SBAF Out of Band Tool Features

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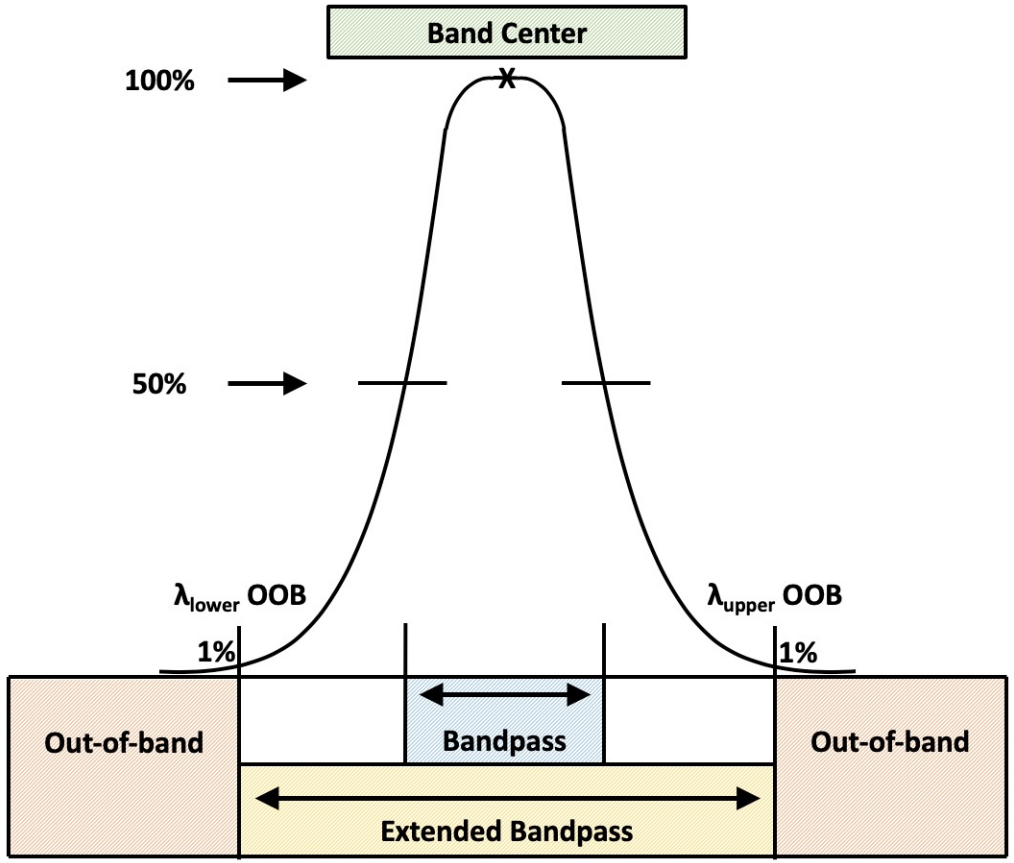
Background

- Well-characterized spectral performance is critical to the reliable on-orbit operation of Earth-monitoring instruments
- E.g., the NASA LaRC CERES project relies on RSR-dependent calibration adjustments and atmospheric transmissivity calculations for consistent flux measurements
- Complete pre-launch evaluation of sensor geometric performance is a necessary requirement in remote sensing
- Laboratory results are valuable, but cannot account for all observation conditions

Background

- Out of band (OOB) contribution to the total scene radiance depends on the spectral shape of the at-sensor radiance
- Difficult to tie the pre-launch spectral performance metrics to OOB behavior for specific Earth-viewed scenes
- **Intention of new tool feature is to help quantify the OOB contribution to the total signal for common Earth scene types**
- Useful for scene-dependent inter-calibration efforts, for environmental retrievals, and error considerations in cloud/aerosol property computations

