Preflight validation of AIRS with AERI

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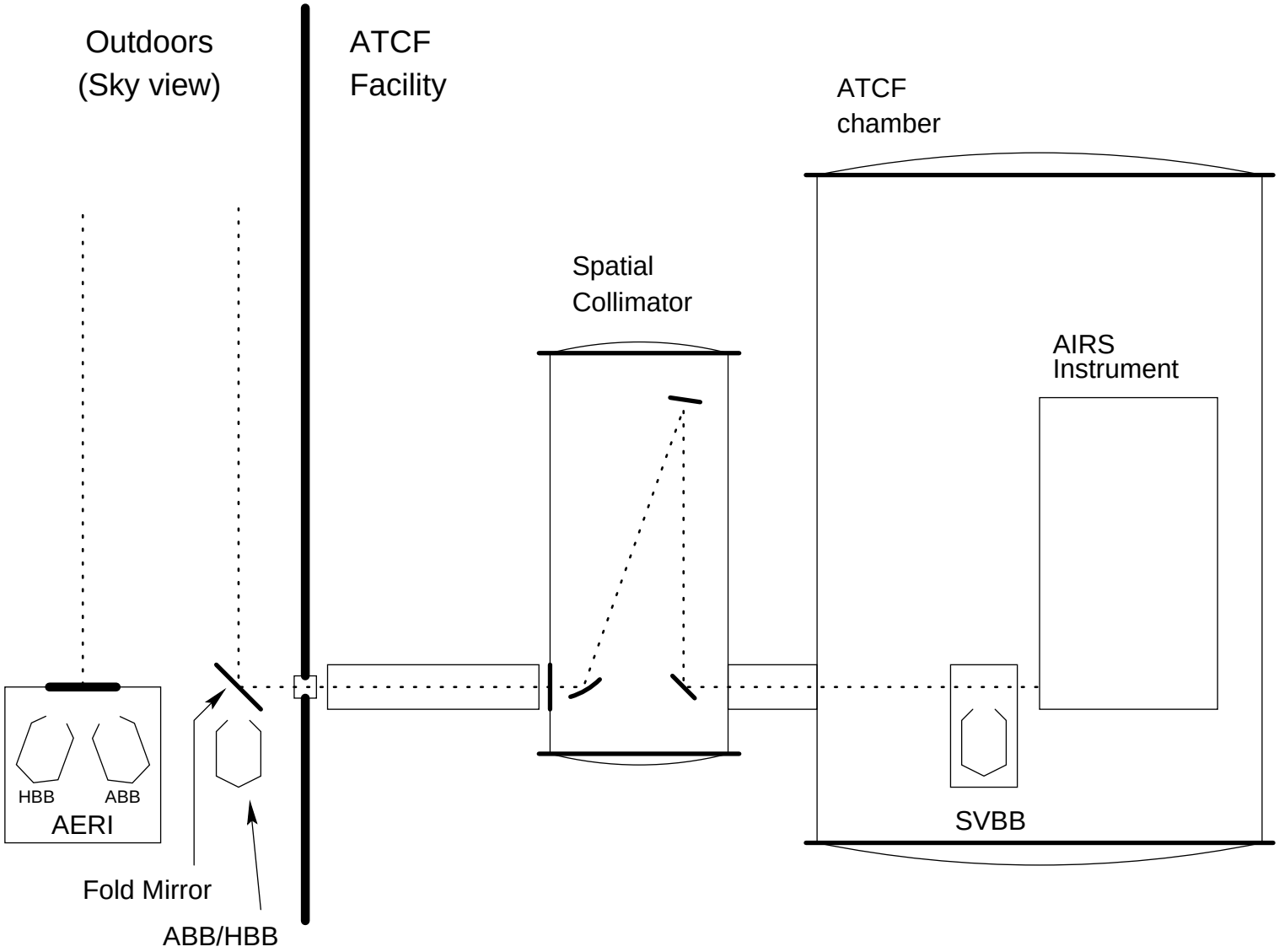
AIRS Validation using AERI

- **AIRS uplooking test**
  - Vertical view of the sky
  - Views of external calibration blackbodies

- **Coincident radiosonde balloon launch in clear sky conditions**
  - Sonde used to characterise atmospheric state in line-by-line radiative transfer model calculations
  - Observed - calculated residuals will minimise errors due to uncertainties in atmospheric state

