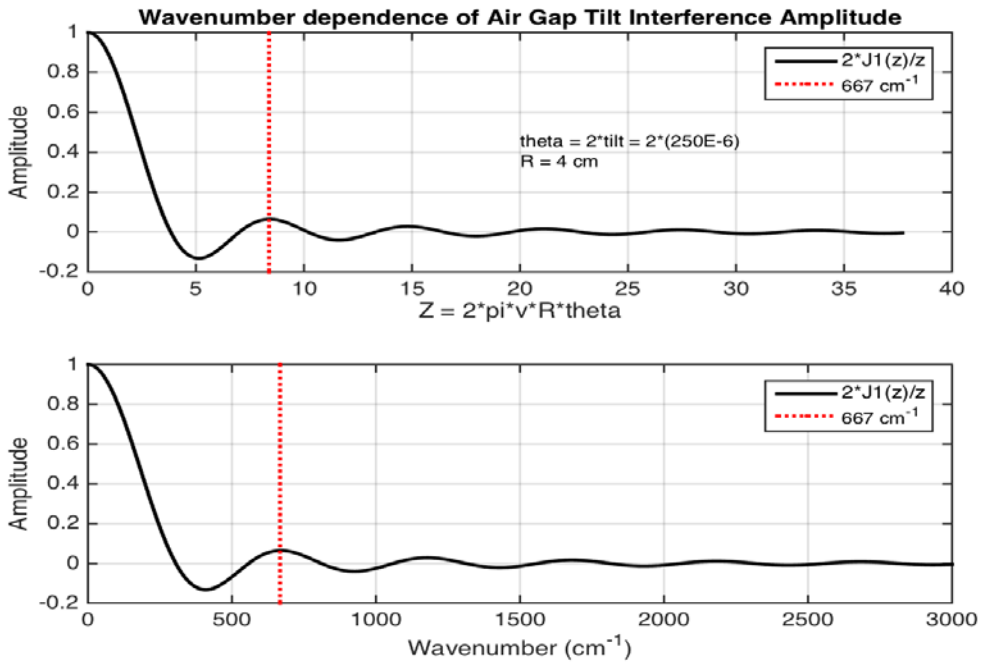
Space Dynamics Laboratory
Utah State University Research Foundation

LW FOV5 Update

Introduction

- For S-NPP CrIS LW FOV5 has higher radiance than other FOVs at 668.125 cm^{-1} for cold scenes
- Numerous presentations on this anomaly
- Latest was from UW exploring unresolved channel spectrum
  - March 16, 2016
  - Beamsplitter gap causes a secondary “ZPD” spike at 0.88 cm OPD
- UW did analysis in the interferogram domain
- Spectral domain analysis should be identical
- Larabee provided monochromatic spectra for hot and cold scenes
- Results ambiguous
- Joe Predina proposed electrical crosstalk as root cause

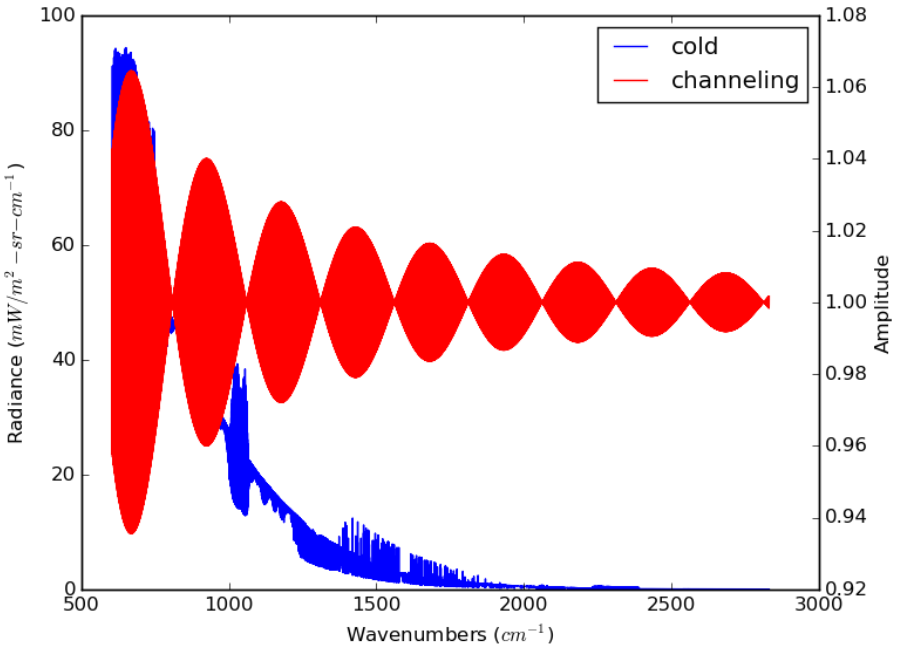
Beamsplitter Gap Wedge Reduces Amplitude