Spectral Performance Metrics



Schematic of VIIRS spectral performance specification metrics

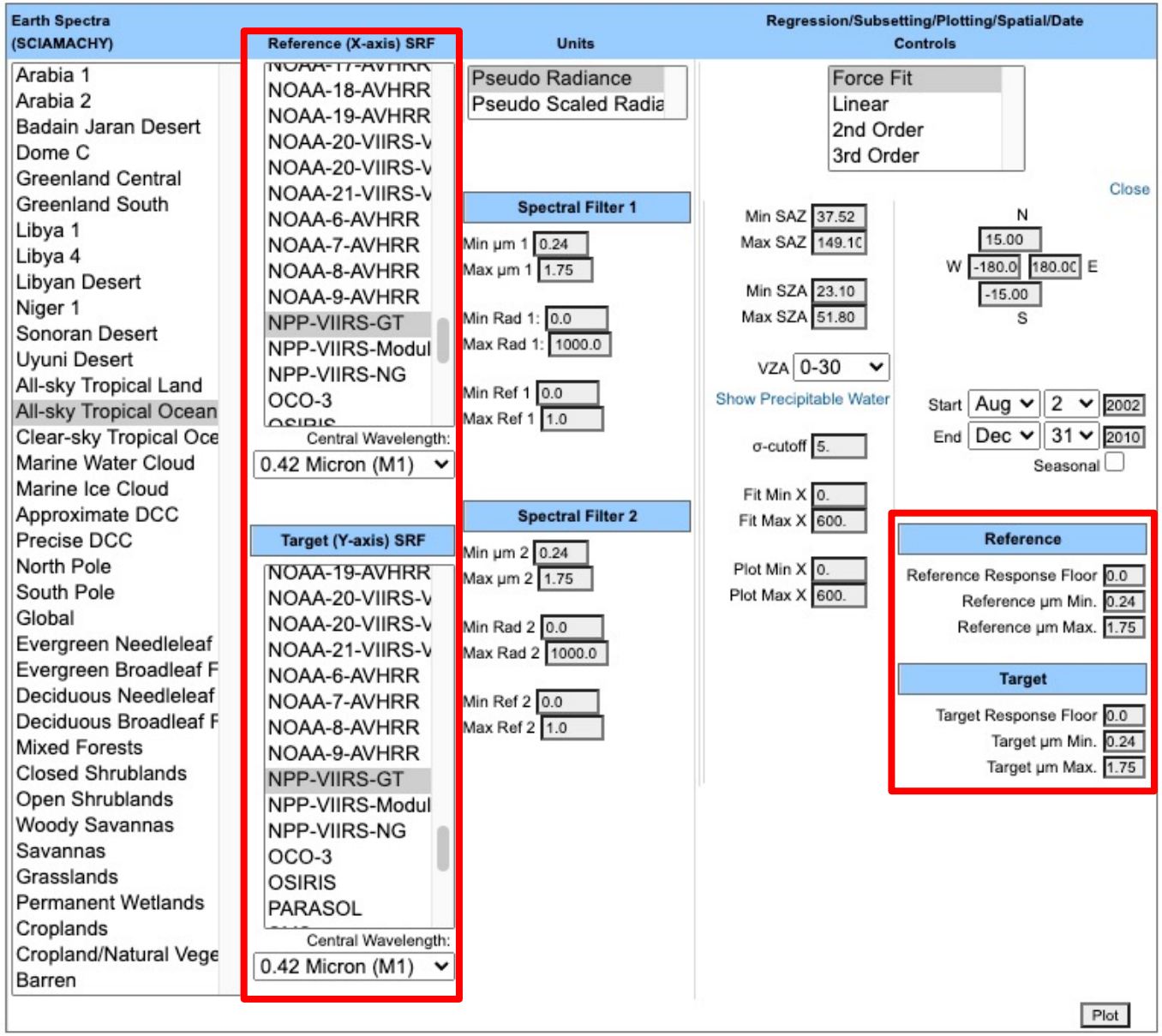
Band	VIIRS Specified		S-NPP VIIRS GT Measured		S-NPP VIIRS NG Measured		NOAA-20 VIIRS V2 Measured		JPSS-2 VIIRS V2 Measured	
	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper	Lower	Upper
I1	0.5650	0.7150	0.5832	0.6866	0.5830	0.6868	0.5944	0.6915	0.5941	0.6878
I2	0.8020	0.9280	0.8287	0.8979	0.8285	0.8978	0.8427	0.8923	0.8359	0.8981
I3	1.5090	1.7090	1.5431	1.6641	1.5413	1.6628	1.5443	1.6677	1.5486	1.6880
I4	3.3400	4.1400	3.4730	4.0090	3.4725	4.0093	3.4741	4.0152	3.4900	4.0405
I5	9.9000	12.9000	10.1910	13.0813	10.1702	13.0355	10.1708	13.0906	10.4751	12.7011
M1	0.3760	0.4440	0.3949	0.4268	0.3948	0.4267	0.3956	0.4251	0.3976	0.4235
M2	0.4170	0.4730	0.4314	0.4585	0.4313	0.4585	0.4292	0.4577	0.4345	0.4565
M3	0.4550	0.5210	0.4725	0.5065	0.4725	0.5026	0.4729	0.5044	0.4761	0.5013
M4	0.5230	0.5890	0.5298	0.5728	0.5298	0.5727	0.5402	0.5737	0.5418	0.5687