AIRS Validation using AERI



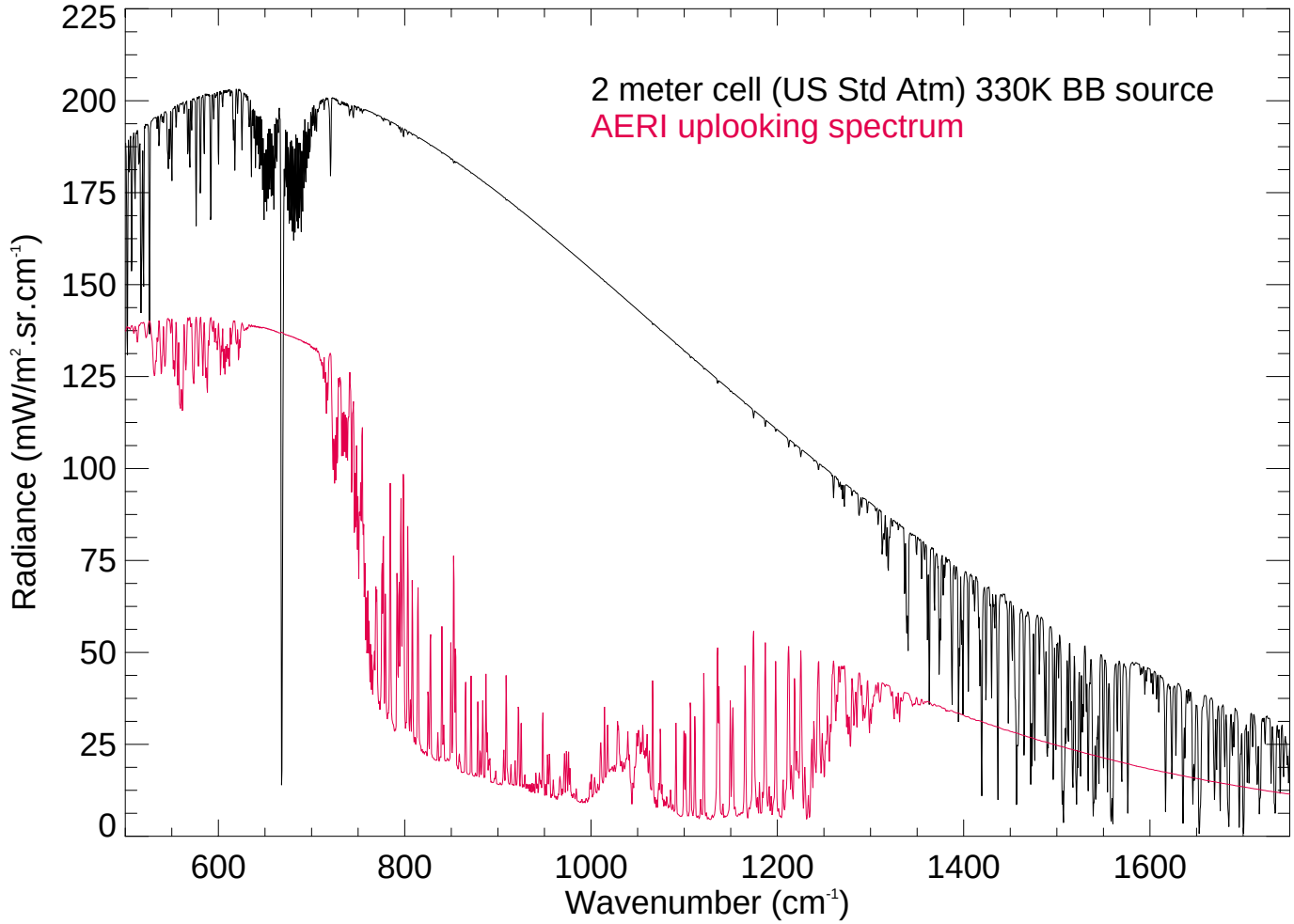
AIRS Validation using AERI

- **Pre-launch AIRS validation**
  - Spectral - allow identification of FWHM anomalies in AIRS SRFs
  - Radiometric - AERI calibration accuracy within 1% of ambient radiance.

- **Use of AERI and gas cell are complementary**
  - AERI allows verification of AIRS radiances for channels with long path lengths, i.e. atmospheric window regions
  - Gas cell provides information for short path length absorption, i.e. opaque regions

AIRS Validation using AERI

Use of AERI and gas cell are complementary



AIRS Validation using AERI

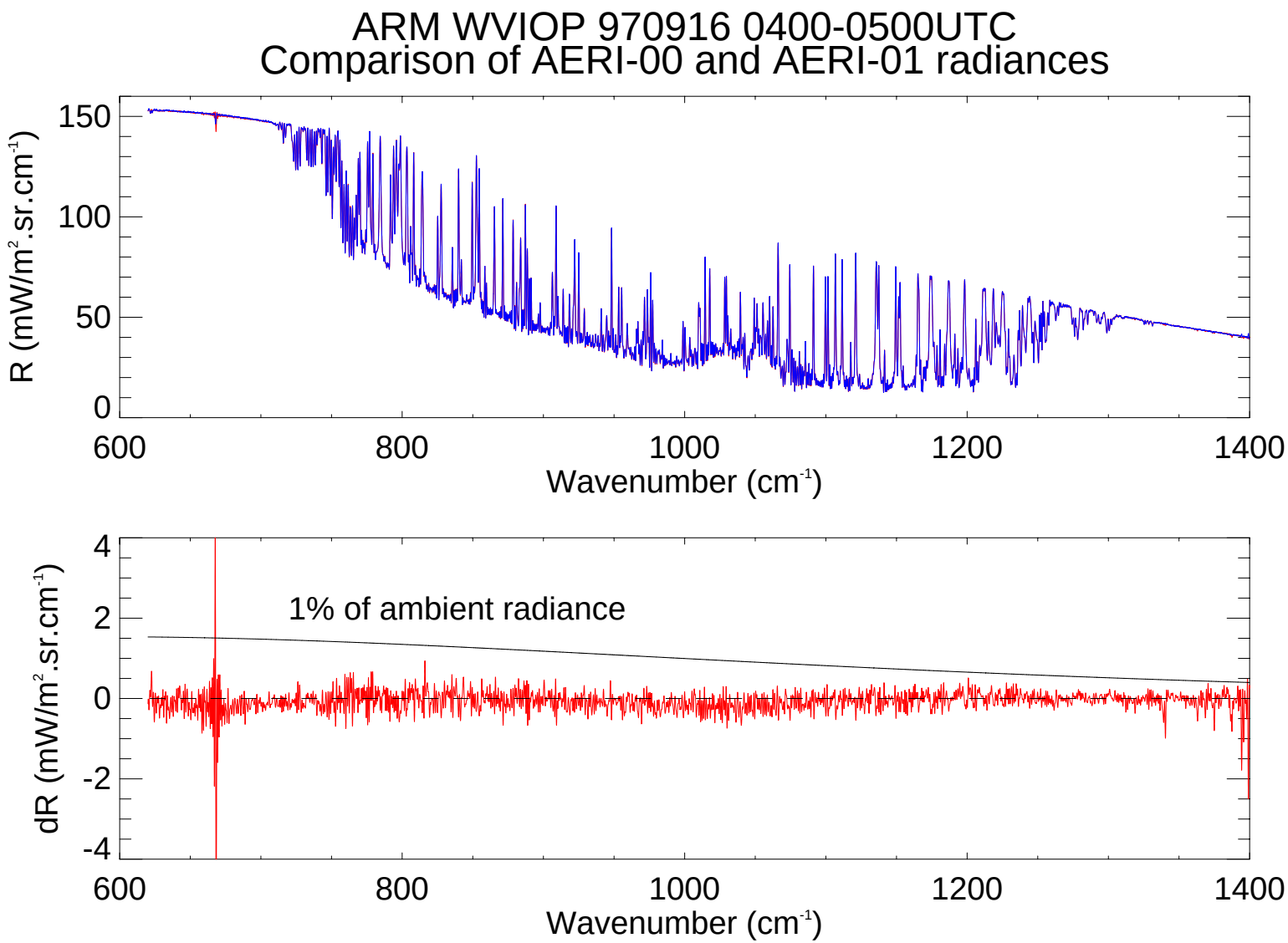
- **AERI instrument has high radiometric integrity**
  - Frequent reference viewing
  - 2 blackbody references
  - No uncalibrated optics
  - Spectral calibration based on FTS laser

- **AERI instrument comparisons show excellent agreement**
  - DOE ARM CART site IOPs (‘95, ‘96, and ‘97)
  - MAERI and TWP AERI