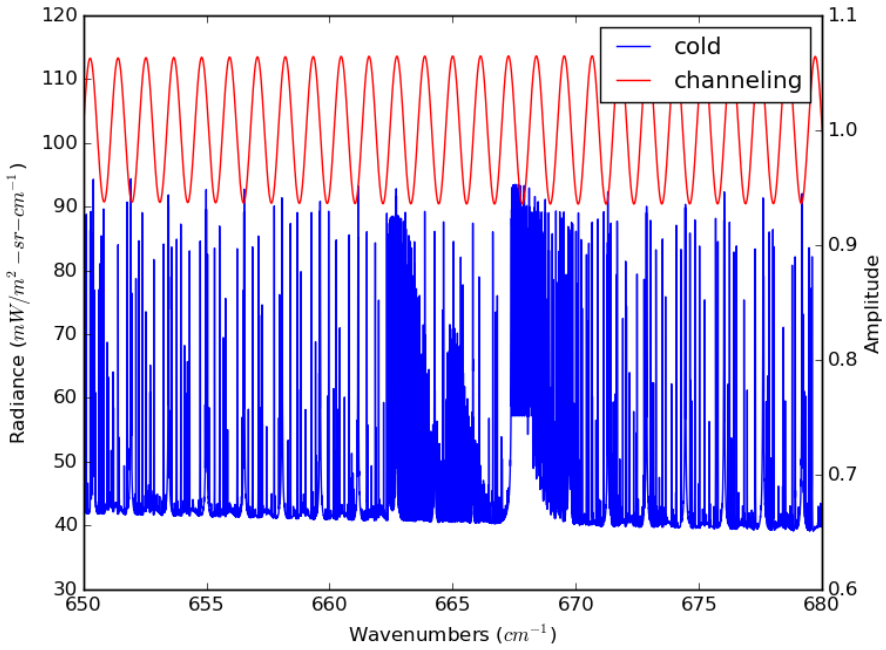


Normalization: 0.5*r ≅ (0.5) * [(n-1)/(n+1)]^2 =0.085 with n = 2.4

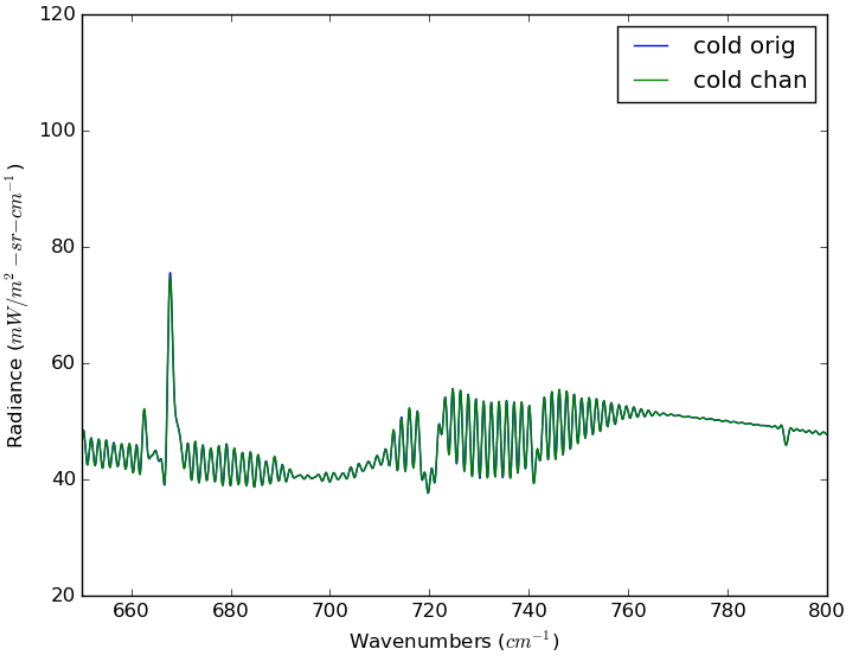
- From March 16, 2015 UW presentation
- Didn't use normalization (conservative analysis)

