

Toward Absolution Calibration of Suomi NPP ATMS

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NOAA/NESDIS/STAR

Outline

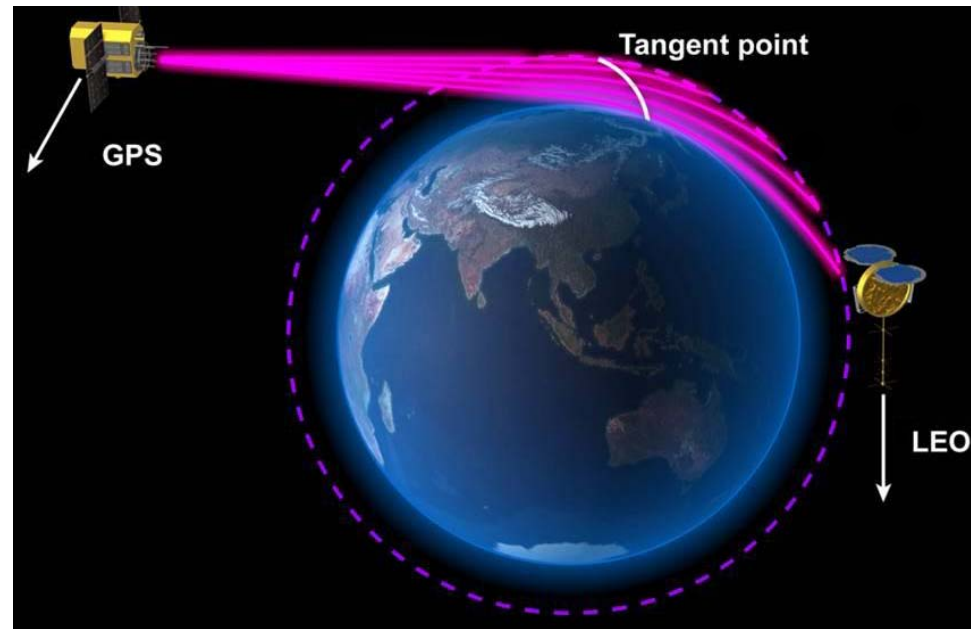
1. A Brief Description of GPS RO
2. Collocation Data Selection
3. A Brief Description of MonoRTM
3. ATMS WF and GPS RO Temperature Profile
4. ATMS Measured SRF and Boxcar SRF
5. MonoRTM Simulations
6. Summary

GPS RO Temperature Profiles

1. High vertical resolution
2. No contamination from clouds
3. No system calibration required
4. High accuracy and precision:

The global mean differences between COSMIC and high-quality reanalyses is $\sim 0.65\text{K}$ between 8 and 30km (Kishore et al. 2008)

The precision of COSMIC GPS RO soundings is $\sim 0.05\text{K}$ in the upper troposphere and lower stratosphere (Anthes et al. 2008)



Collocation Data Selection

- **Time period of data search:**

January, 2012

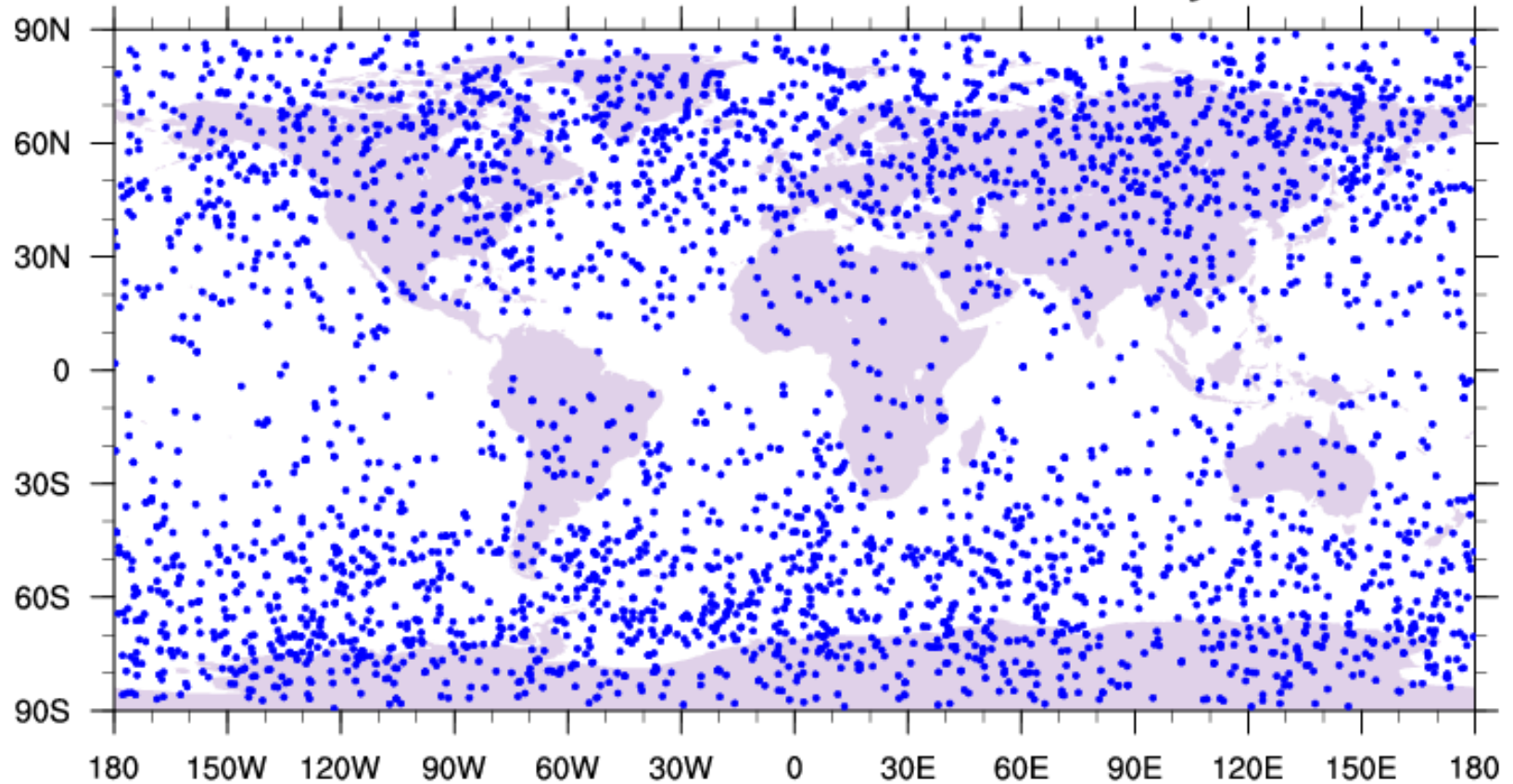
- **Collocation of CloudSat and COSMIC data:**

Time difference < 0.5 hour

Spatial distance < 30 km

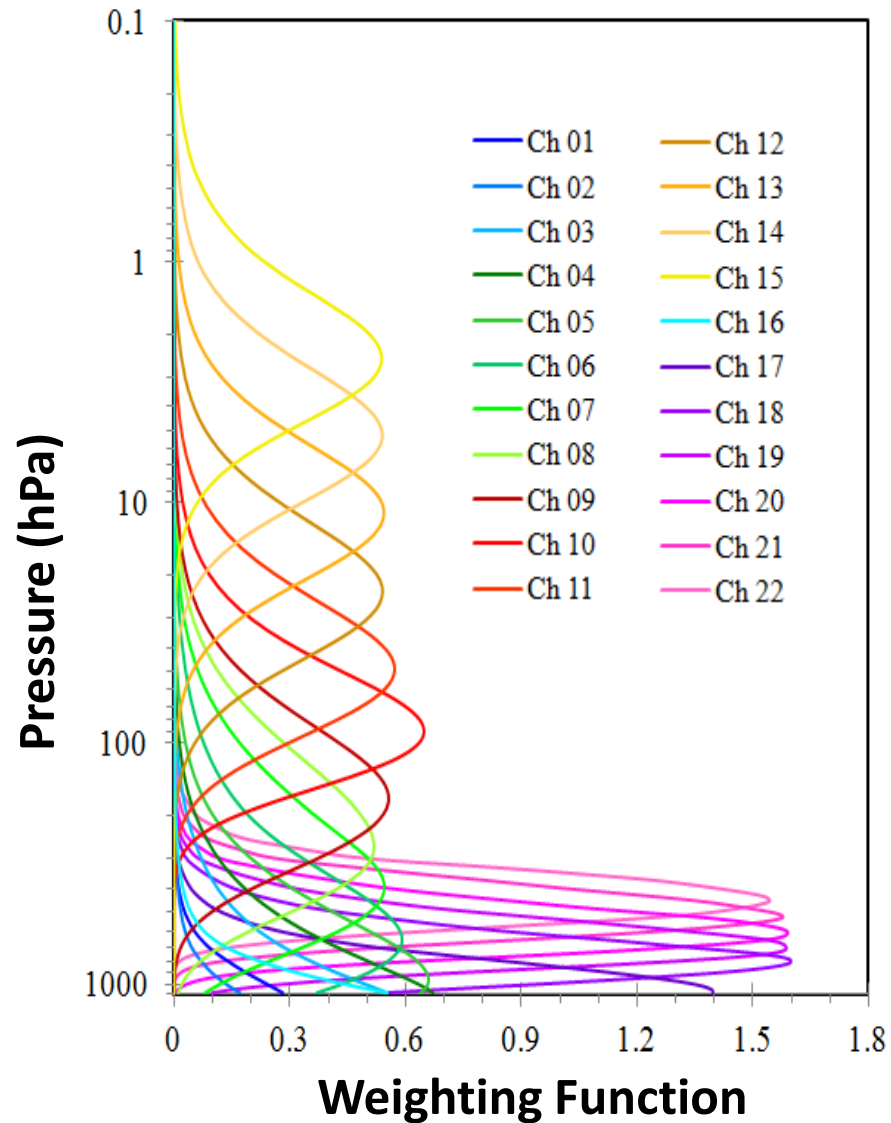
(GPS geolocation at 10km altitude is used for spatial collocation)

