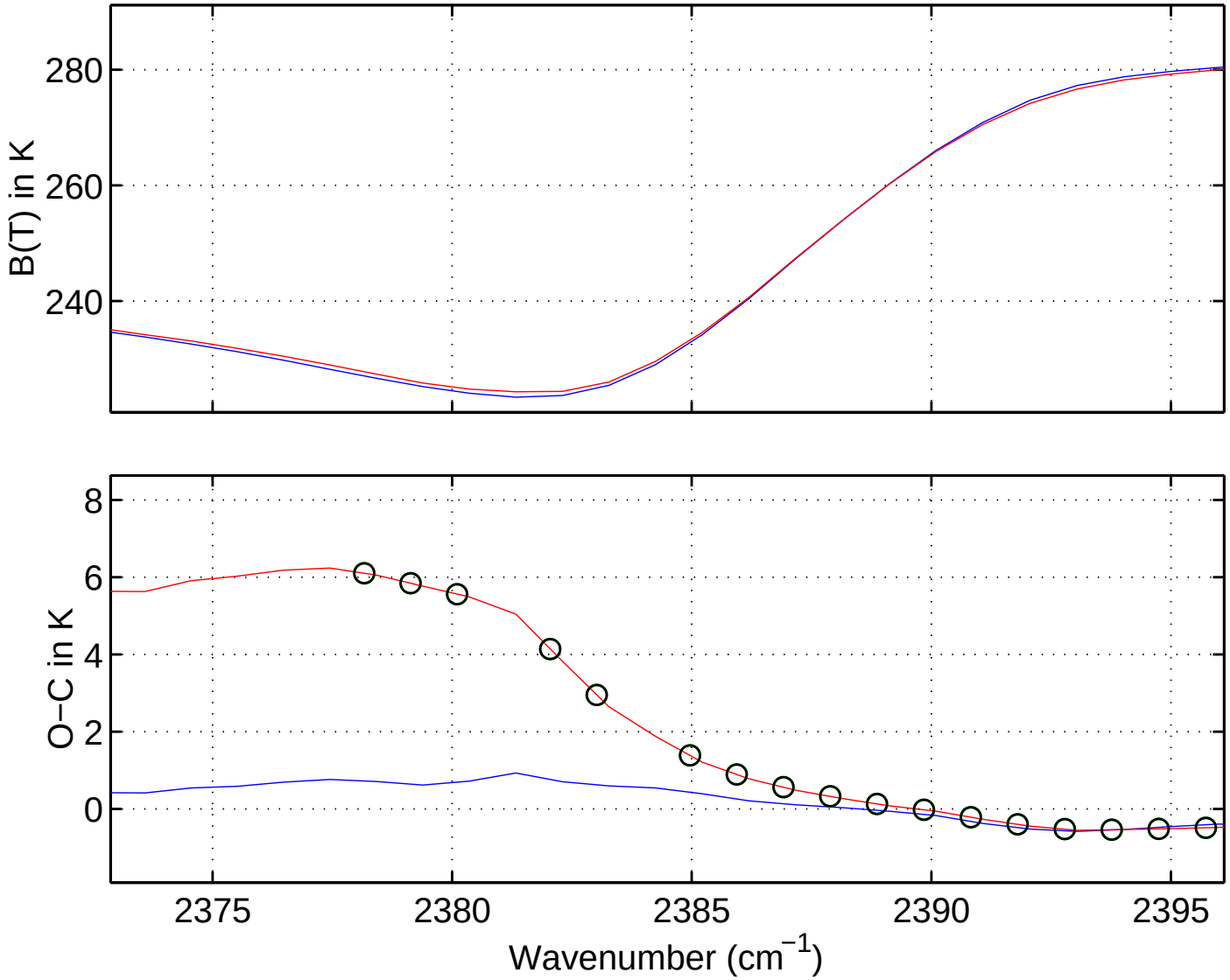

June 14, Granule 212
B(T) in K
280
260
240
O−C in K
1
0
−1
−2
1250
1300
1350
1400
1450
1500
1550
1600
Wavenumber (cm^{-1})


June 14, Granule 212
300
280
260
240
220
B(T) in K
15
10
5
0
−5
O−C in K
2200
2250
2300
2350
2400
Wavenumber (cm^{-1})


June 14, Granule 115
B(T) in K
300
280
260
240
220
O−C in K
10
5
0
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Wavenumber (cm^{-1})


June 14, Granule 116 (only 2 clear FOVs)
B(T) in K
280
260
240
220
O−C in K
8
6
4
2
0
−2
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Wavenumber (cm^{-1})

Day vs Night Obs-Calcs at 4.3 microns



Day vs Night Obs-Calcs at 4.3 microns