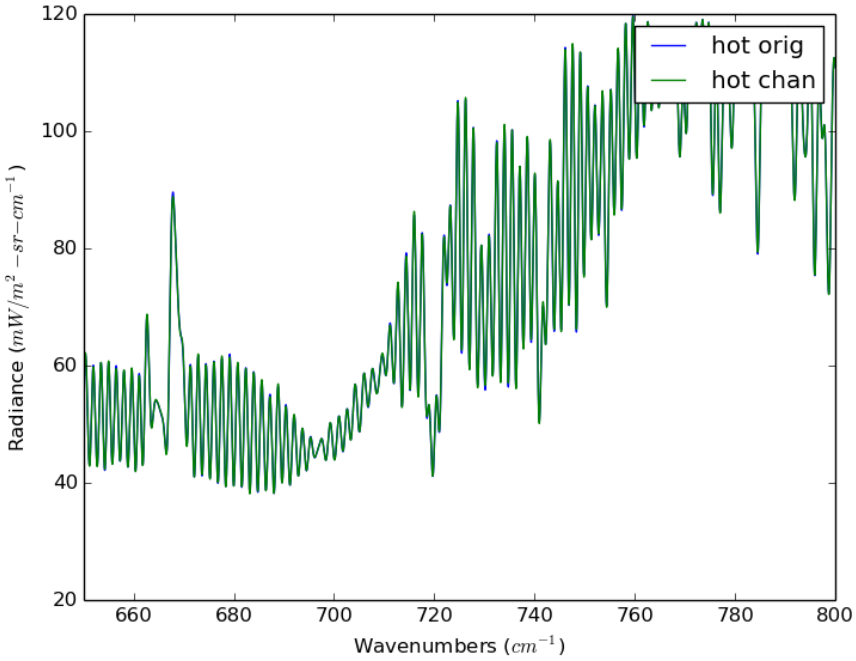
Effect of Beamsplitter Gap Reflection



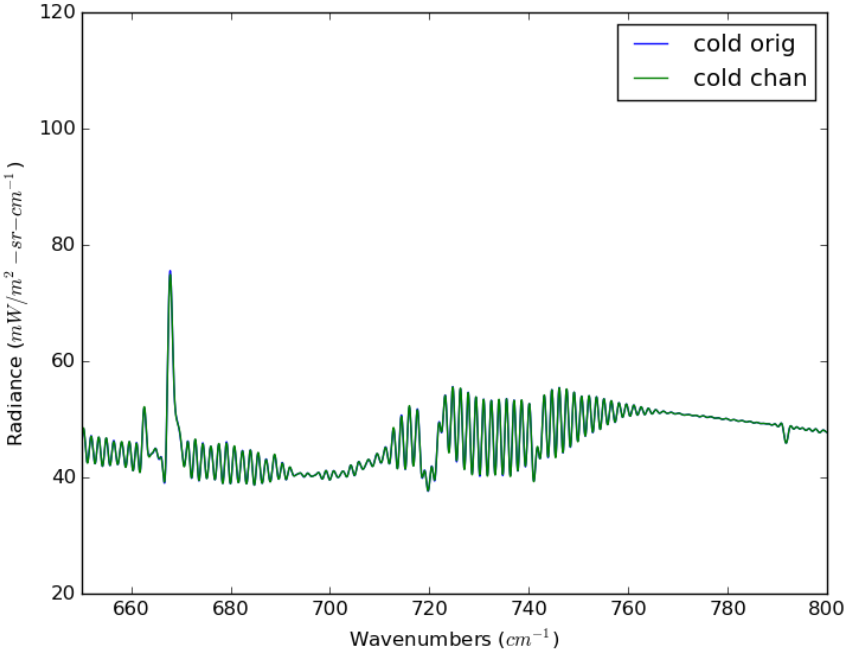


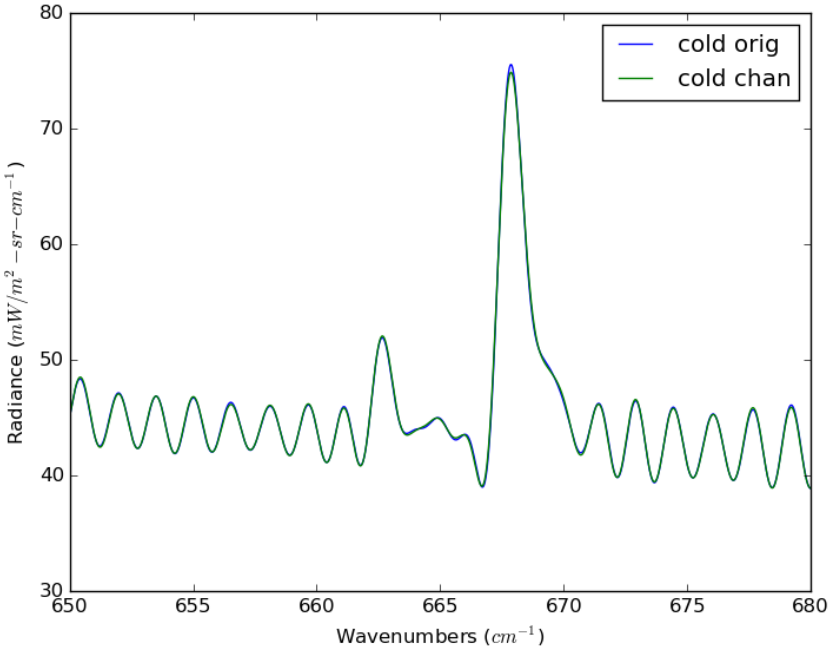
- High resolution spectra is modulated by channeling
- Phase of channeling is unknown





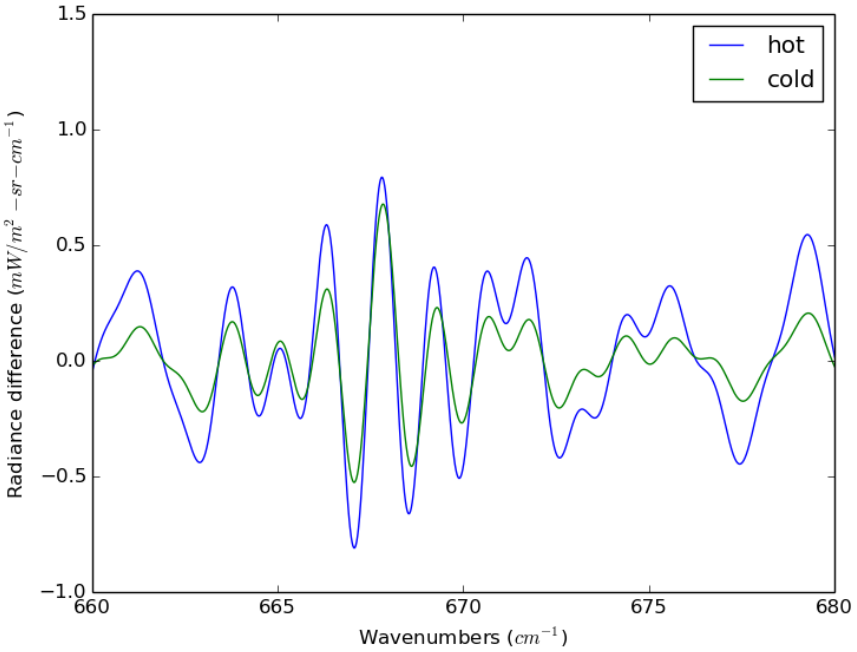
- Monochromatic spectra from Larrabee Strow
- Spectral resolution reduced to CrIS
- Modulation does not have a big affect