Distribution of Collocated ATMS in January 2012

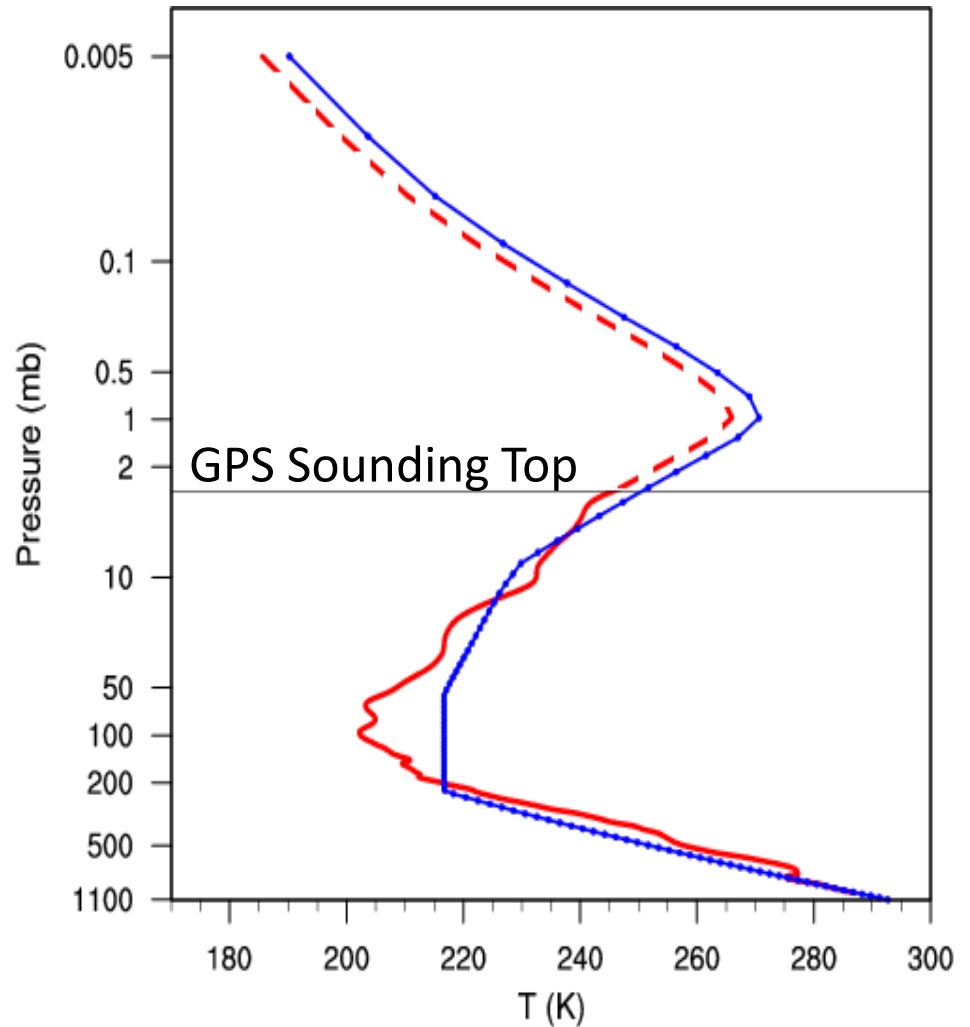


3056 collocated measurements

ATMS WF (U.S. Standard Atmosphere)



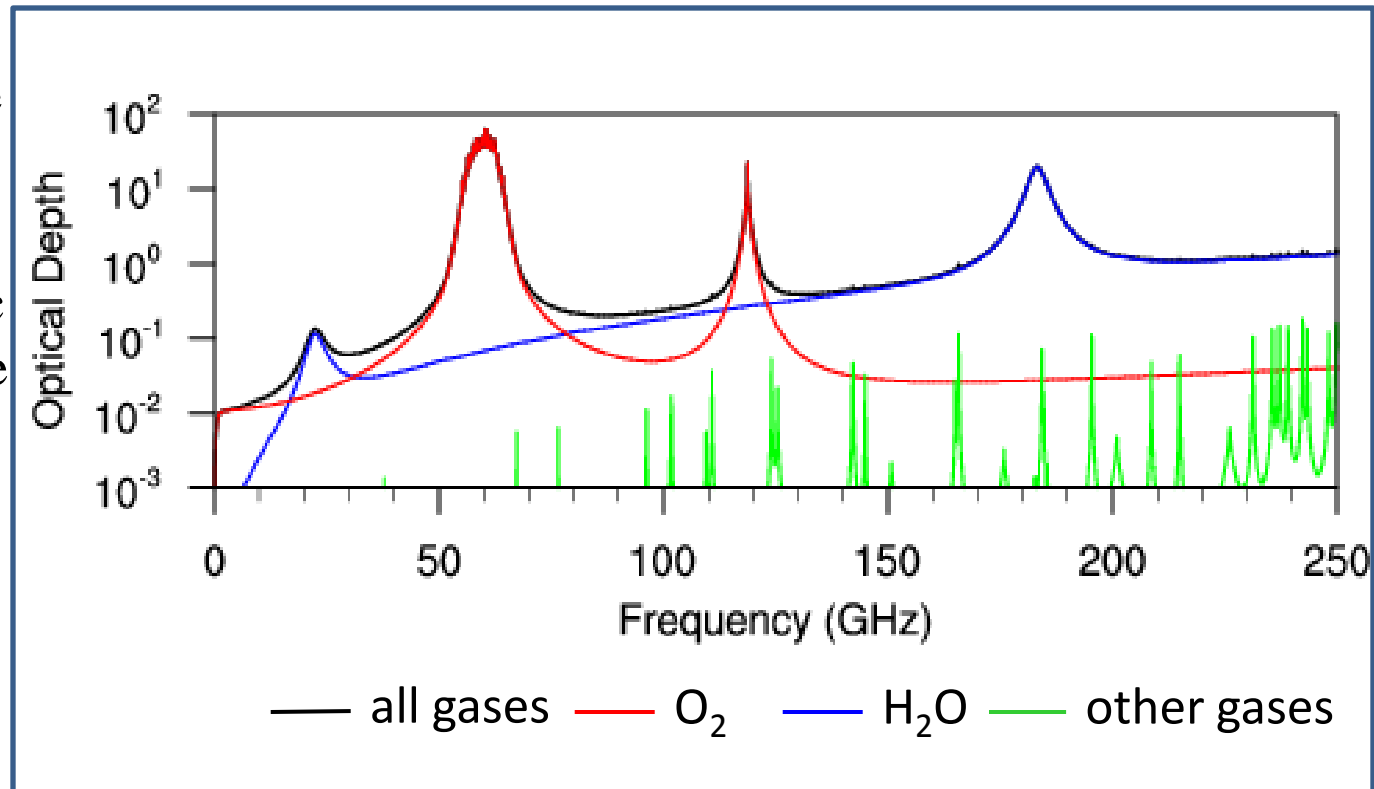
Add 1976 U.S. Standard Atmosphere State to GPS Soundings



1051 UTC on January 1, 2012

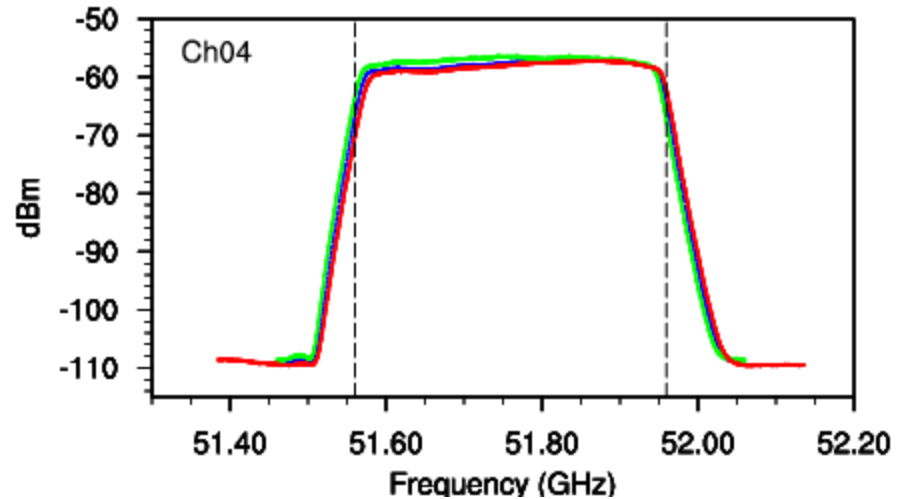
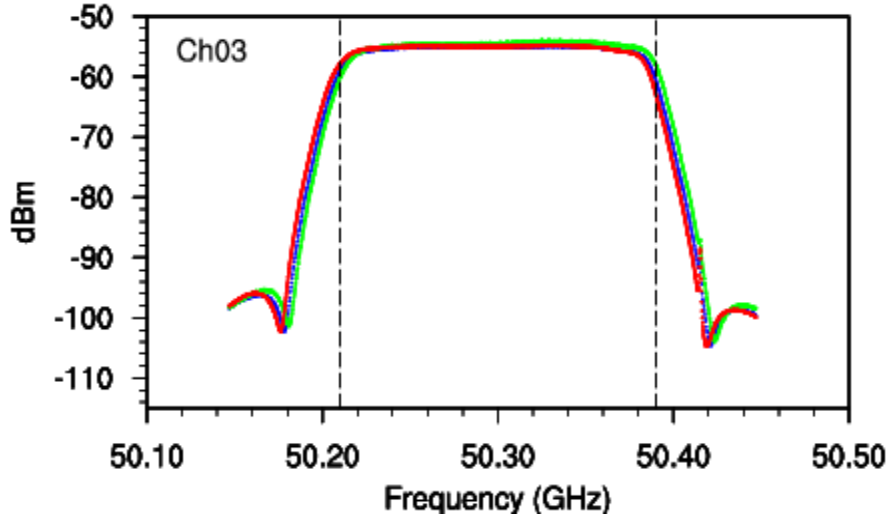
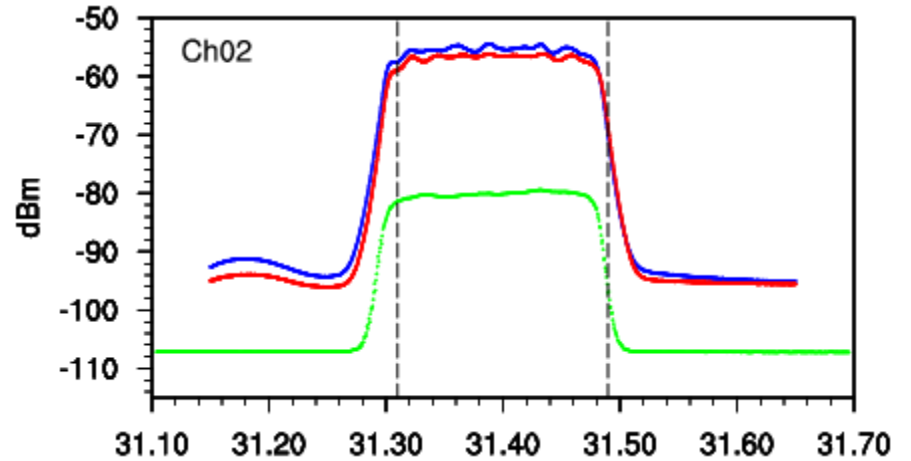
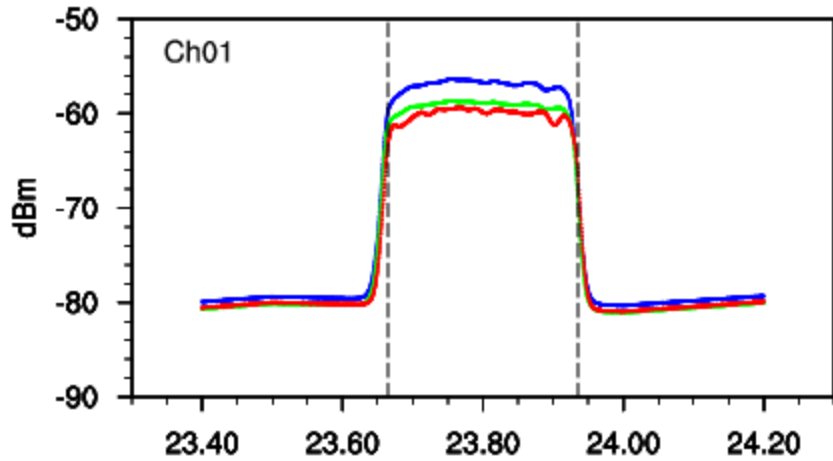
MonoRTM