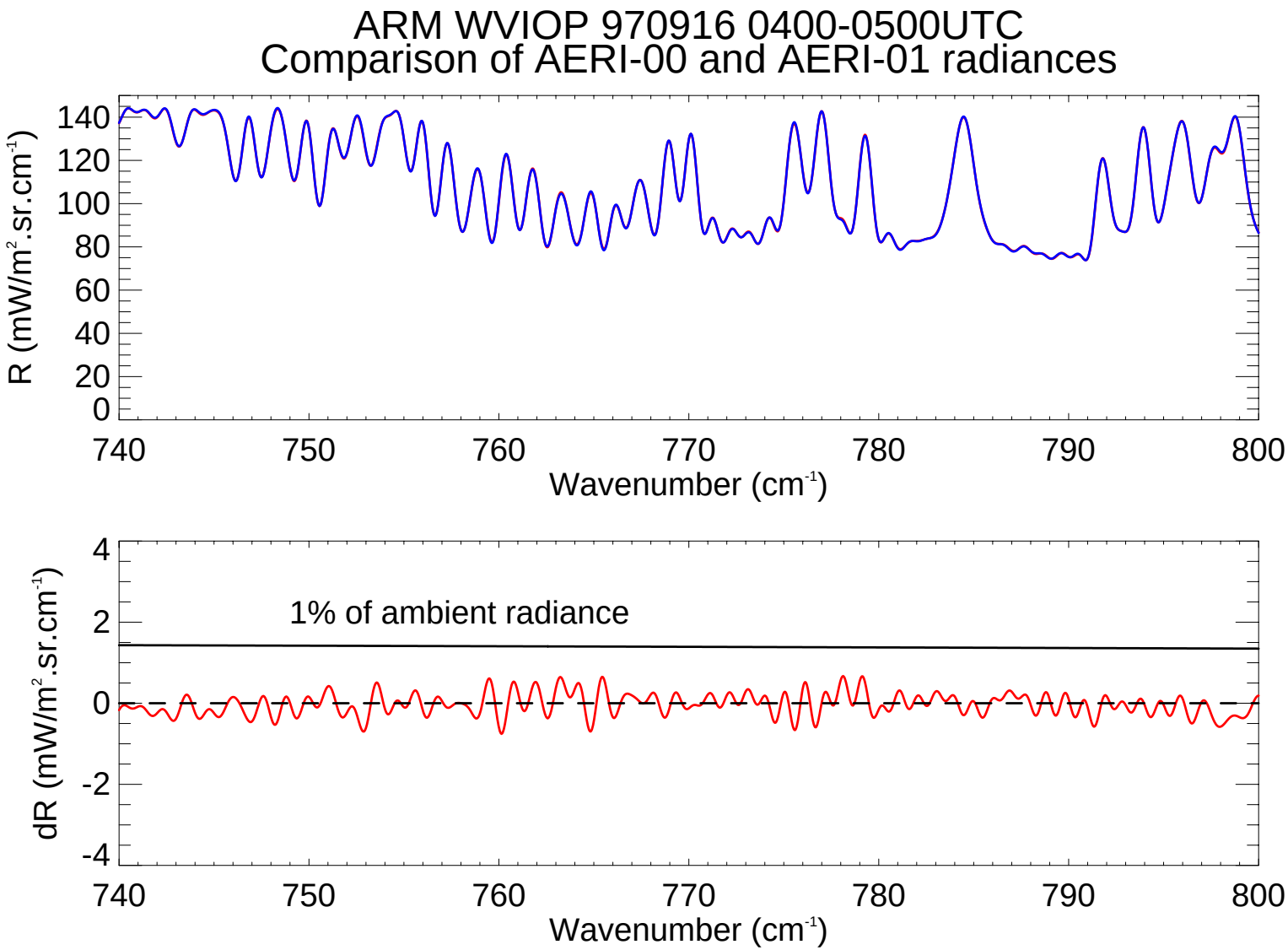
AERI data from DOE ARM WVIOP-97

- **DOE ARM WVIOP-97 AERI-00/01 comparisons**
  - 300m spatial, 6m vertical separation
  - AERI-00/01 agree to within 0.2K
  - Atmospheric H_2O and T differences dominate
- **Sept. 16, 1997 AERI-00/01 instrument comparison**
  - 0400-0500UTC average
  - ~4.0cm precipitable water, T_s ~ 300K
  - Surface temperature characterised well
- **Sept. 26, 1997 AERI-00/01 instrument comparison**
  - 0500-0700UTC average
  - ~1.2cm precipitable water vapor, T_s ~ 290K
  - Near-surface temperature not characterised as well due to rapidly developing inversion during observations