M5	0.6380	0.7060	0.6484	0.6938	0.6484	0.6937	0.6497	0.6851	0.6513	0.6937
M6	0.7210	0.7710	0.7302	0.7606	0.7302	0.7605	0.7342	0.7582	0.7364	0.7585
M7	0.8010	0.9290	0.8293	0.8980	0.8293	0.8979	0.8428	0.8925	0.8362	0.8983
M8	1.2050	1.2750	1.2135	1.2652	1.2105	1.2652	1.2140	1.2649	1.2257	1.2564
M9	1.3510	1.4050	1.3621	1.3900	1.3613	1.3899	1.3620	1.3900	1.3691	1.3977
M10	1.5090	1.7090	1.5426	1.6648	1.5420	1.6645	1.5457	1.6676	1.5487	1.6877
M12	3.4100	3.9900	3.5162	3.8900	3.5153	3.8905	3.5191	3.8938	3.5290	3.8749
M13	3.7900	4.3100	3.9005	4.2137	3.9004	4.2408	3.9091	4.2247	3.8665	4.1710
M14	8.0500	9.0500	8.3335	8.8759	8.3322	8.8755	8.3363	8.8793	8.2331	8.9251
M15	9.7000	11.7400	9.9187	11.6499	9.9162	11.6502	9.9169	11.6387	10.0329	11.3481
M16A	11.0600	13.0500	11.0951	12.6700	11.0684	12.6681	11.1041	12.6925	11.2984	12.6509
M16B	11.0600	13.0500	11.0983	12.6787	11.0727	12.6766	11.1015	12.6985	11.2986	12.6576
DNBM	0.4700	0.9600	-	-	-	-	0.4878	0.9069	0.4909	0.9003
DNBL	0.4700	0.9600	-	-	-	-	0.4910	0.9001	0.4907	0.9012