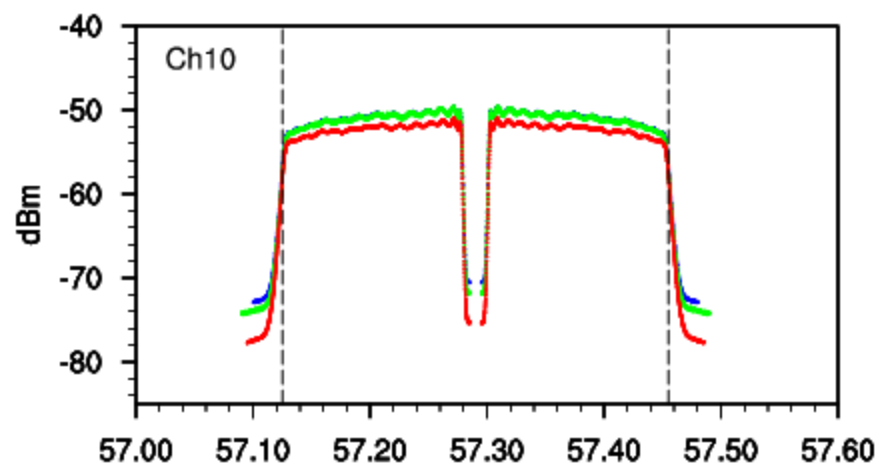
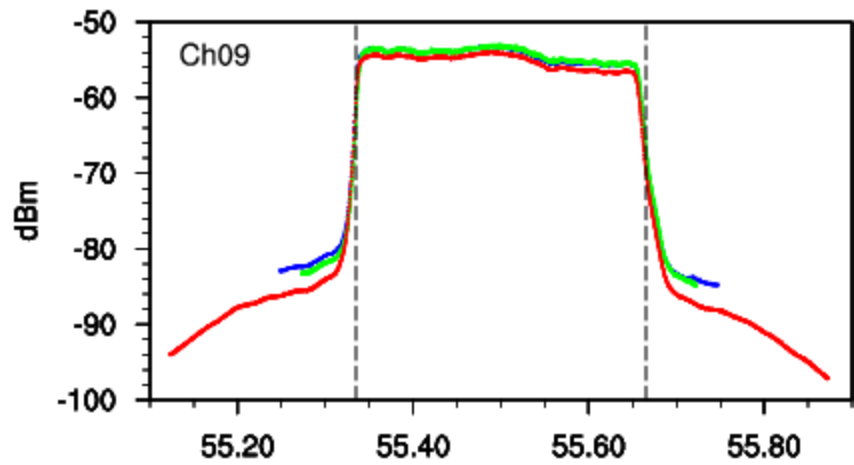
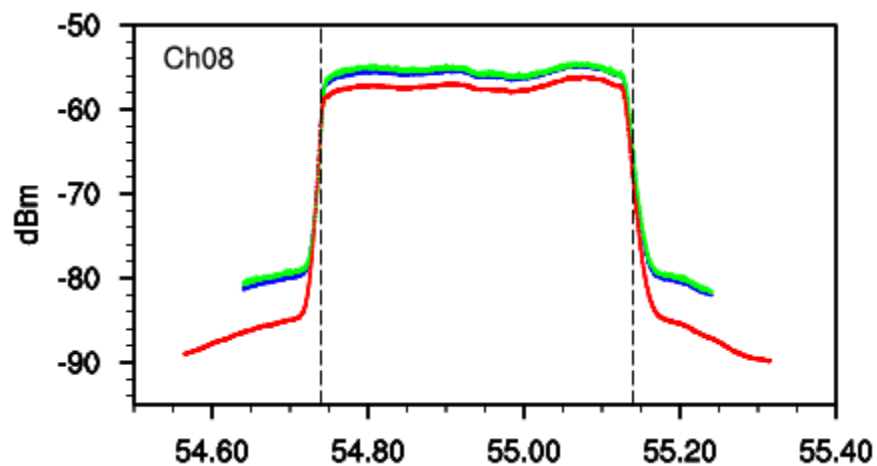
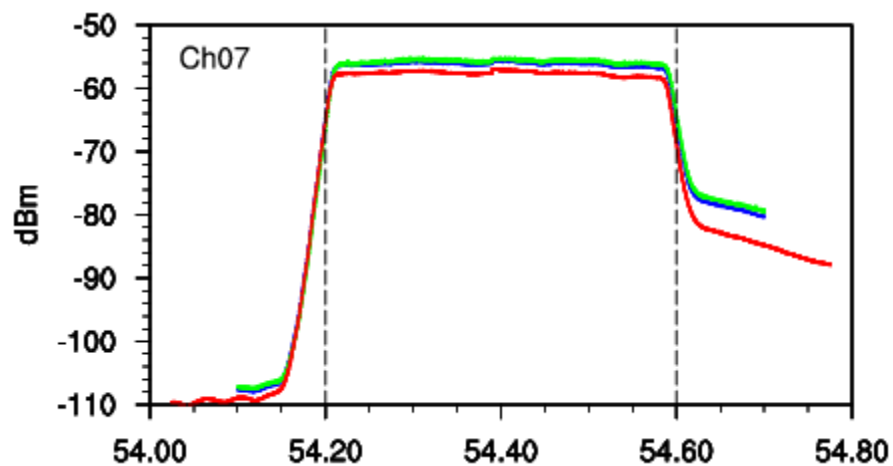
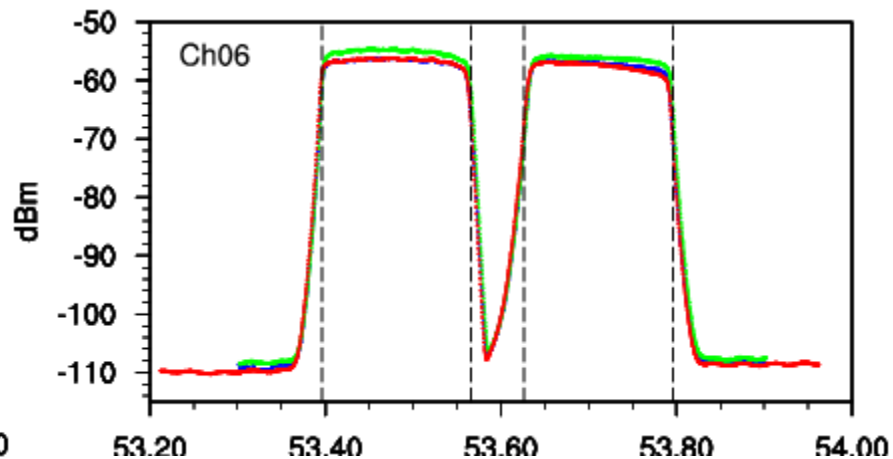
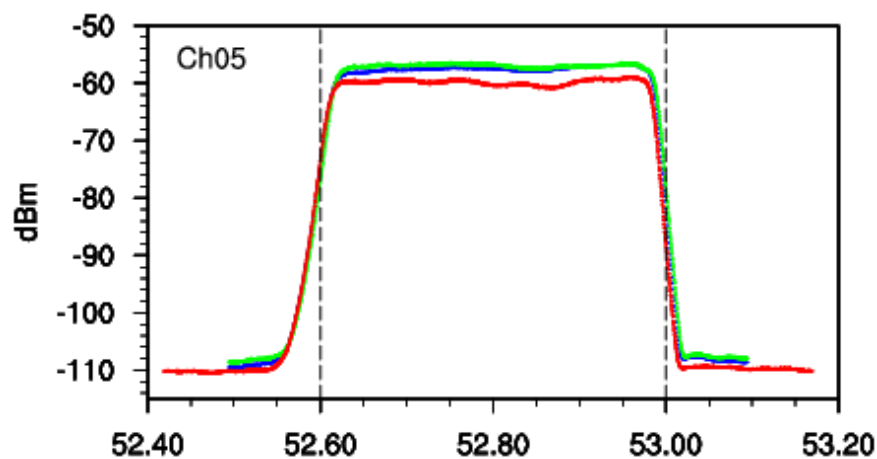
- Perform a line by line radiative transfer calculation
- Accurate atmospheric spectroscopy data base
- Only gaseous absorption
- Vertical stratification