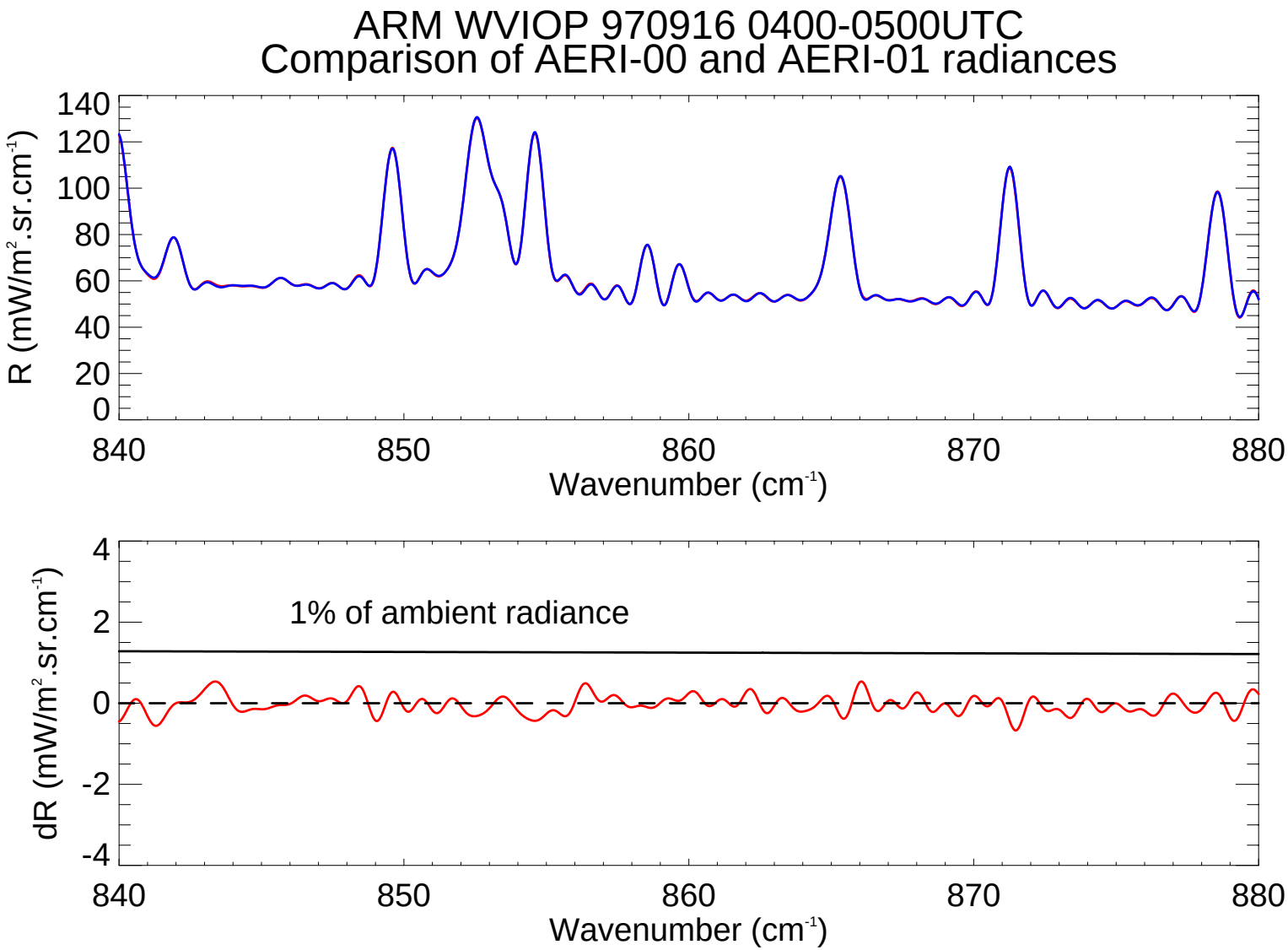
970916: AERI Channel 1



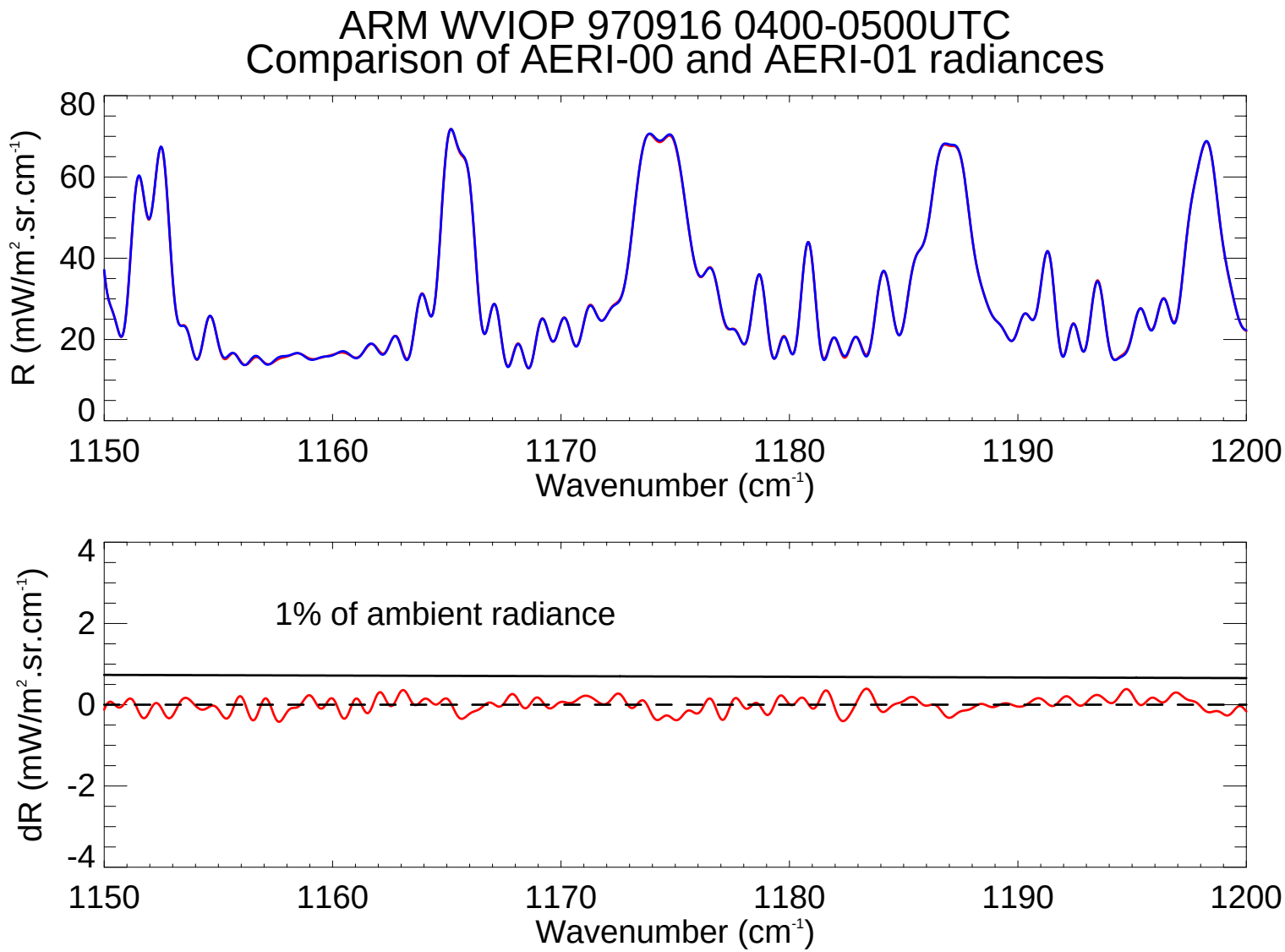
970916: 740-800cm^{-1}



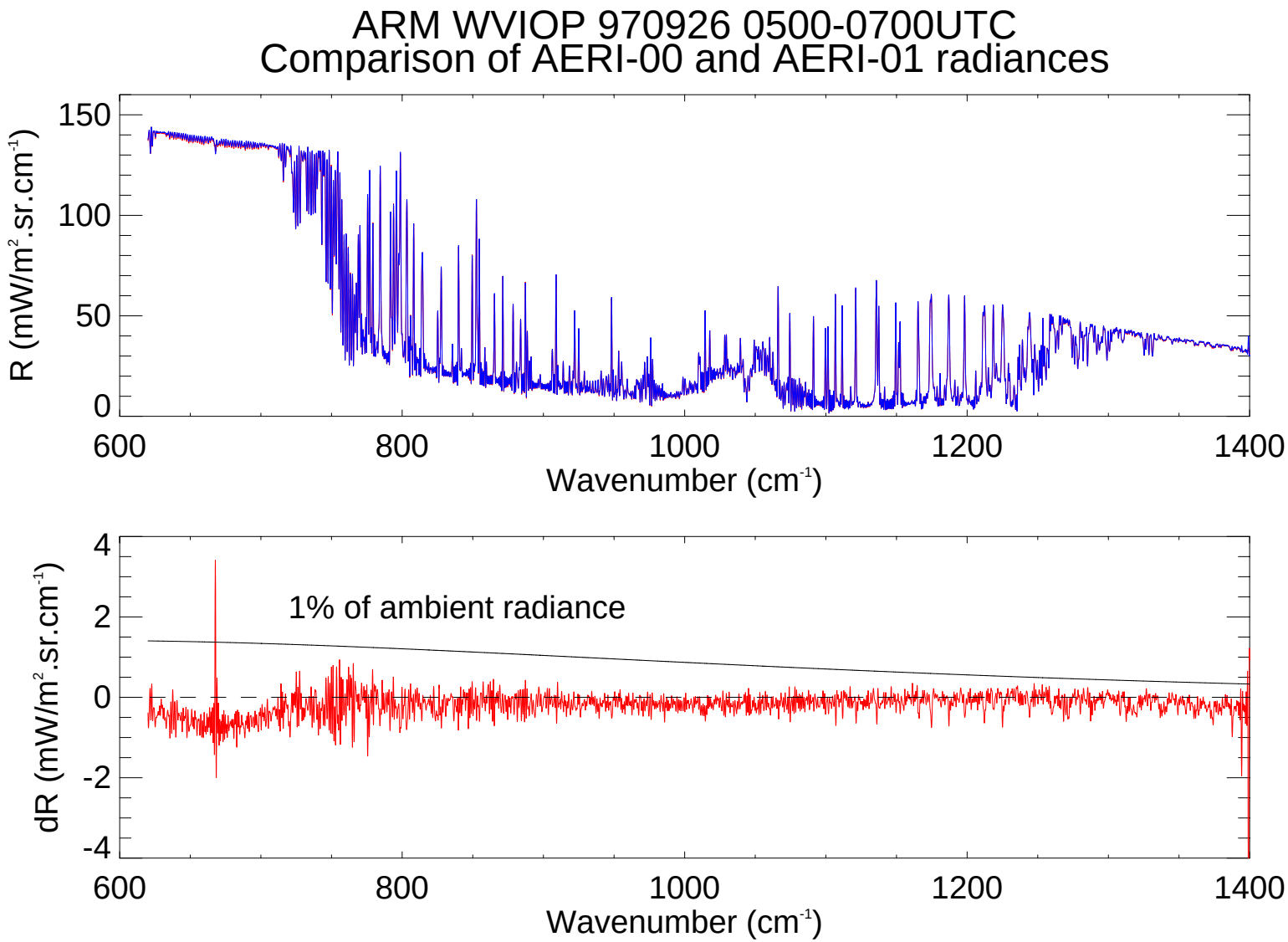
970916: 840-880cm^{-1}



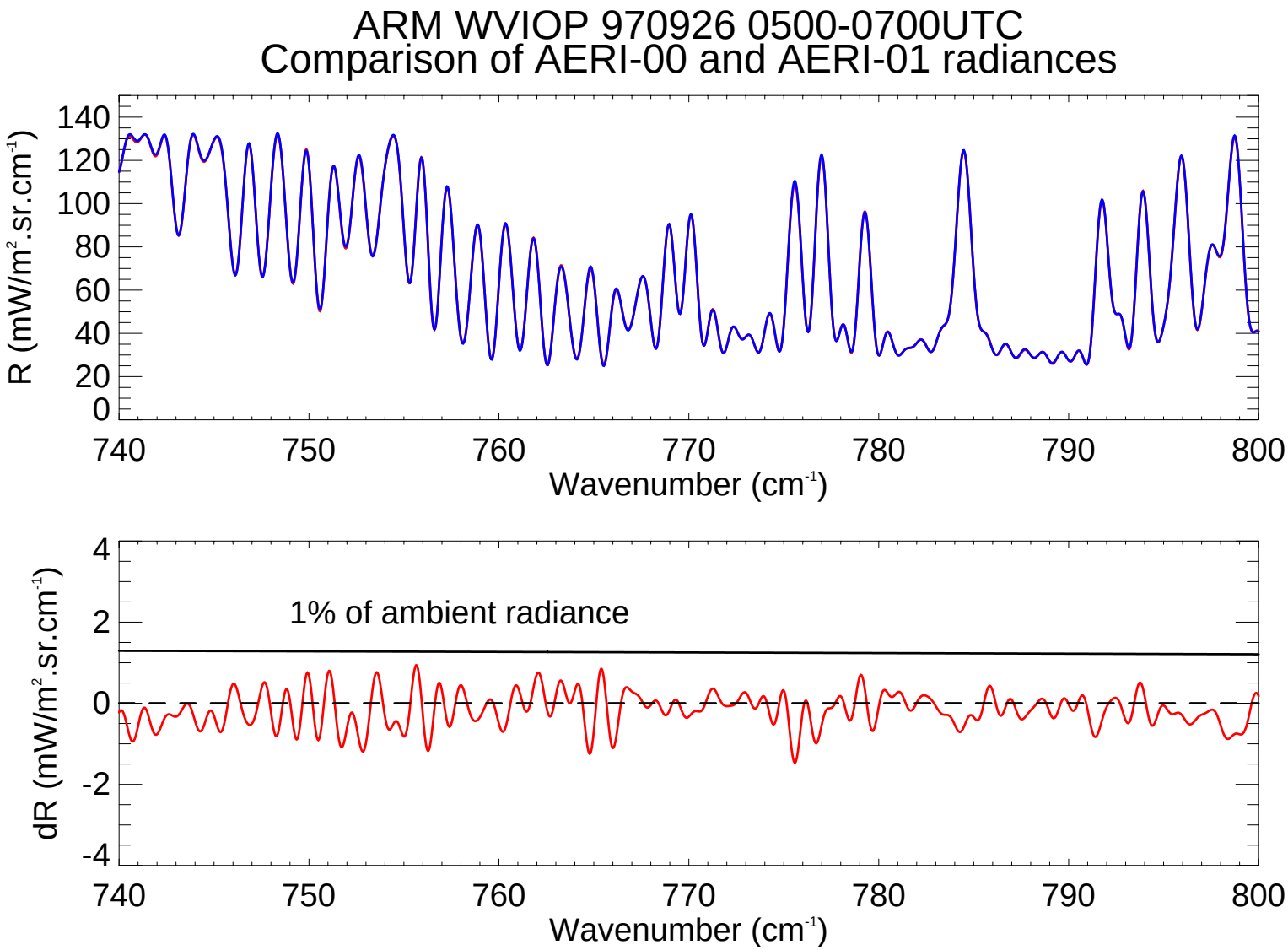