Lower and upper 1% extended bandpass limits (μm) as provide by Moeller et al.

* Recreated from the works of Moeller et al. and Schwarting et al.

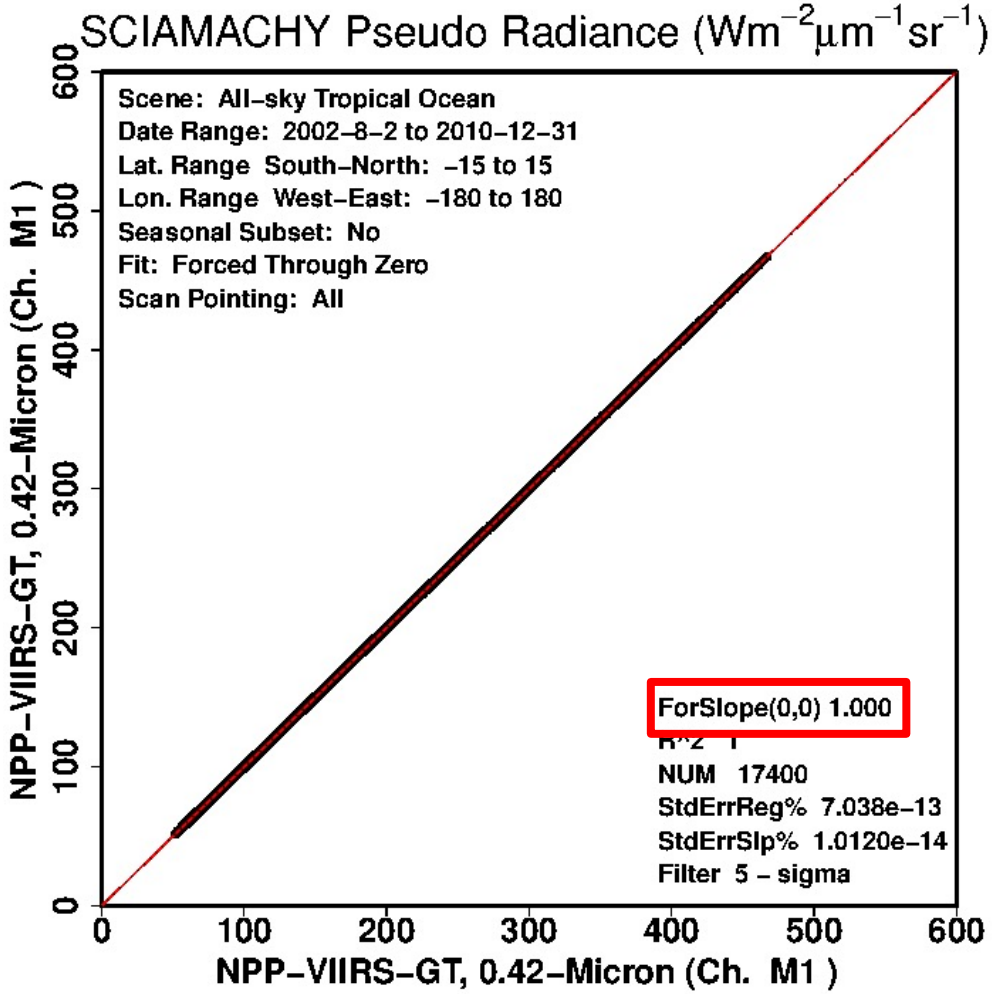
New SBAF Tool Feature

- NASA Langley SBAF Tool
  - satcorps.larc.nasa.gov/SBAF
  - cloudsway2.larc.nasa.gov/SBAF (backup)
  - Or follow NASA/Langley/Calibration link on GSICS page
- SRF bandpass filter controls found under advanced options, lower right side
- Specify λ_{lower}OOB and λ_{upper}OOB for selected reference or target SRF
- Result will demonstrate effect of truncating the SRF as the given limits in terms of a spectral difference correction
- Option available to ignore response below a certain level



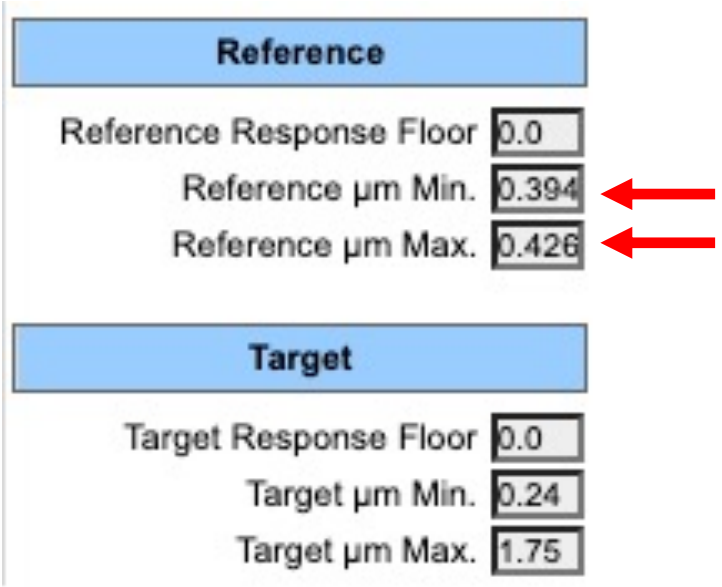
New SBAF Tool Feature

Zoomed view of tool OOB options (default)