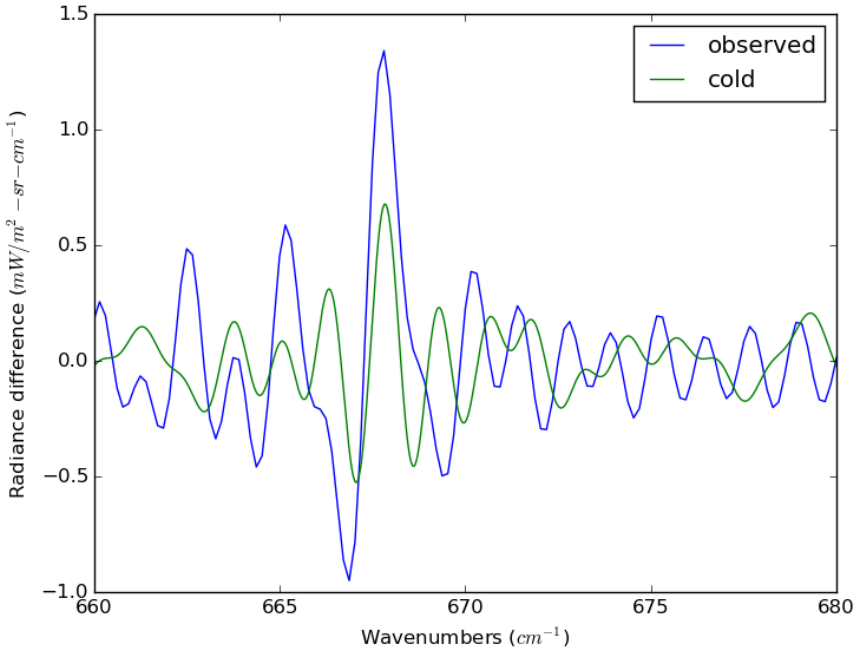




- Spectral resolution reduced to CrIS
- Modulation does not have a big affect

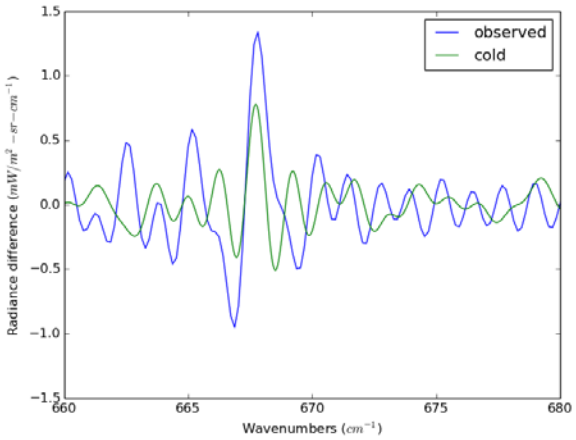
Observed Anomaly Doesn't Match Model



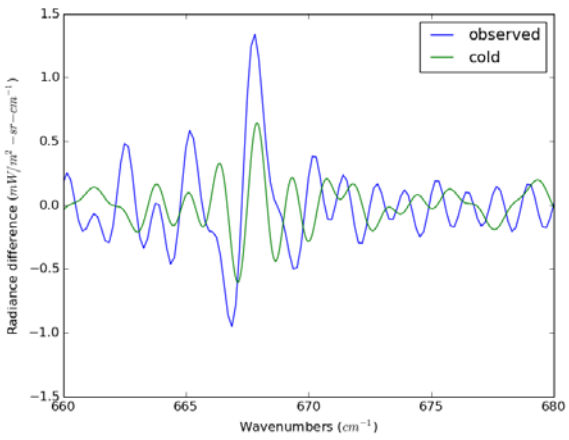


- Observed anomaly larger than modeled
- Larger affect seen for hot spectra than cold
- Shape not a very good match
- Could there be a non-LTE spectral line not in model