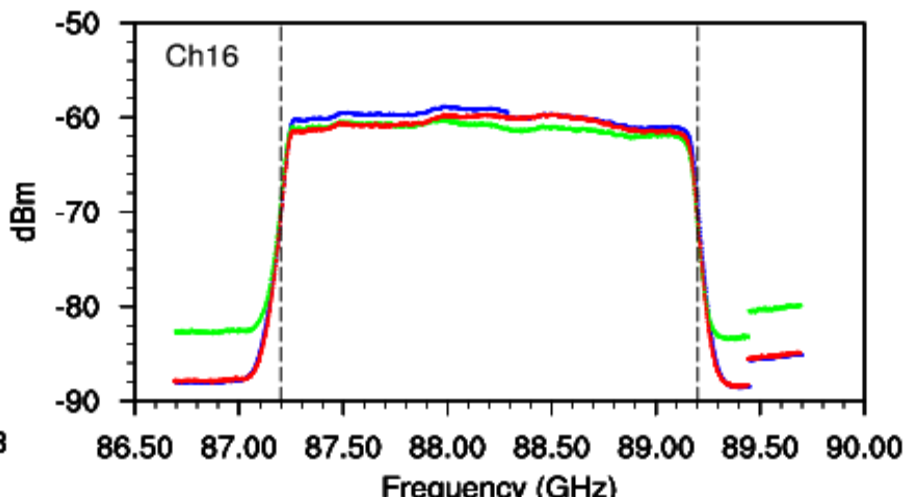
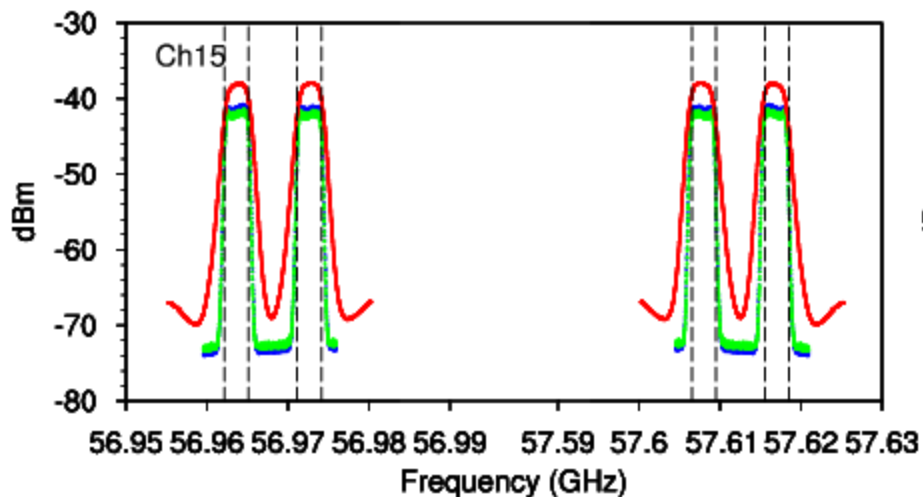
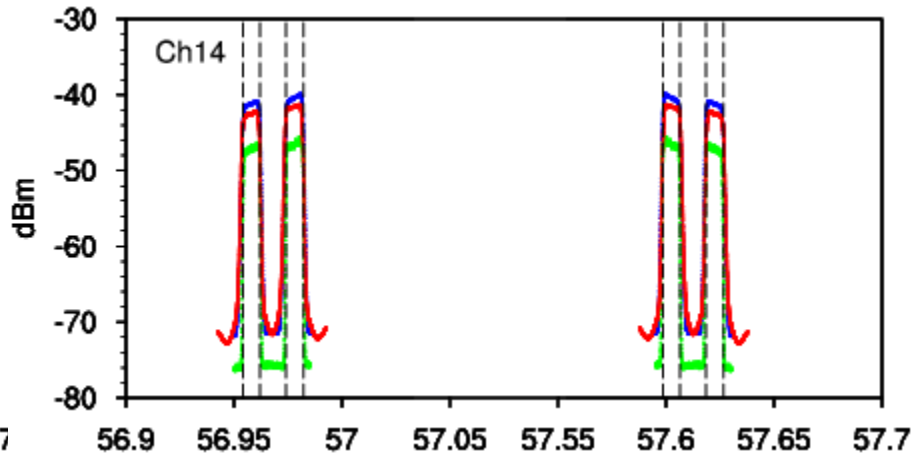
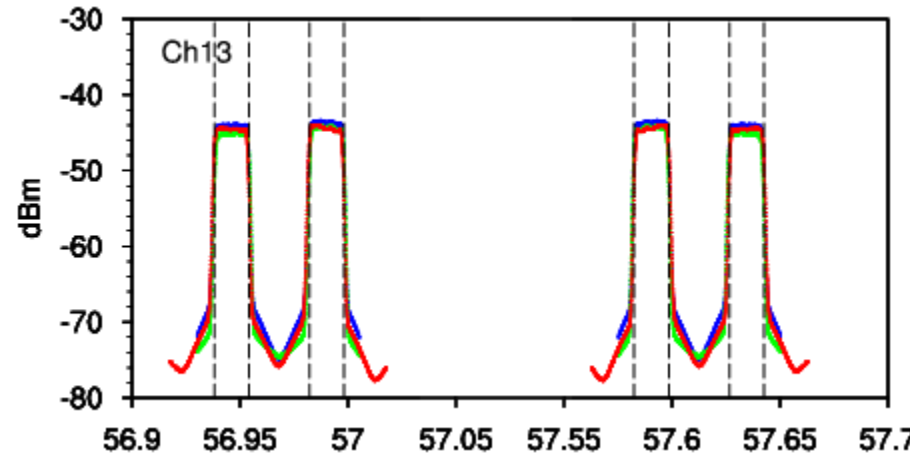
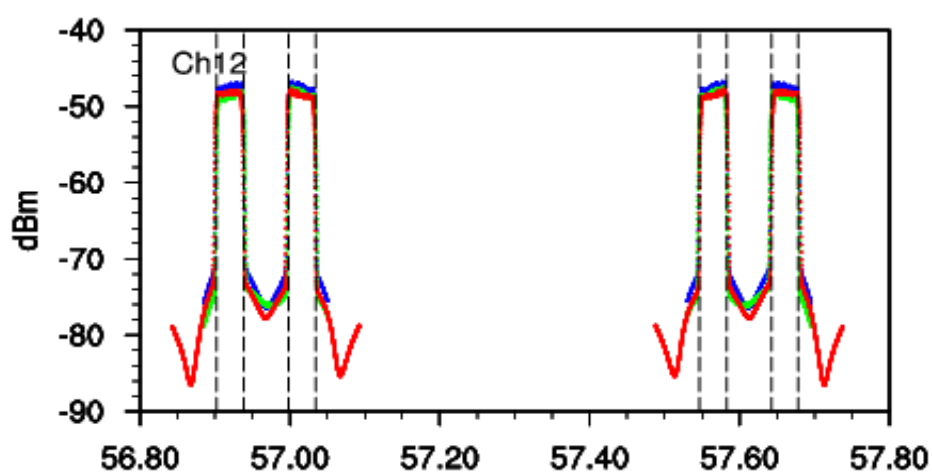
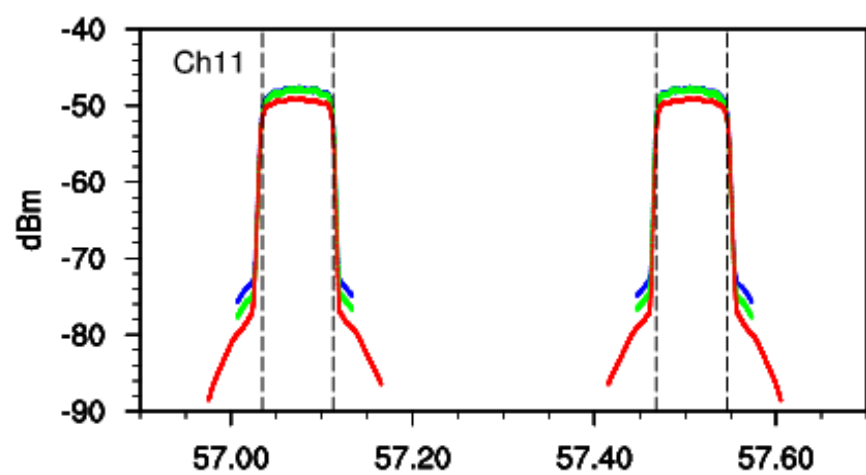