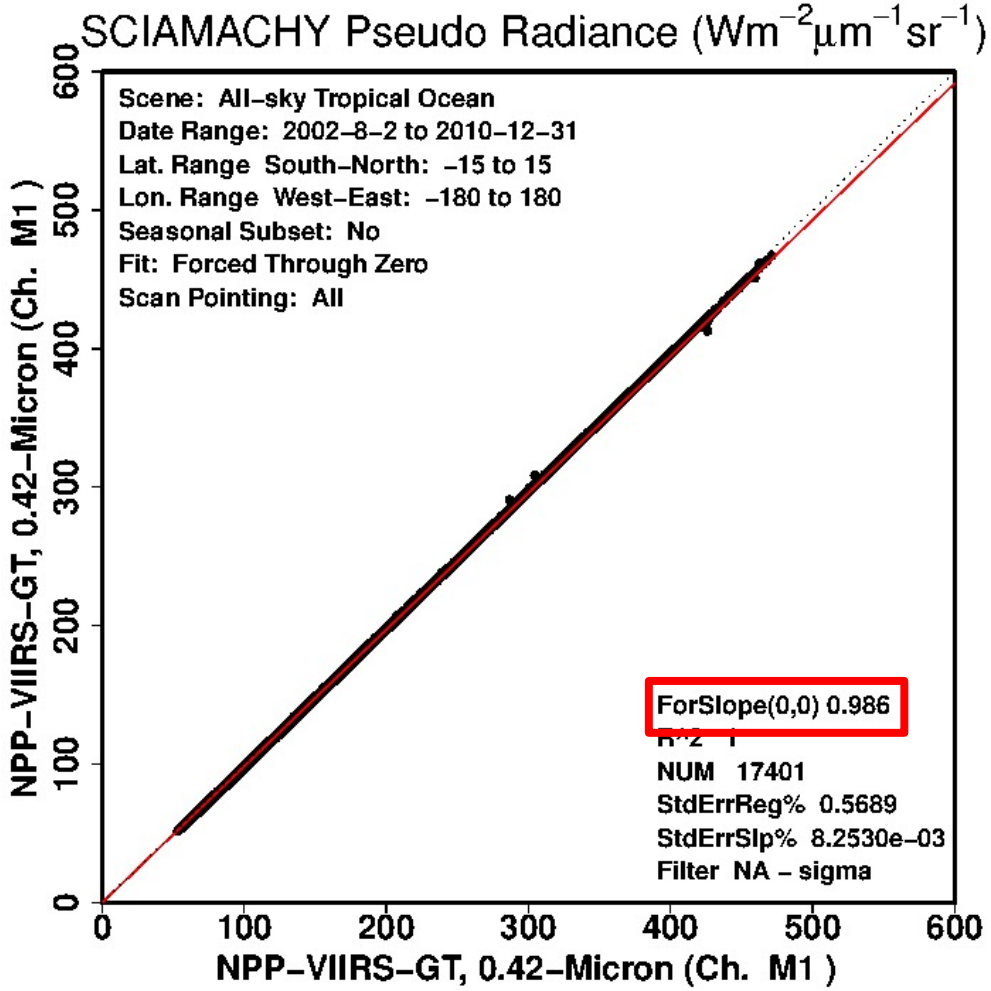


Resultant spectral correction owed to OOB contributions (no adjustment with no OOB specified)

New SBAF Tool Feature



Zoomed view of tool OOB options
(S-NPP-VIIRS GT Band M1 measured limits)



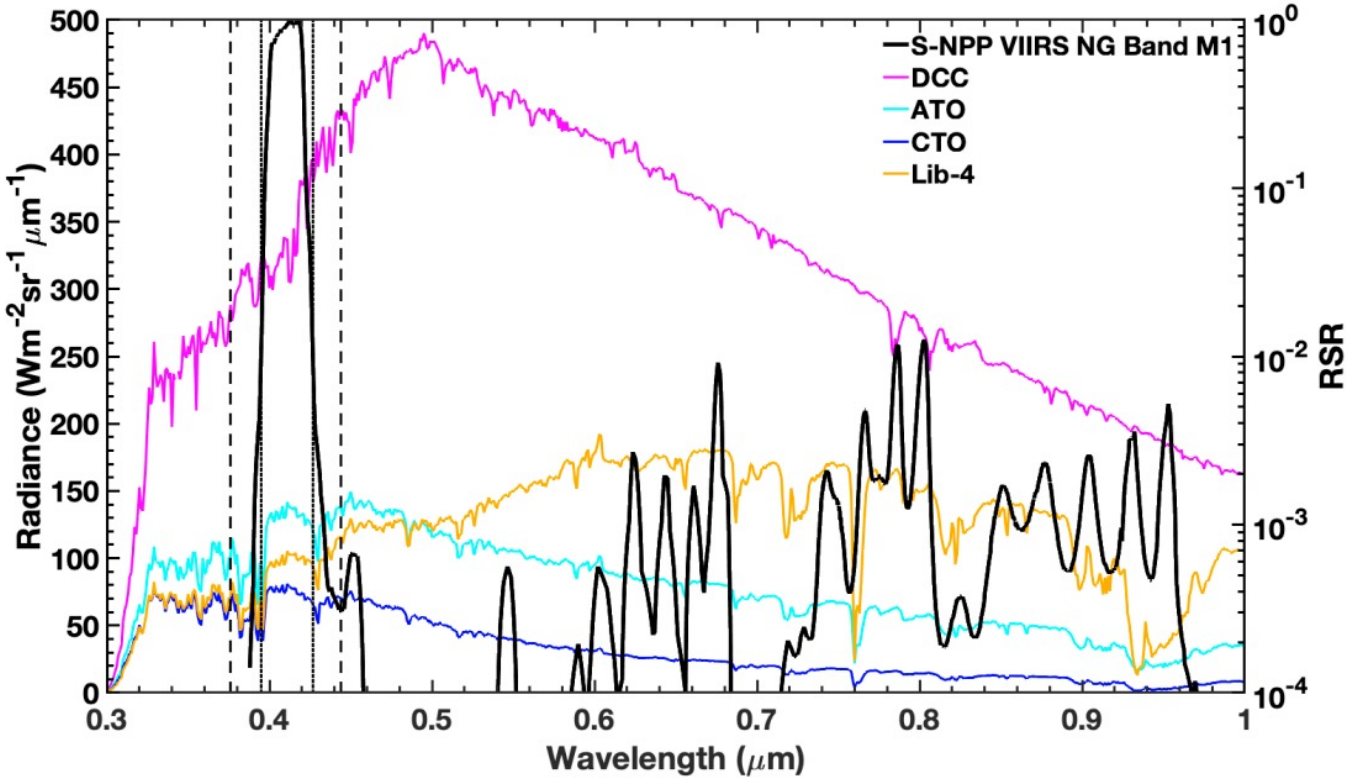
Resultant spectral correction owed to OOB contributions
(1.4% spectral band adjustment)