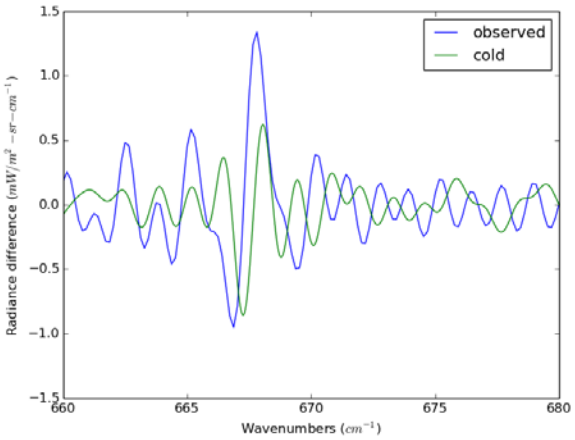
Spectral Shift of Anomaly



Phase 0



Phase -30



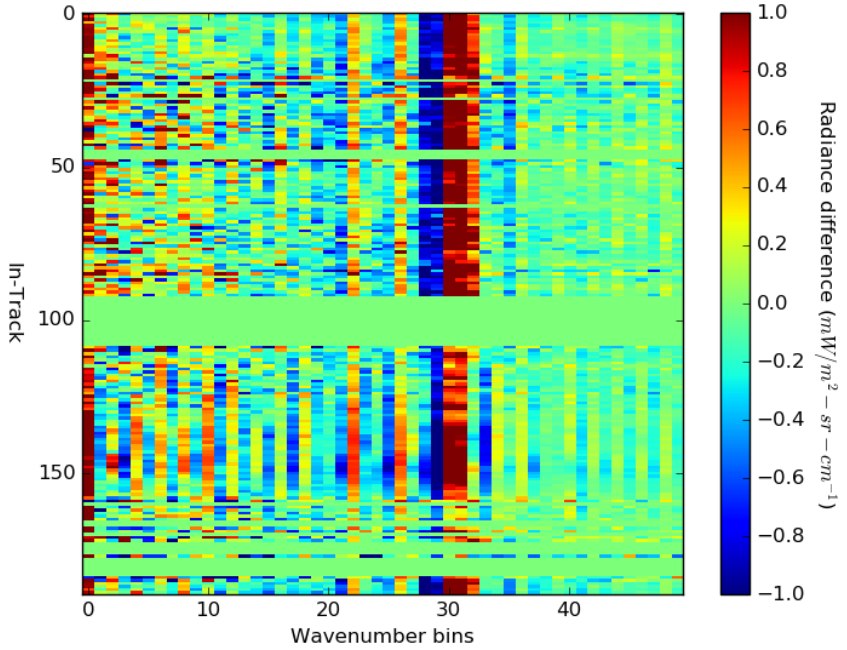
Phase -60

- Position of peak sensitive to the modulating phase
- Beamsplitter gap OPD is 0.88 cm^{-1} or 8800 μm
- Aluminum has thermal expansions of $24x10^{-6}$/ºC at 20 C
- Change in length for 1 C change 0.21 μm compared to wavelength of 15 μm (5 degrees of phase)
- On orbit OMA temperature change not large enough to expect to see change

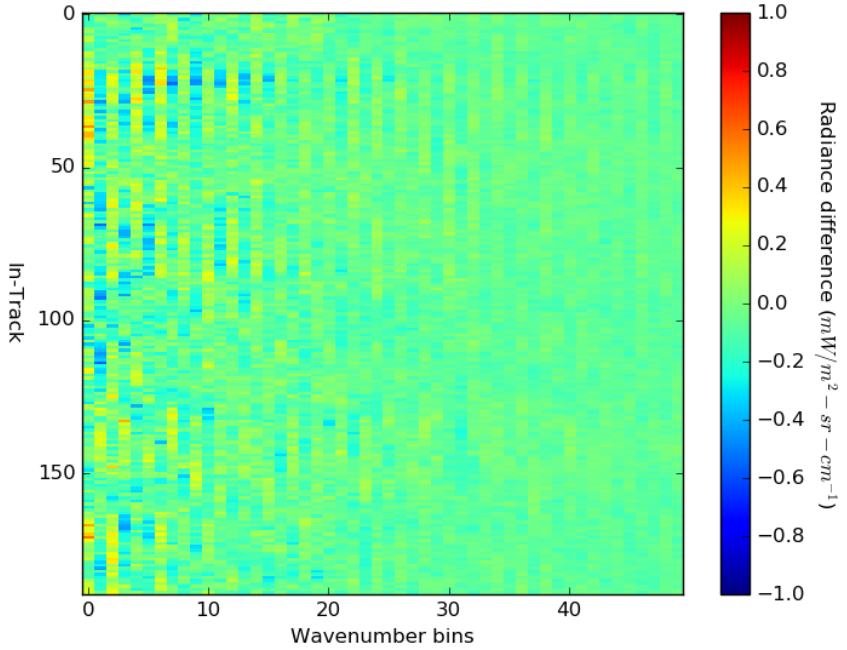
Electrical Cross-Talk

- Joe Predina proposed the effect could be due to electronic cross-talk
- General electronic pickup would likely not have same phase as optical signal and would show in imaginary spectra