970916: 1150-1200cm^{-1}



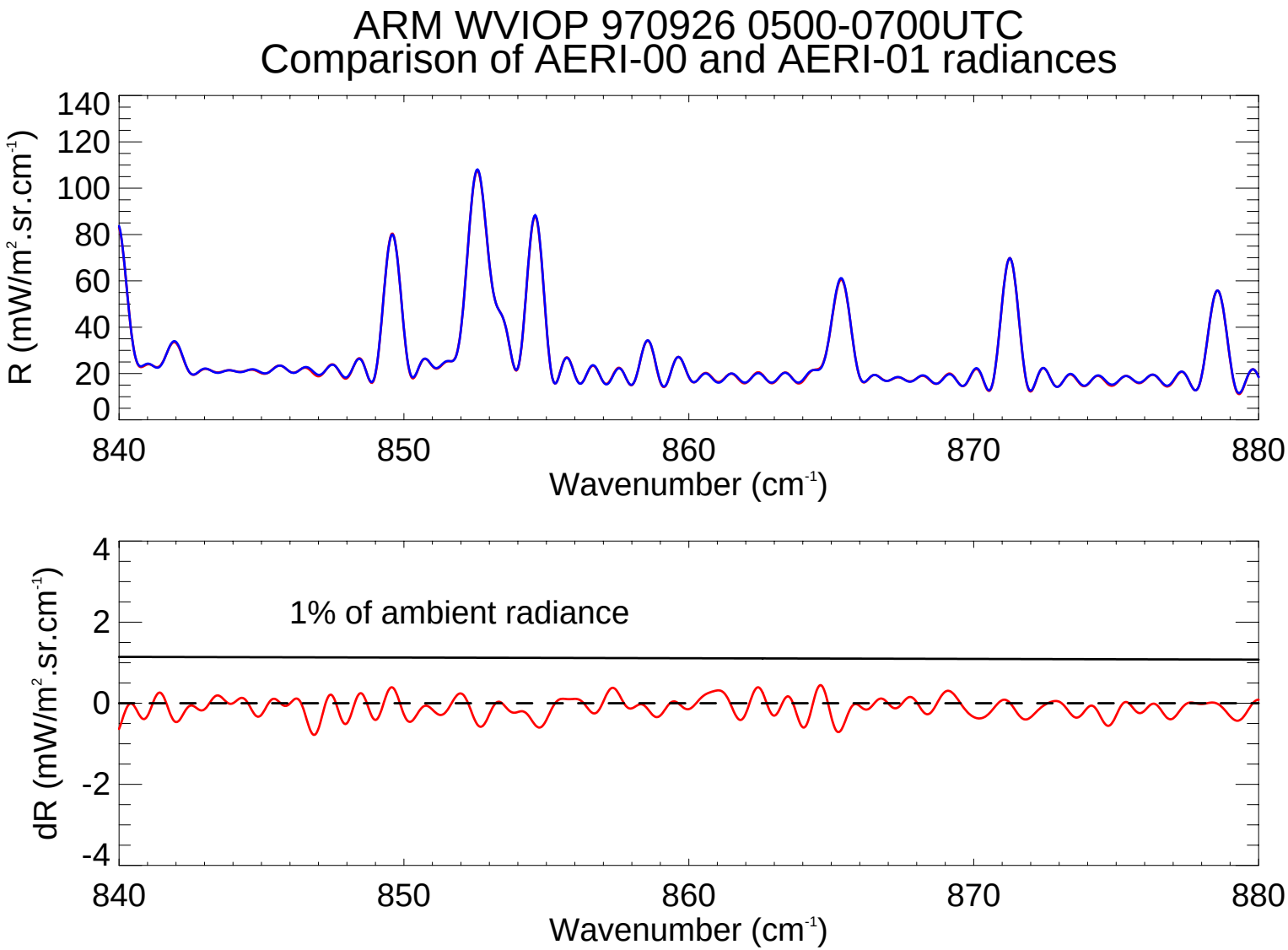
970926: AERI Channel 1



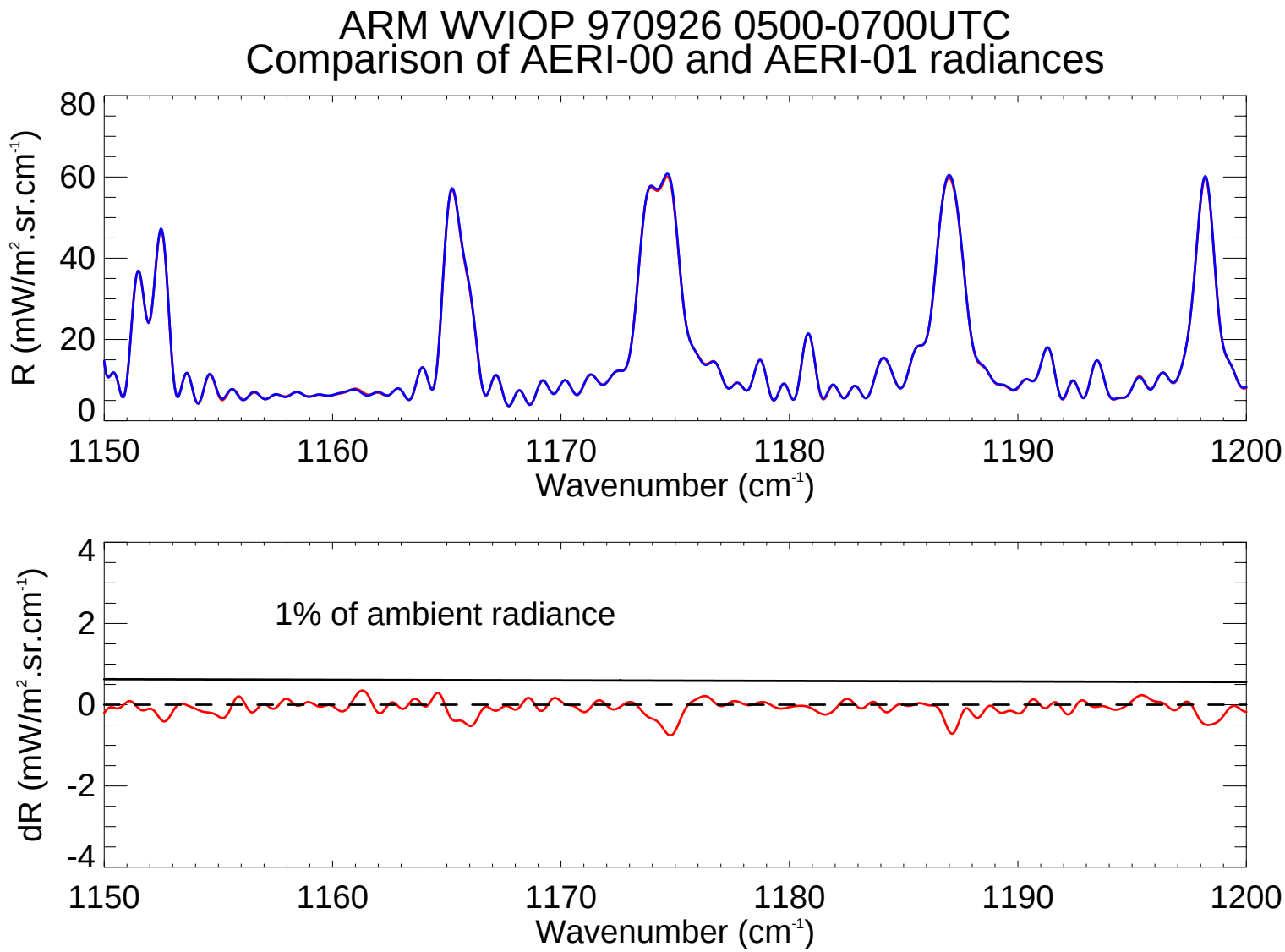
970926: 740-800cm^{-1}



970926: 840-880cm^{-1}



970926: 1150-1200cm^{-1}