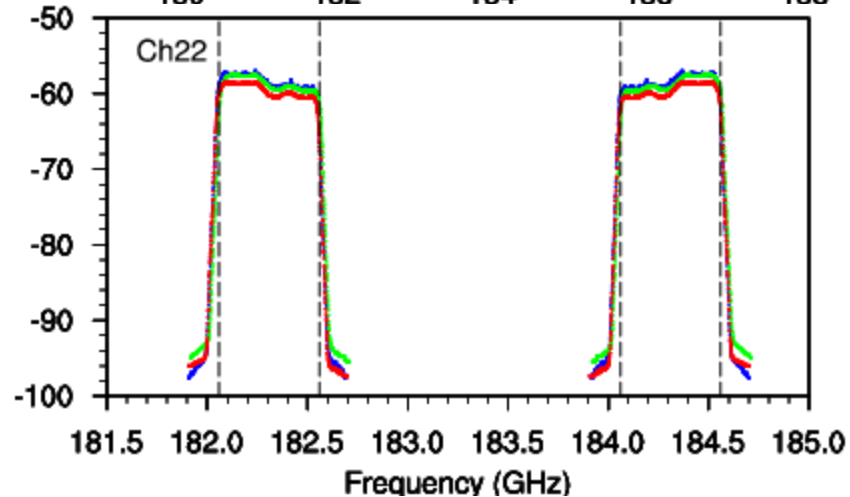
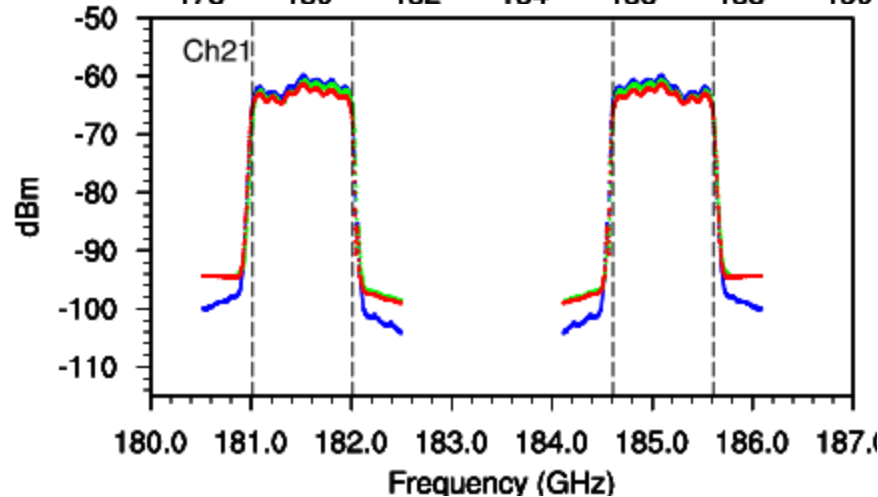
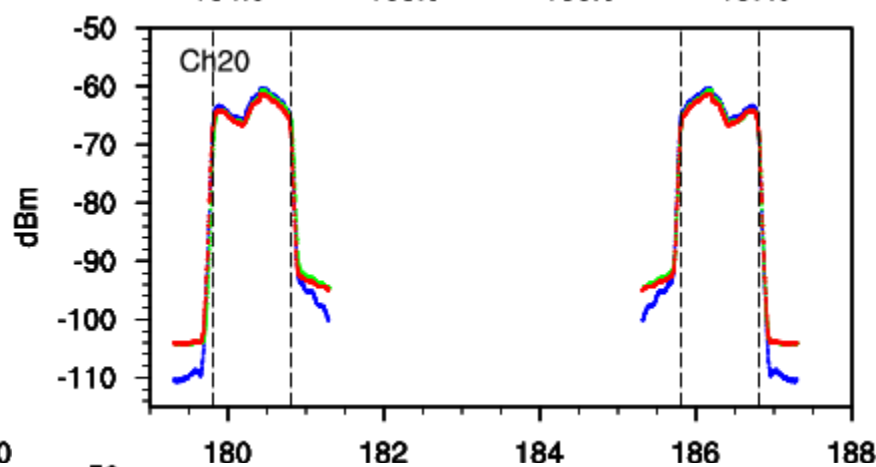
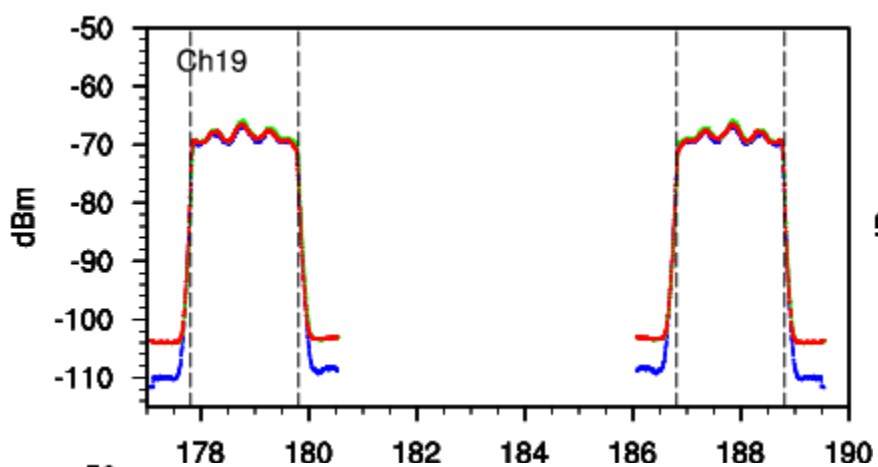
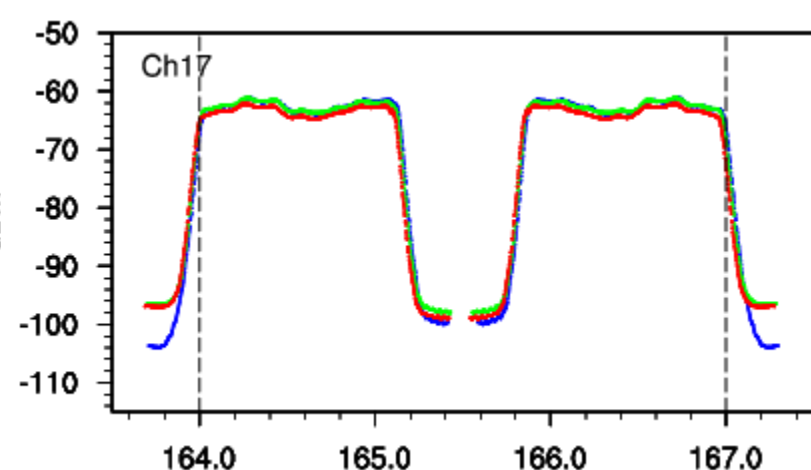
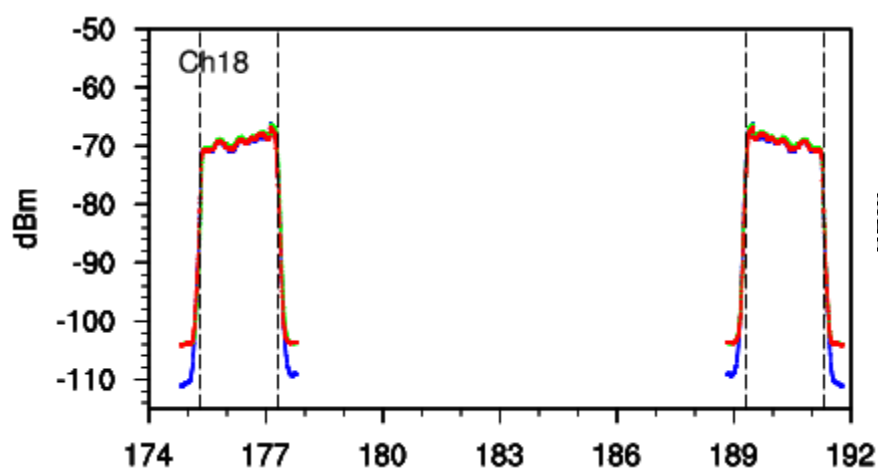
Microwave sounding channels at 50-60 GHz O₂ absorption band can be best simulated under a cloud-free atmosphere using line by line calculation

ATMS Measured SRF at Baseplate Temperature of **-10°C**, **20°C**, and **50°C**

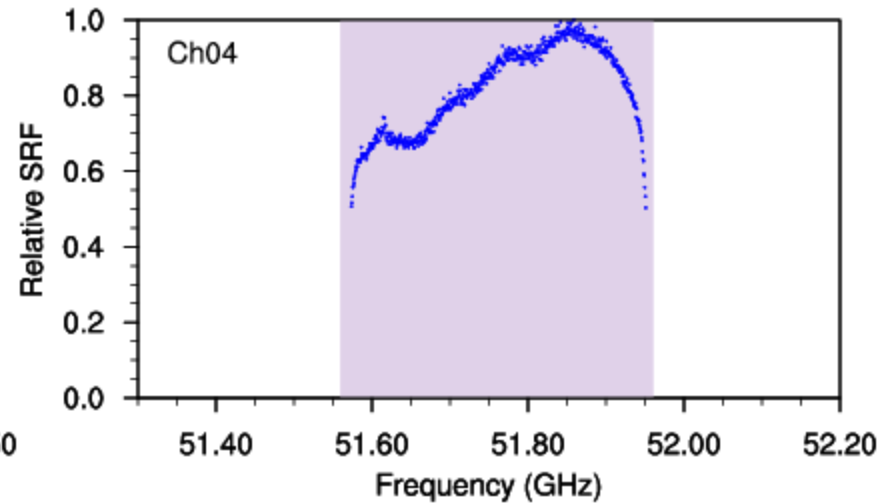
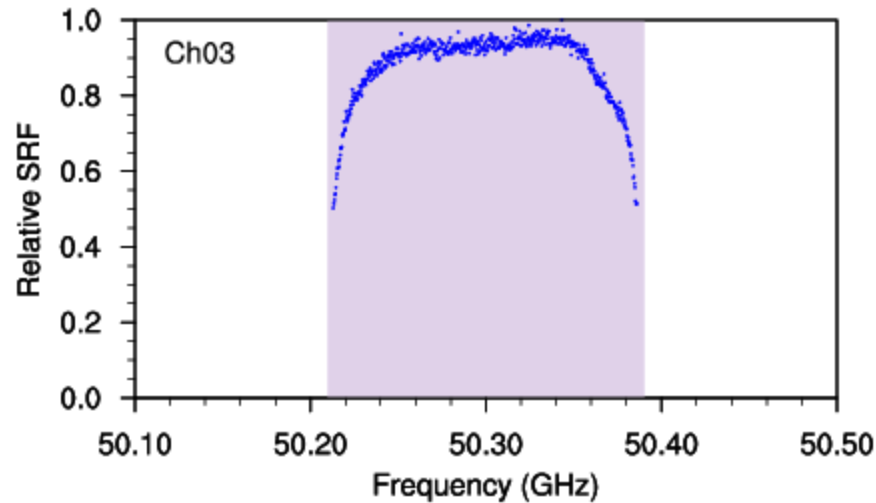
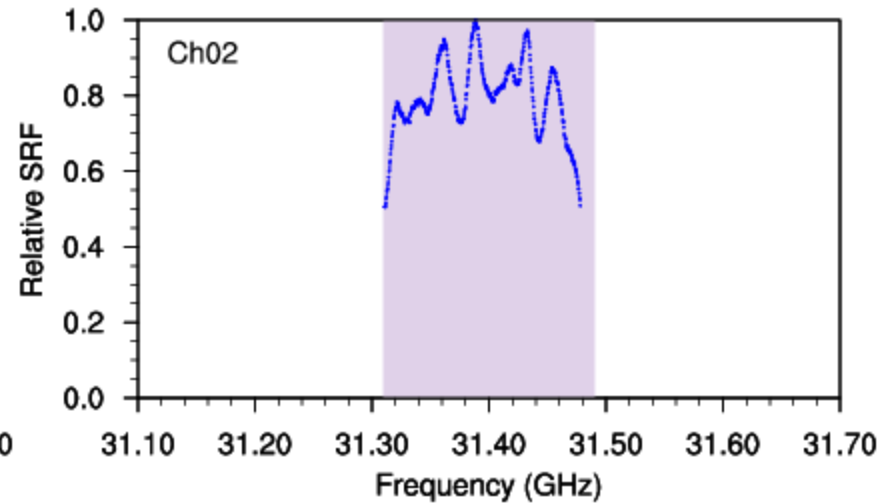
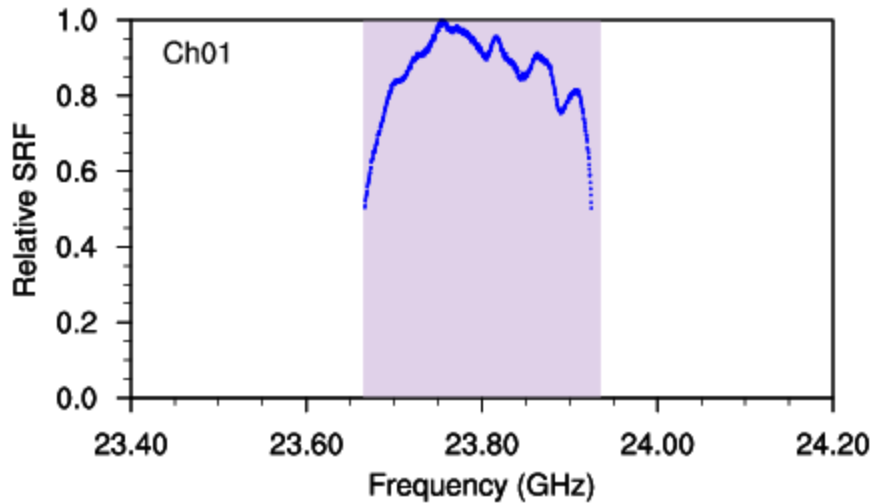