Anomaly Only Visible in Real Spectrum



real



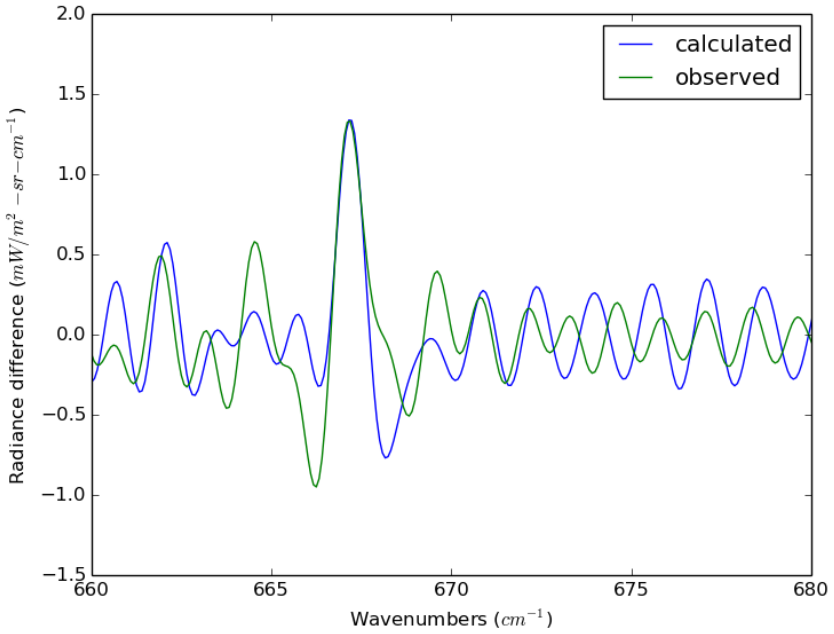
imaginary

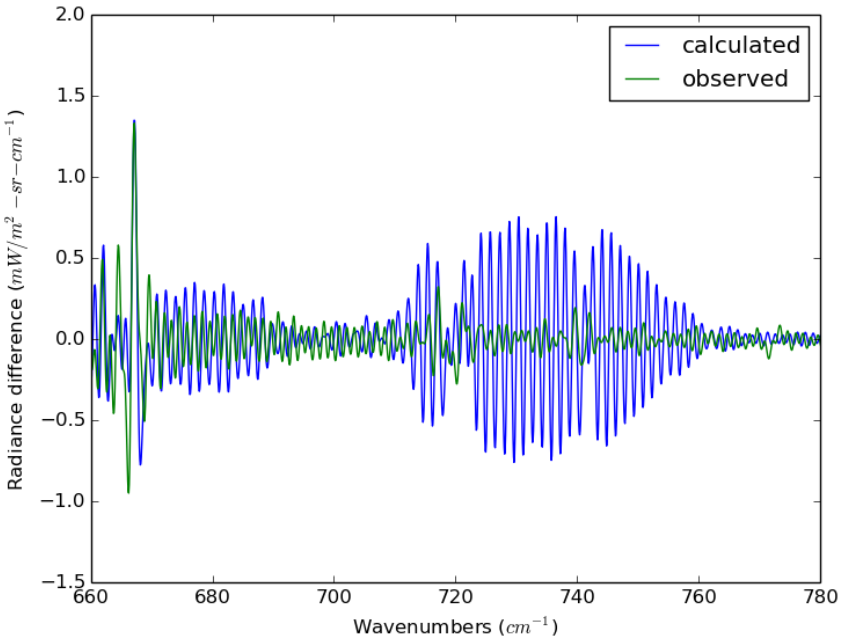
- Difference between FOV5 and FOV6
- Anomaly shows up in real but not imaginary spectra
- August 1, 2015 orbit 19478

Electrical Cross-Talk

- If optical or detector electrical cross-talk were getting into FOV5 the line shape would be incorrect
- Synthesized spectra including SA matrix effects
  - From Larrabee Strow's high resolution spectrum
- Added small amount of FOV1 and FOV2 into FOV5
- Applied inverse SA matrix for FOV5
- Plot difference between correct FOV5 spectra