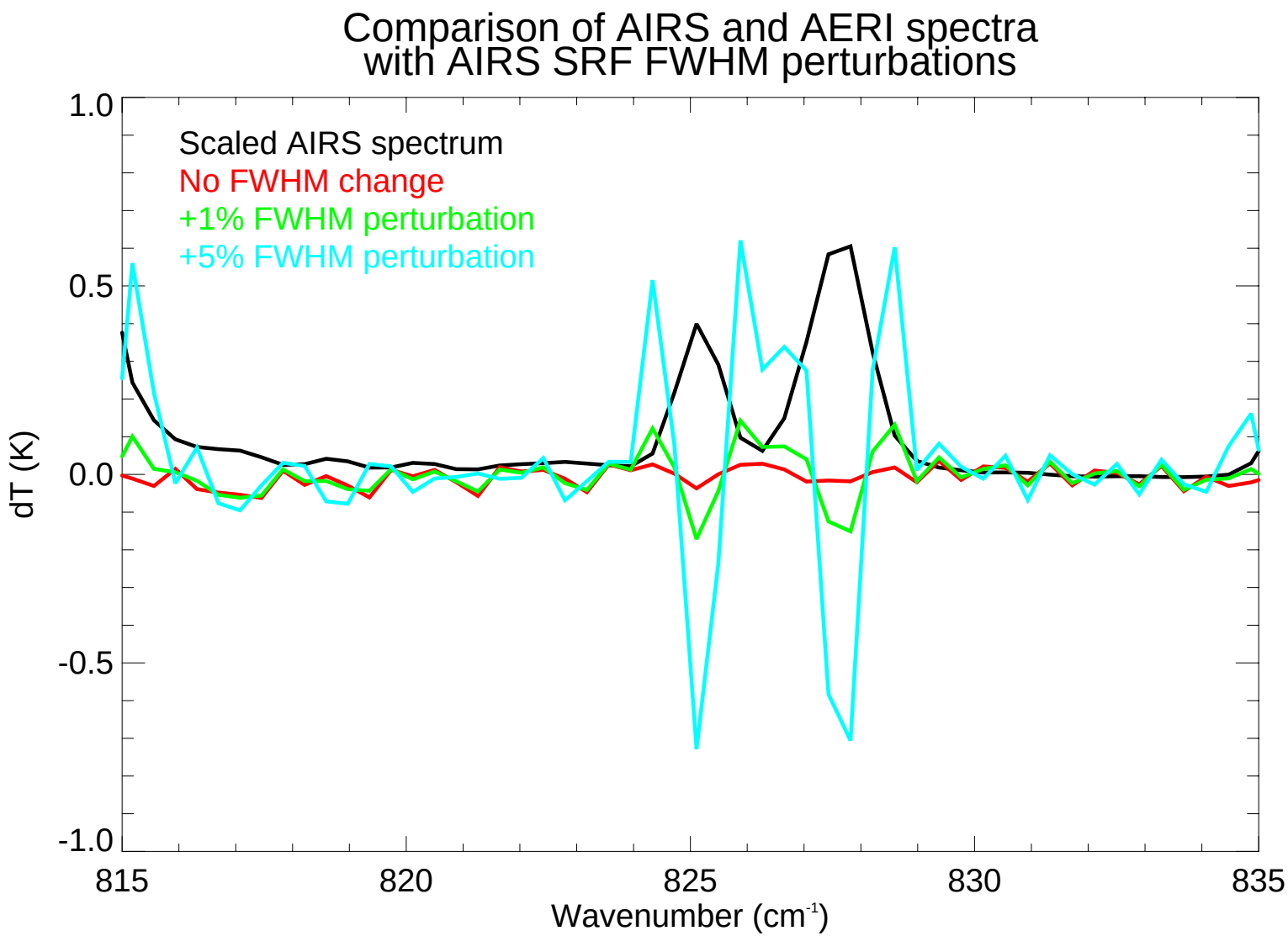
Comparison of AIRS and AERI

- **Comparison of AIRS and AERI uplooking spectra**
  - Application of each instrument's response function to the other to match radiances
  - Difference the residual spectra

$$(AIRS_{obs} - AIRS_{calc}) - (AERI_{obs} - AERI_{calc})$$

- **AIRS SRF FWHM error detection**
  - 1% error in AIRS SRF FWHM is detectable on absorption lines in the window region
  - Assumed noise level ~0.05K. Achievable by averaging.