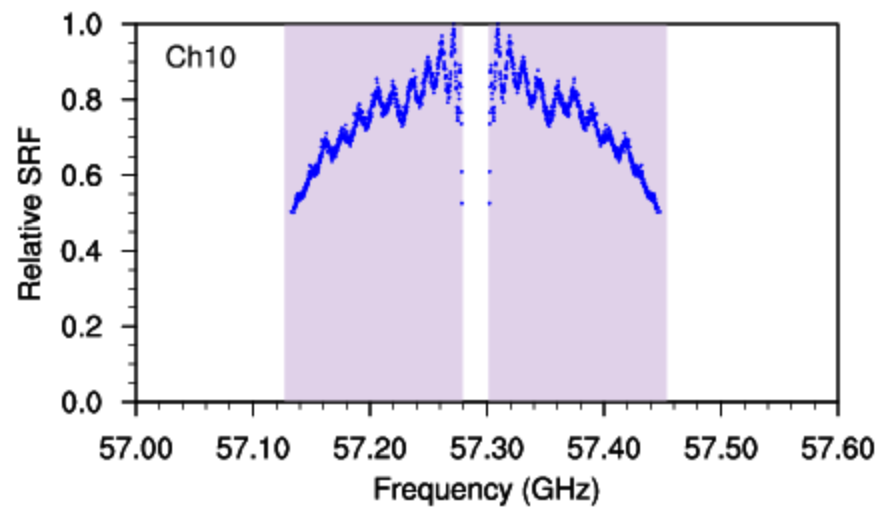
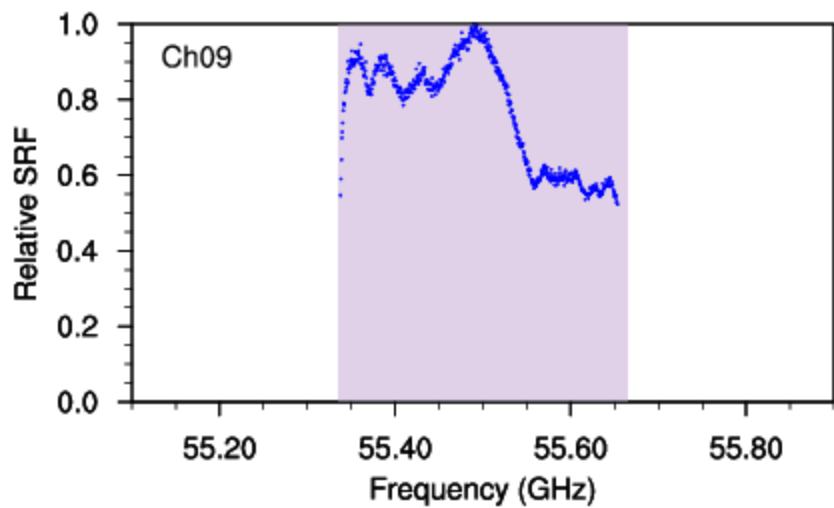
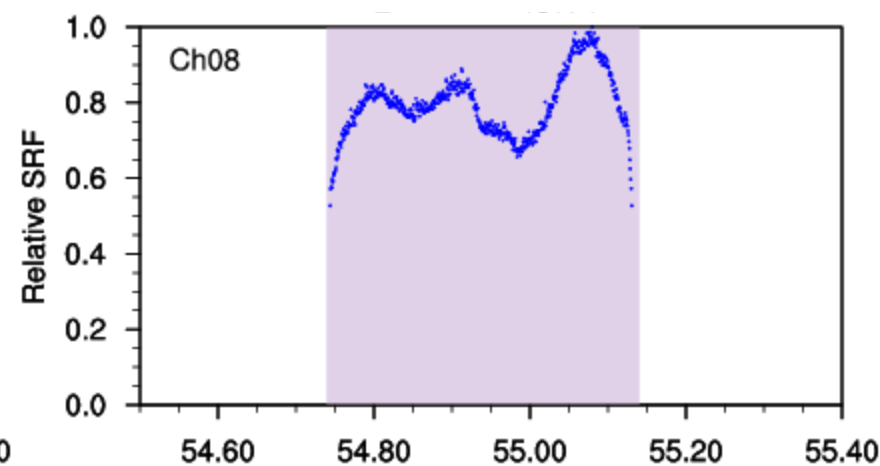
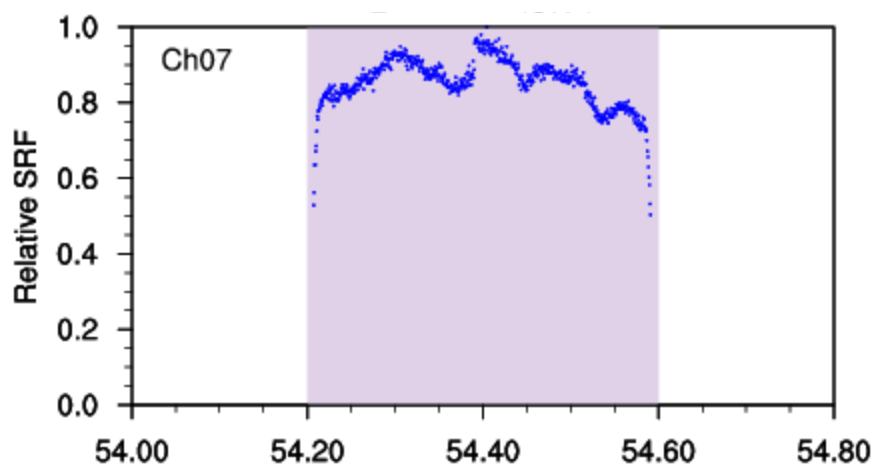
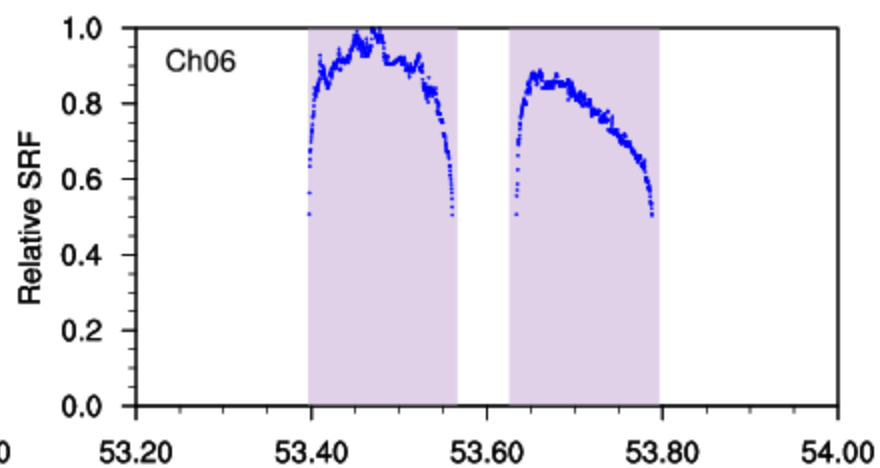
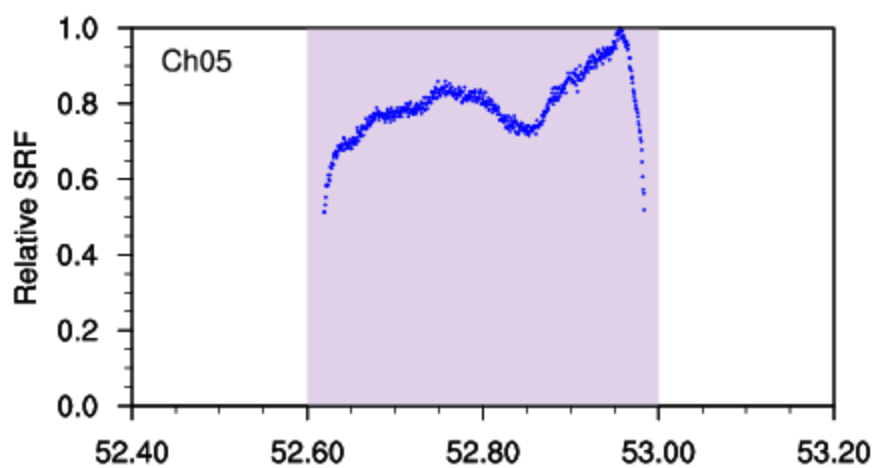