Common Earth Targets

Band	DCC	ATO	CTO	Lib-4	Uyuni	Forest	Shrubland	Woodland	Grassland	Wetland	Cropland
I1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I2	0.10	0.05	0.16	0.08	0.03	0.16	0.07	0.11	0.08	0.11	0.11
I3	0.00	0.04	0.03	0.03	0.02	0.05	0.02	0.04	0.03	0.03	0.04
M1	**0.83**	**1.69**	**2.50**	**1.27**	0.40	**1.08**	0.10	**1.24**	**0.64**	**1.58**	**0.89**
M2	0.35	**0.61**	**0.94**	0.49	0.16	**0.55**	0.03	**0.52**	0.24	**0.67**	0.39
M3	0.48	**0.64**	**0.90**	0.20	0.30	0.18	0.08	0.32	0.16	0.41	0.21
M4	0.27	0.19	0.04	0.24	0.22	0.38	0.27	0.16	0.10	0.37	0.10
M5	0.01	0.04	0.45	0.40	0.15	**1.94**	0.28	**0.74**	0.02	**1.19**	**0.56**
M6	0.02	0.06	0.09	0.31	0.12	**0.51**	0.33	0.37	0.30	0.38	0.40
M7	0.12	0.06	0.18	0.08	0.04	0.18	0.07	0.13	0.08	0.13	0.12
M8	0.03	0.08	0.10	0.10	0.06	0.12	0.10	0.11	0.10	0.11	0.11
M9	0.00	0.02	0.22	**1.27**	0.09	0.41	**1.01**	**0.79**	0.79	**0.59**	**0.85**
M10	0.01	0.04	0.04	0.03	0.02	0.05	0.03	0.04	0.03	0.02	0.04