Comparison of AIRS and AERI



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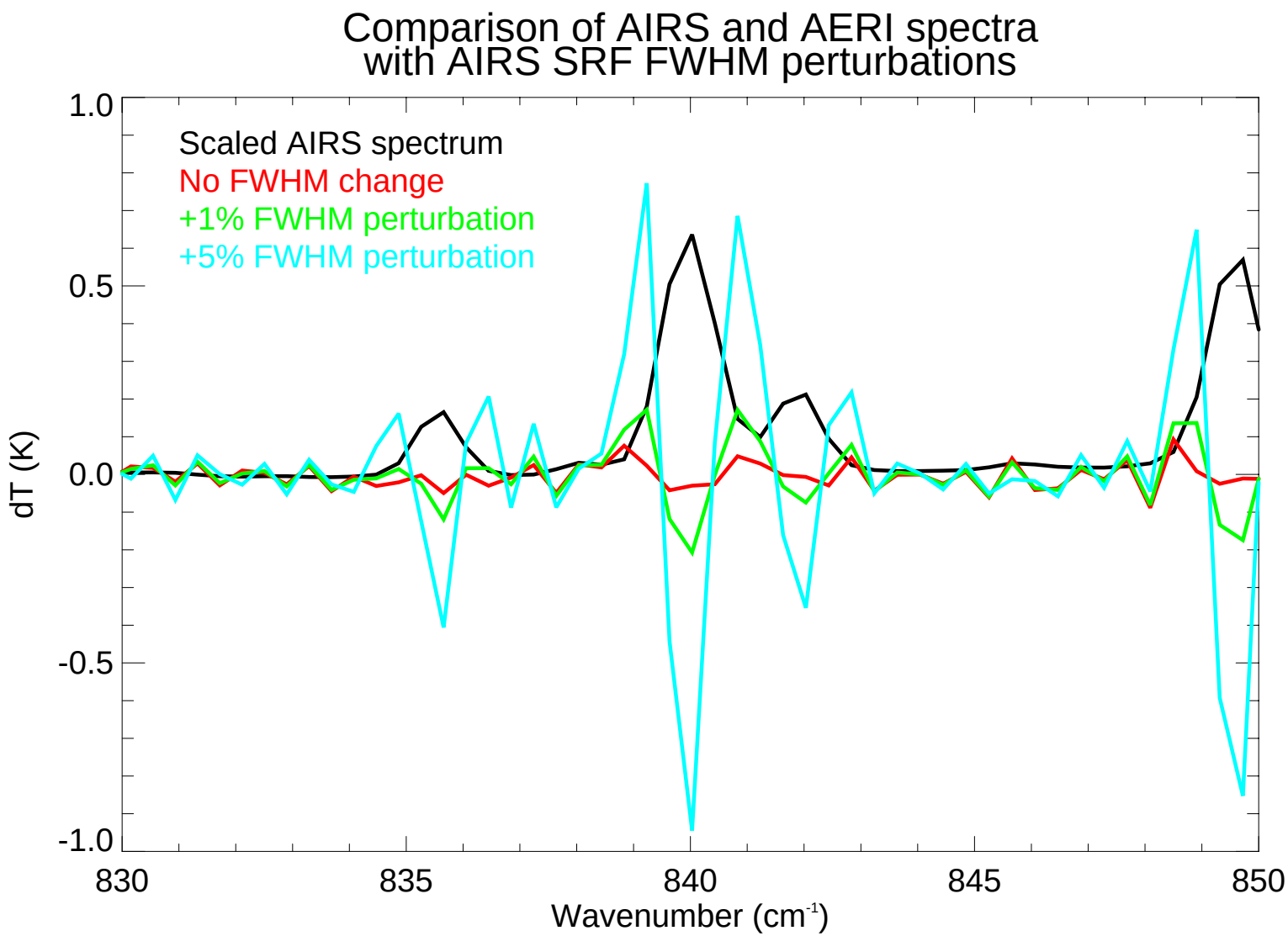
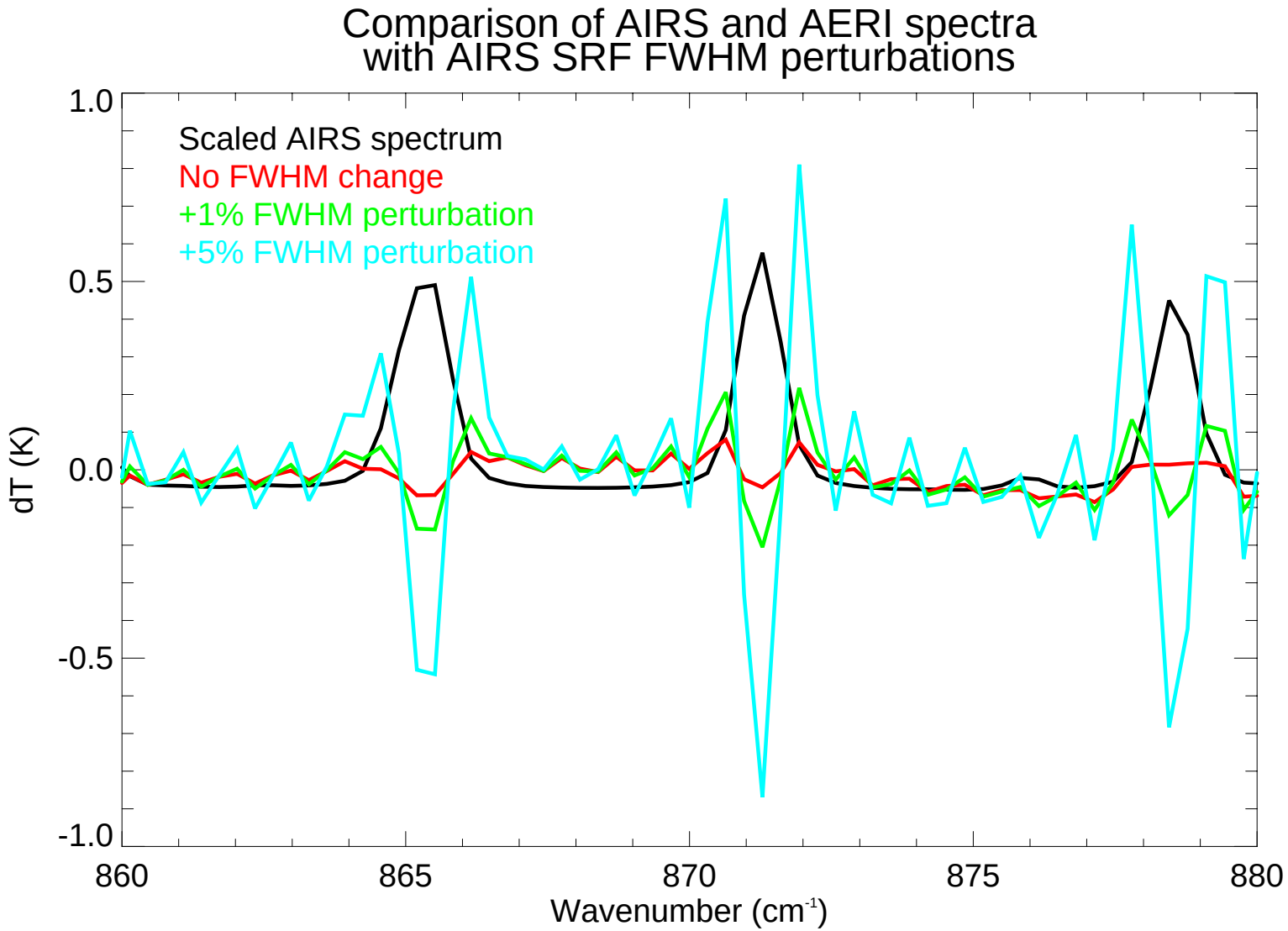
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