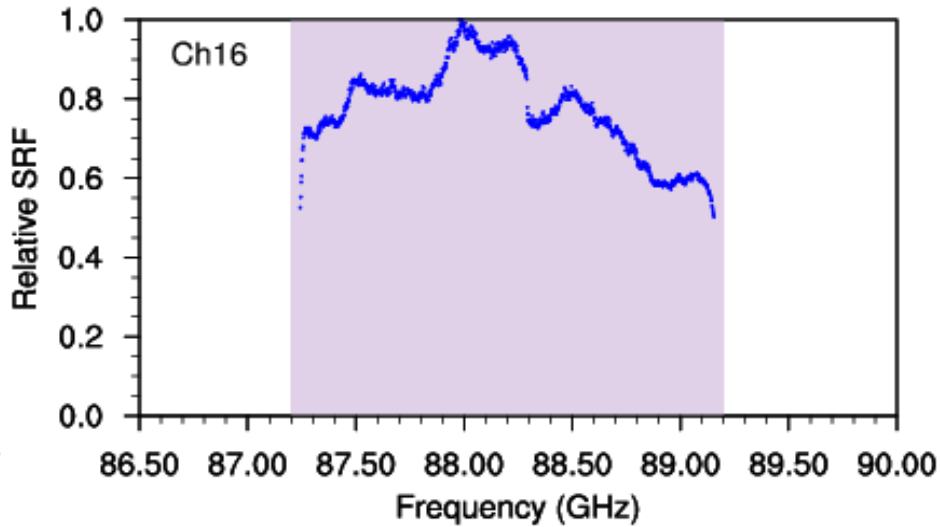
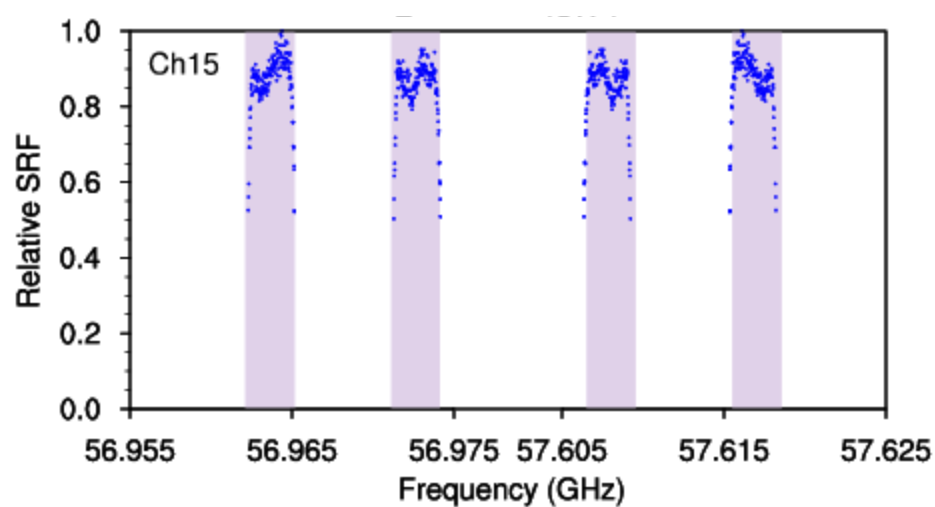
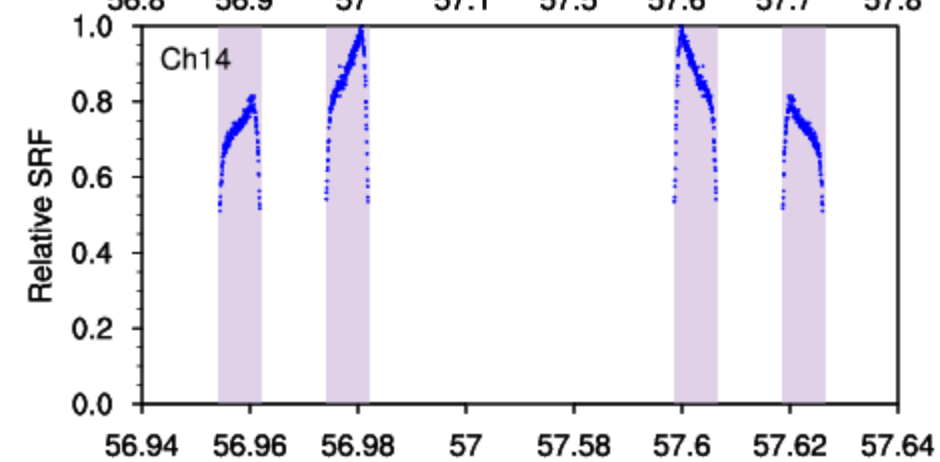
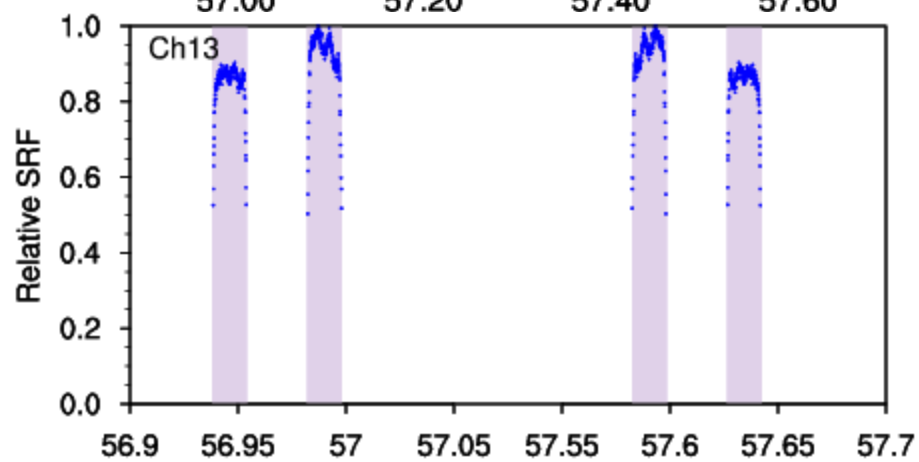
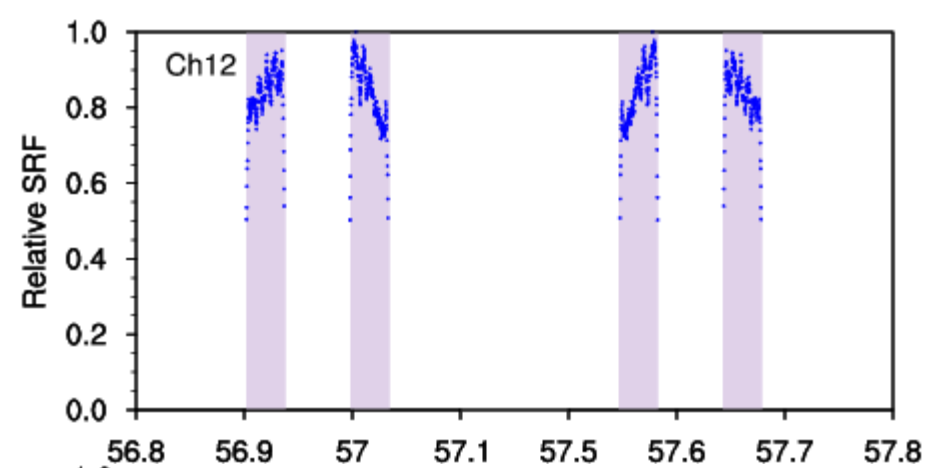
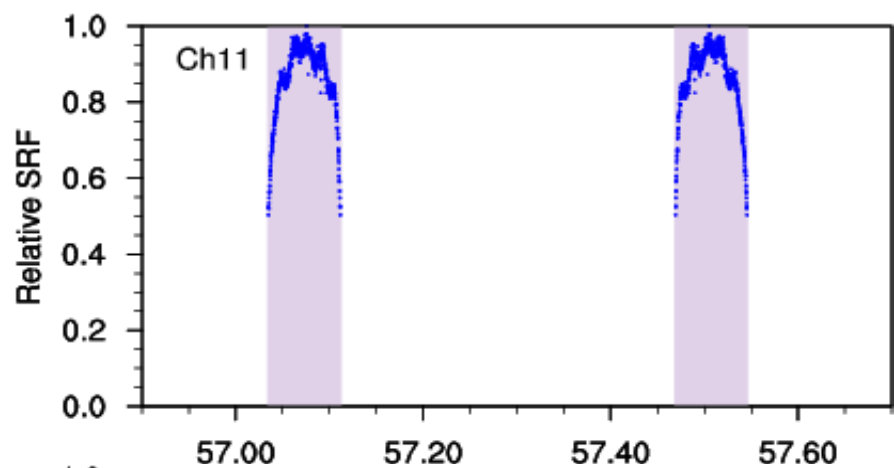