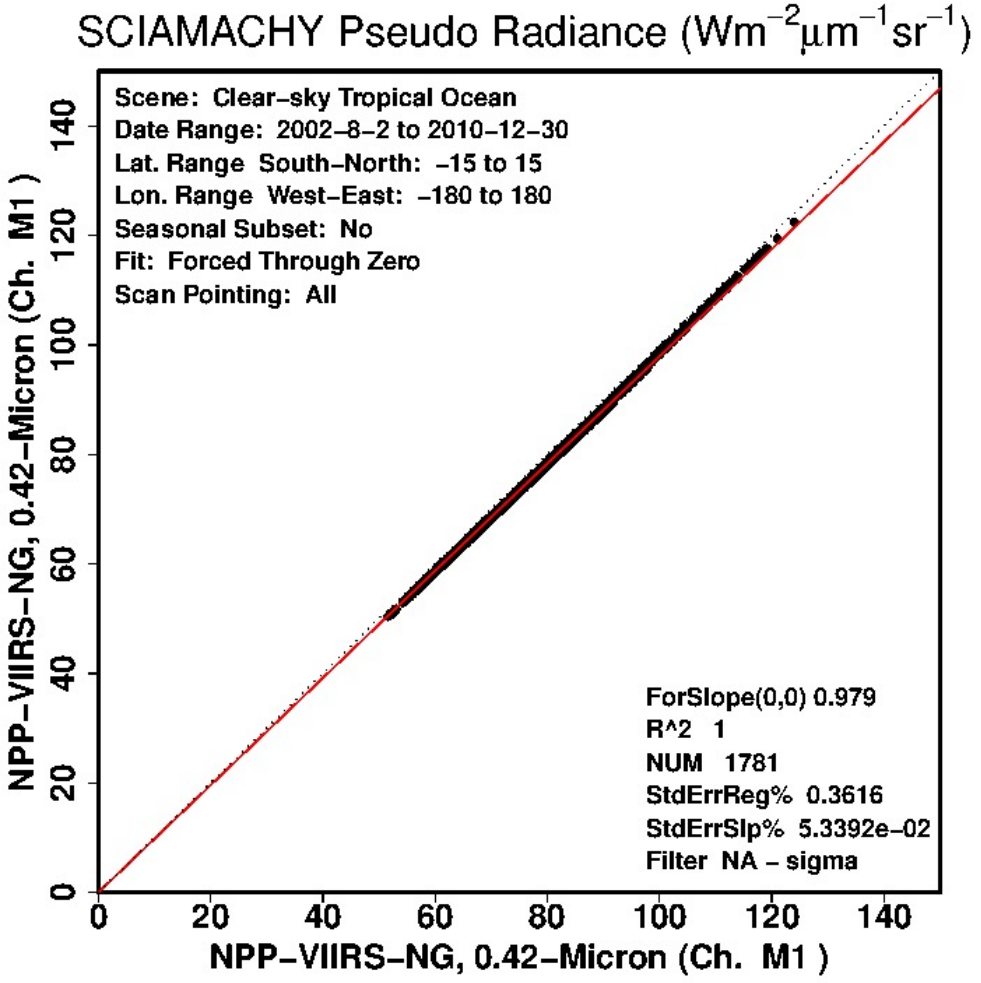
OOB contributions (%) for common earth targets (S-NPP VIIRS NG)

Scene Examples



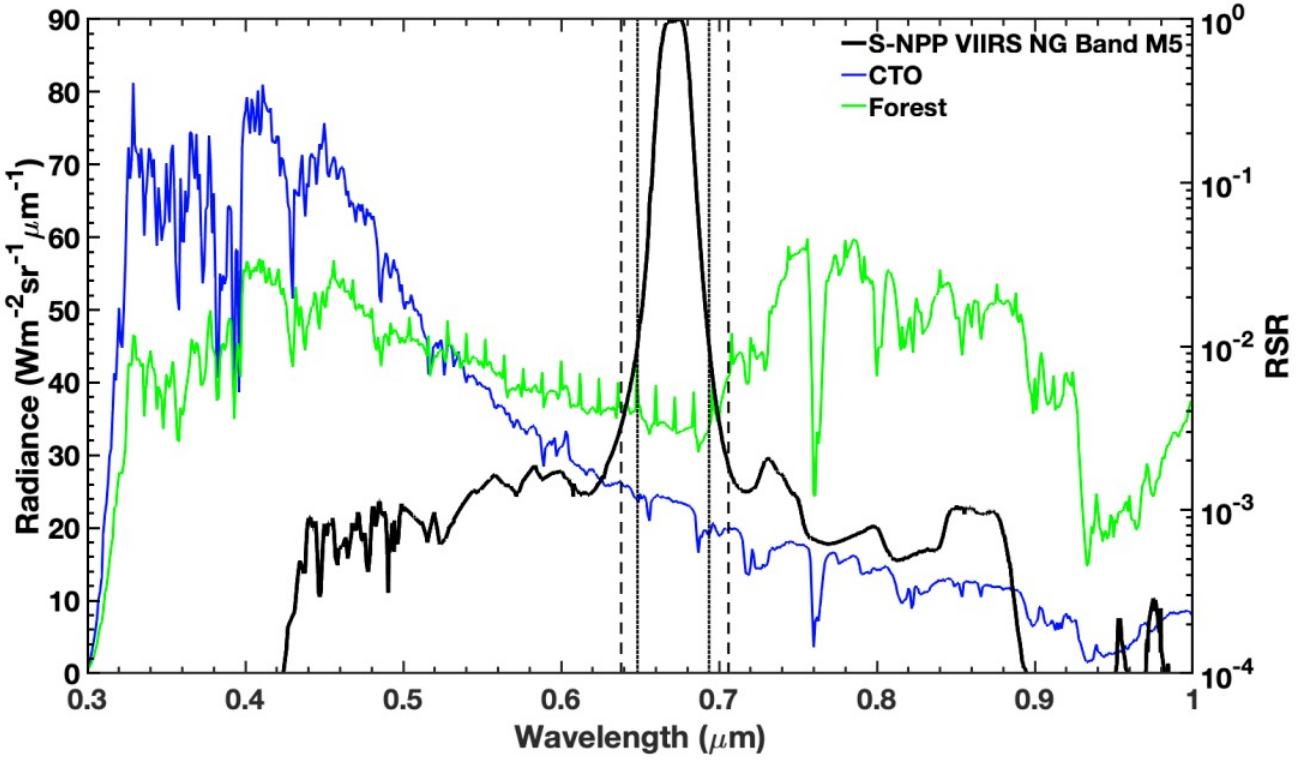
S-NPP VIIRS NG band M1 RSR with SCIAMACHY Earth-reflected radiance