Adding Cross-Talk Not Consistent with Anomaly

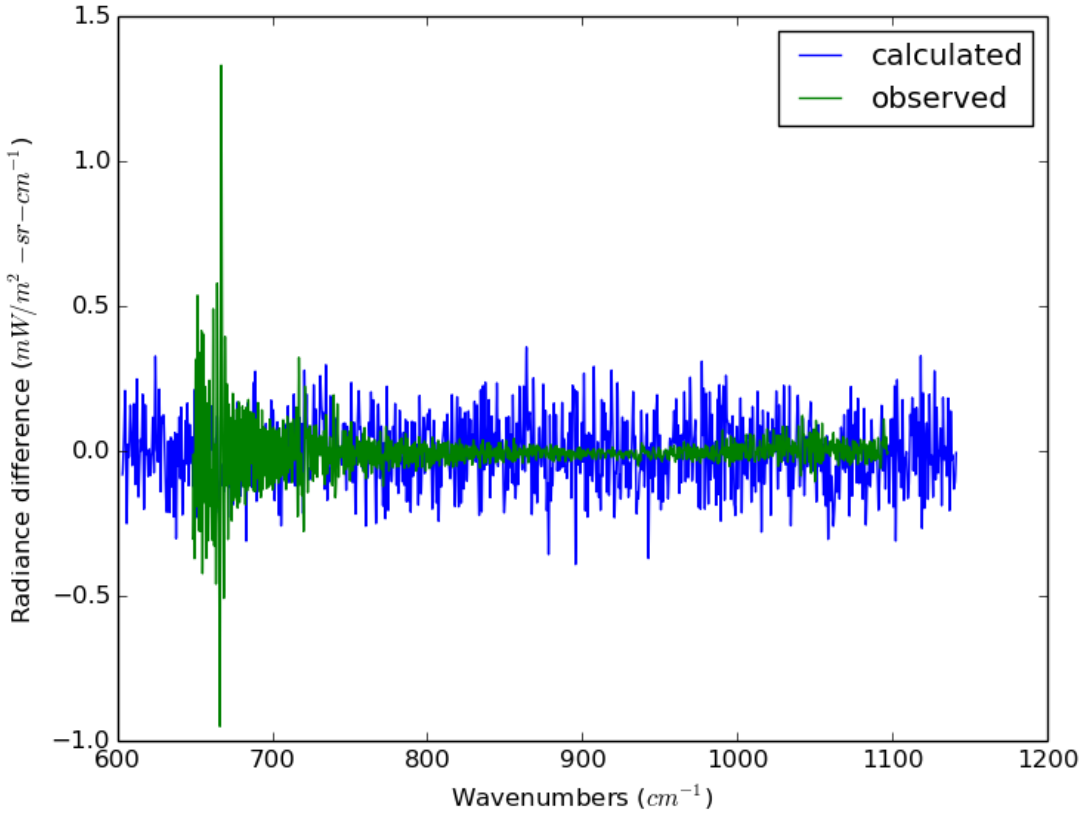




- 0.07 of FOV1 & FOV2 added to FOV5
- Biggest effect in 720 to 760 cm^{-1} region not 668 cm^{-1}
- Other combination of cross-talk also not a good fit

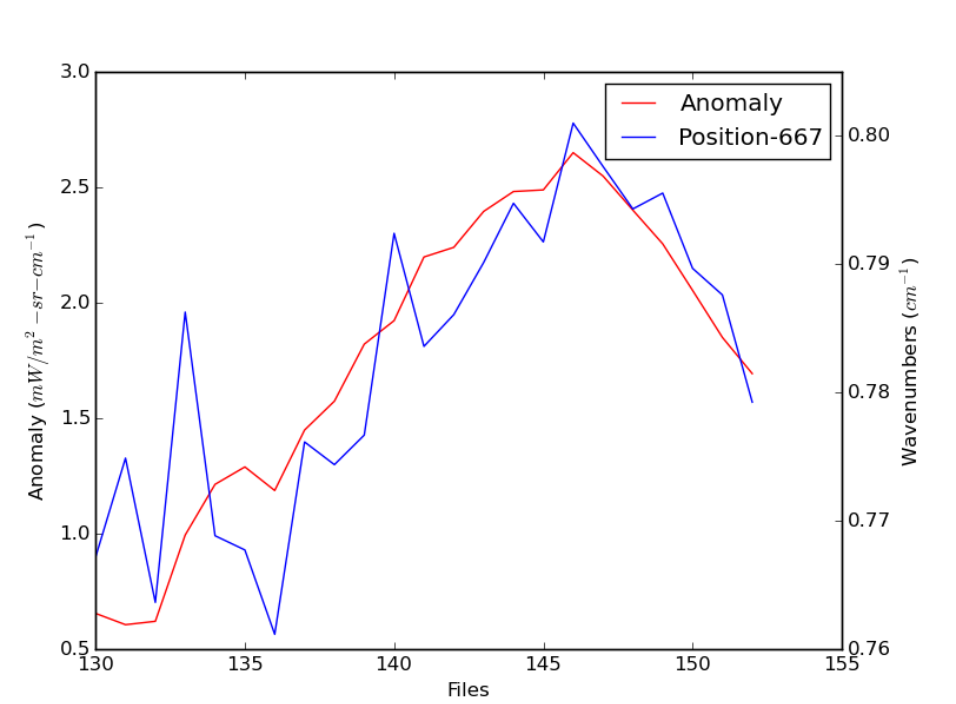
BACKUP

How Large is Anomaly?