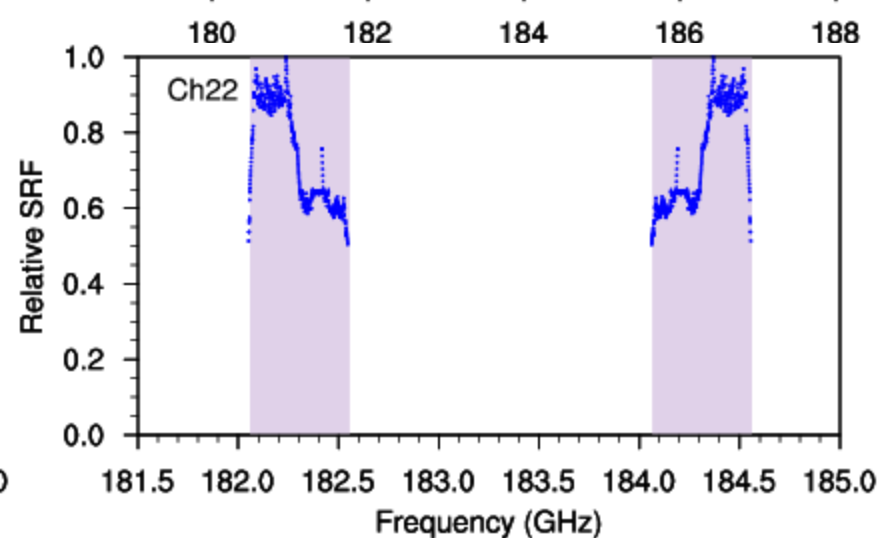
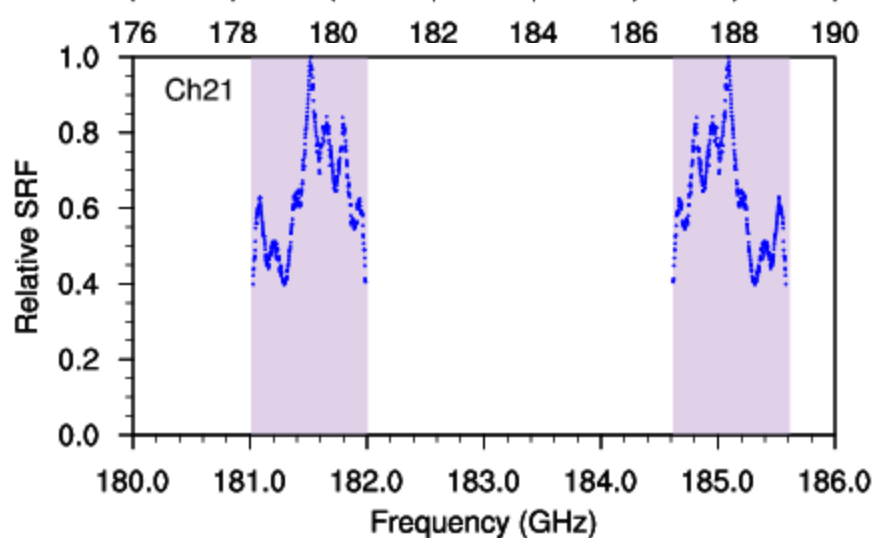
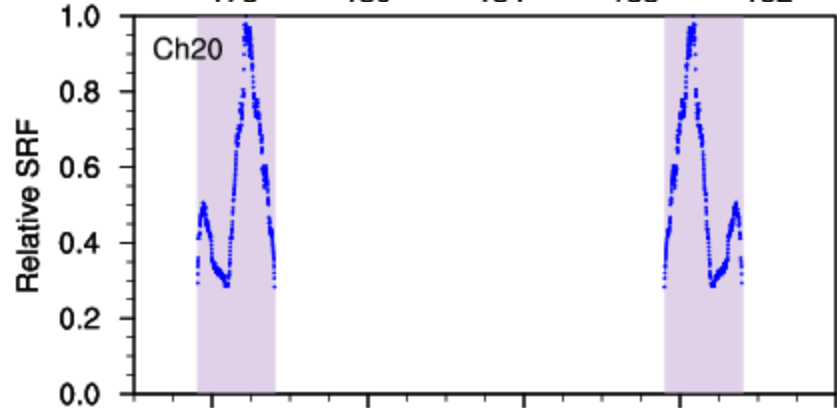
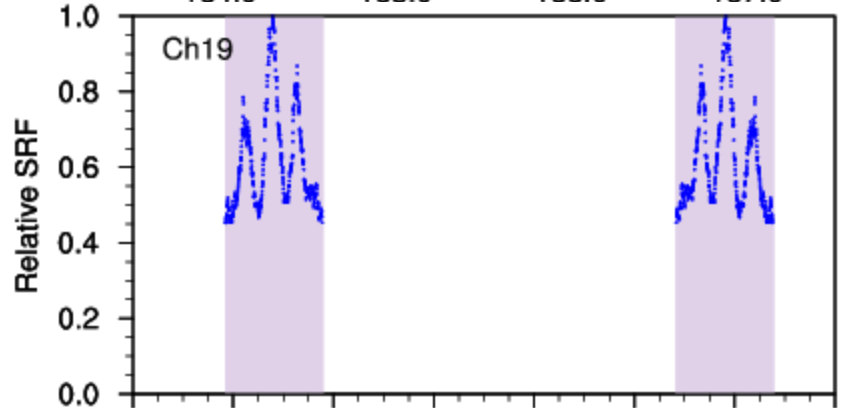
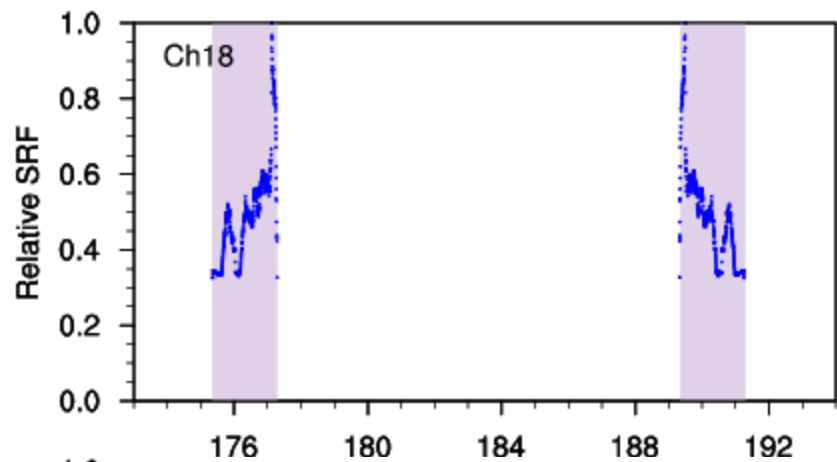
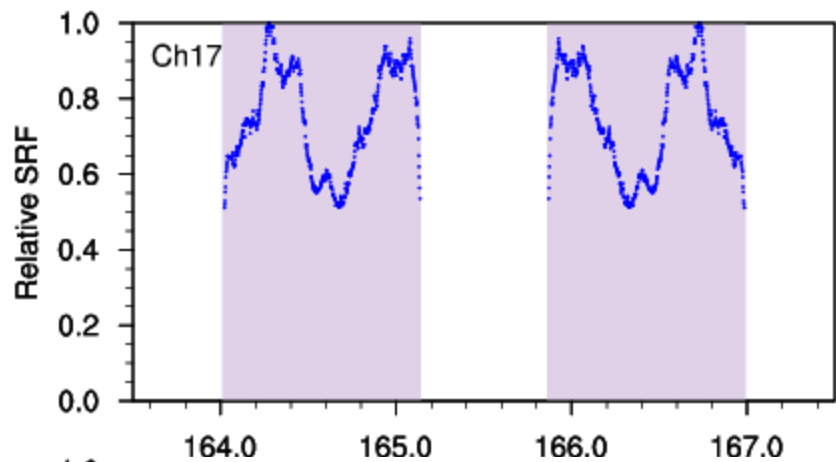


SRF after -3dB Truncation for Baseplate of 20°C





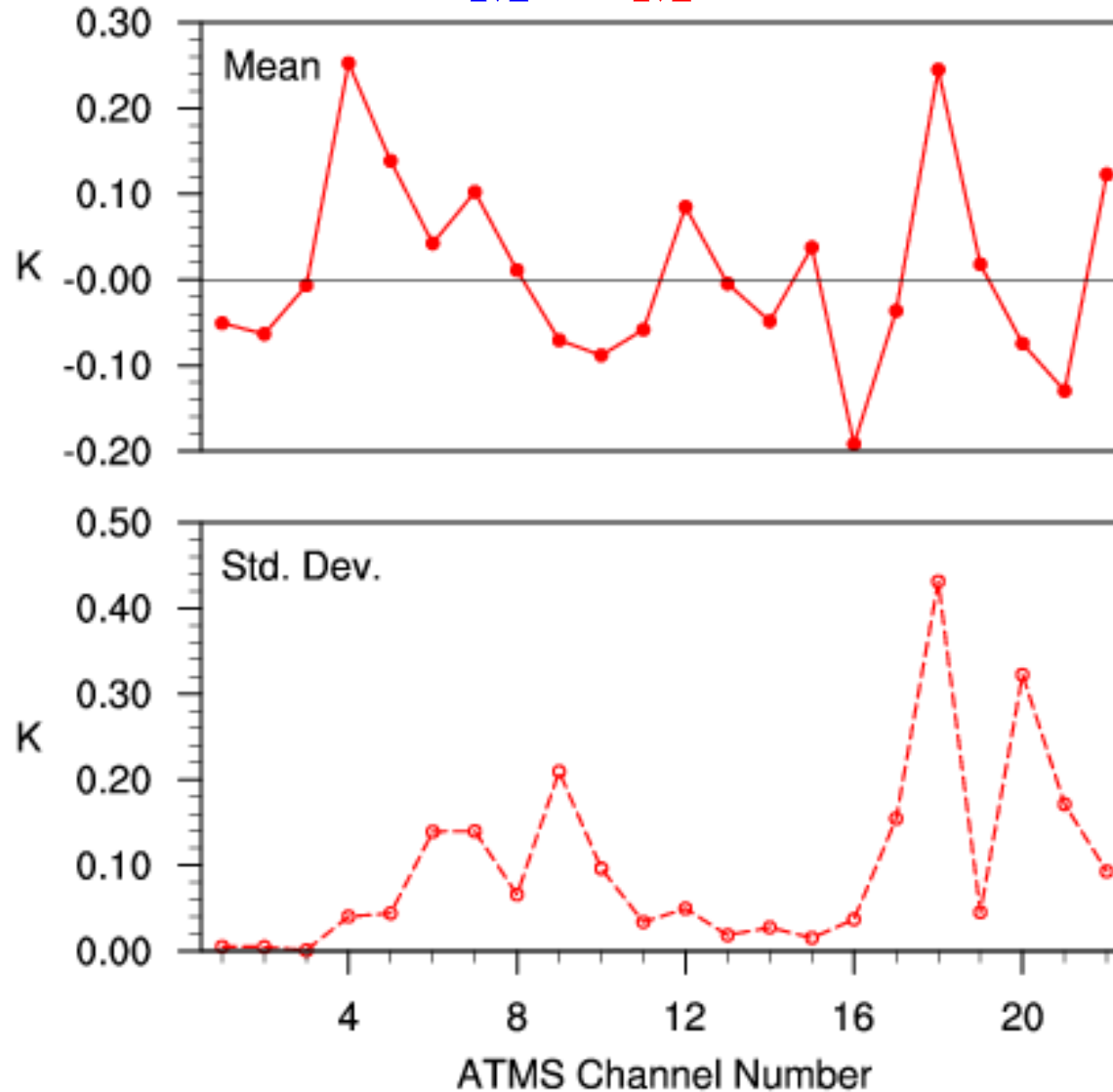




Channel Number	Number of Line		Frequency Resolution (mHz)	Channel Number	Number of Line		Frequency Resolution (mHz)
	Original	-3dB			Original	-3dB	
01	2501	808	0.32	12	2002	844	0.165
02	1601	536	0.3125	13	2002	822	0.075
03	1001	577	0.3	14	2002	864	0.035
04	1001	630	0.6	15	2002	702	0.016
05	1001	609	0.6	16	1600	1020	1.88
06	2002	1061	0.3	17	2002	1308	1.7
07	1001	641	0.6	18	2002	1296	2.97
08	1001	645	0.6	19	2002	1112	3.46
09	1001	632	0.5	20	2002	976	1.98
10	2002	1558	0.185	21	2002	978	1.97
11	2002	1214	0.126	22	2002	1250	0.79

MonoRTM simulation for January, 2012

$M^{\text{SRF}} - M^{\text{Boxcar}}$



Summary

Difference between simulations using Boxcar SRF and measured SRF is within **0.3K**.

For NWP radiance assimilation, forward models need to consider the measured SRF.