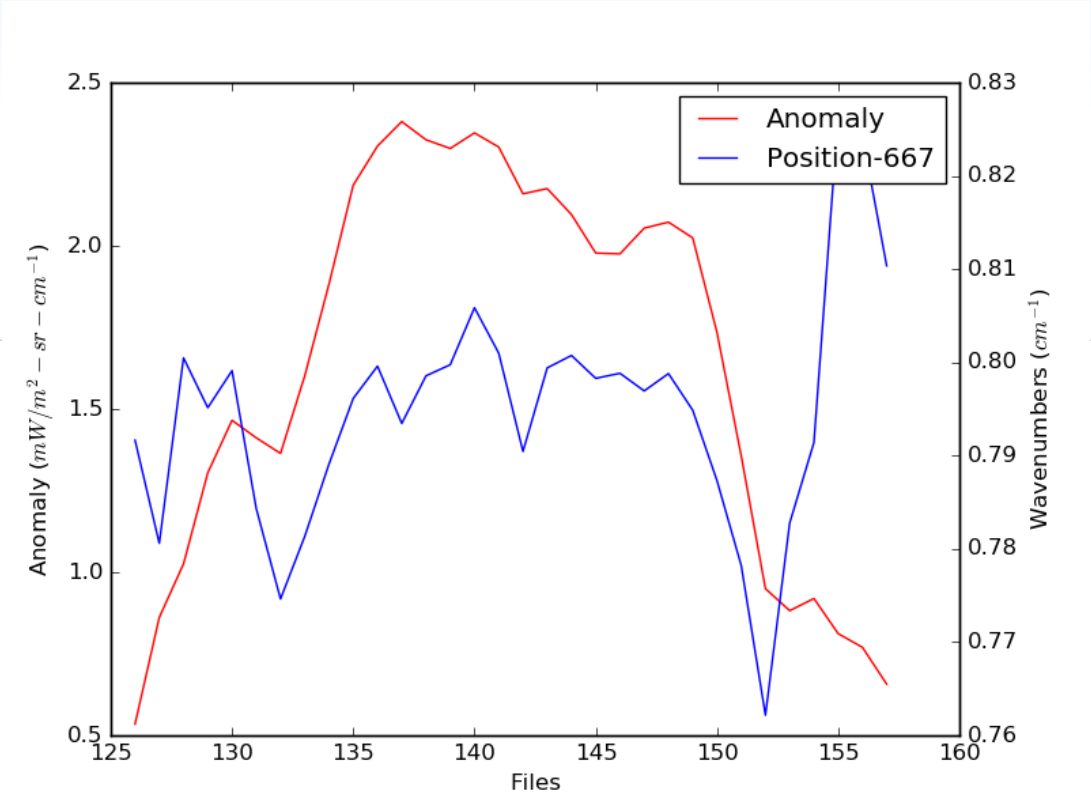
- Anomaly compared to a single pixel noise
- Anomaly was averaged over a granule

Anomaly Spectral Position not Constant



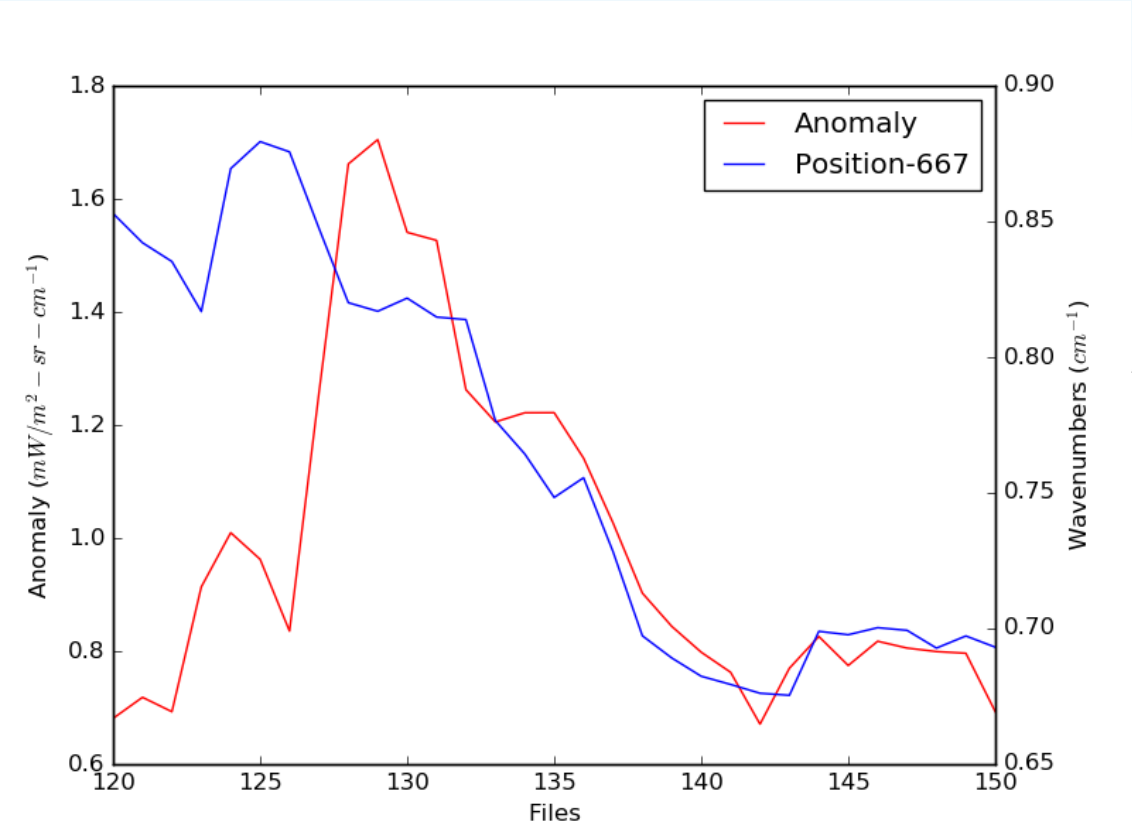
- Spectral position of anomaly correlated with amplitude
- Anomaly amplitude uses left axis, position right axis
- South pole region, averaged over each granule
- August 1, 2015 orbit 19480

Anomaly Spectral Position not Constant



- Spectral position of anomaly correlated with amplitude
- Anomaly amplitude uses left axis, position right axis
- South pole region, averaged over each granule
- June 21, 2015 orbit 18900

Anomaly Spectral Position not Constant



- Spectral position of anomaly correlated with amplitude
- Anomaly amplitude uses left axis, position right axis
- South pole region, averaged over each granule
- December 21, 2015 orbit 21496