Vertical dotted lines indicate the measured lower and upper 1% response limits

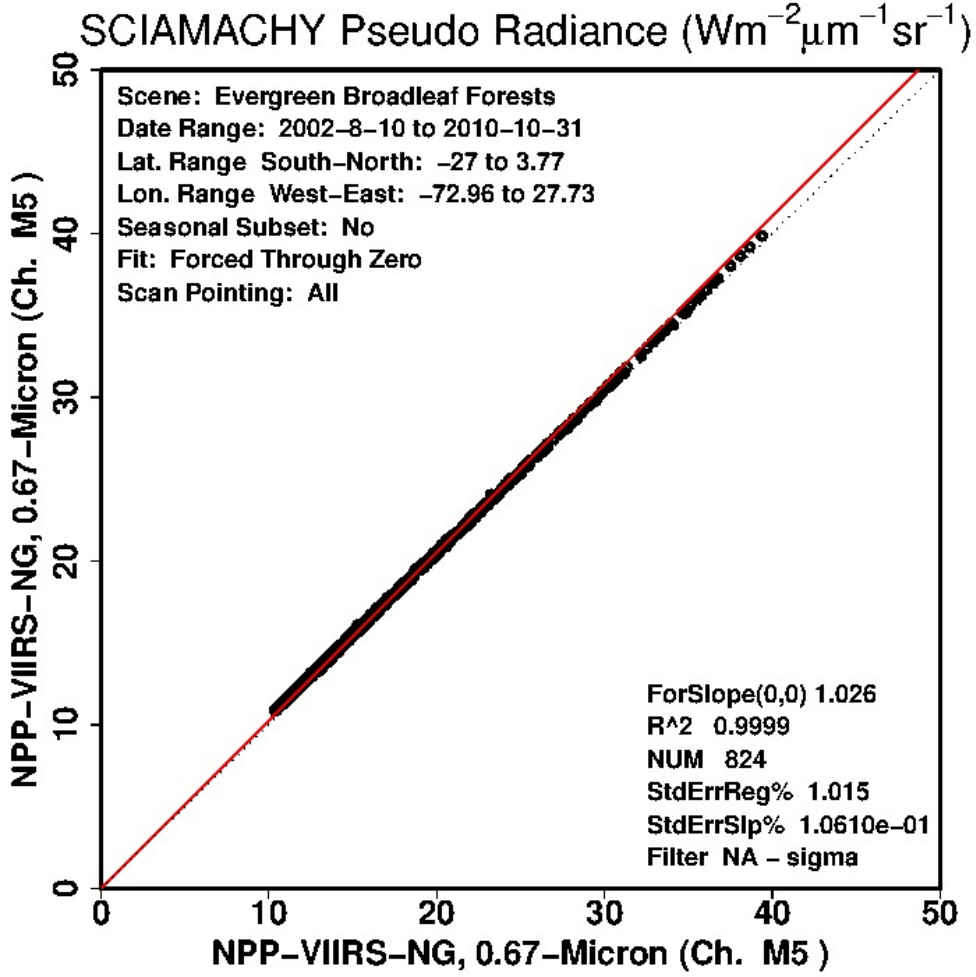


(2.1% spectral band adjustment)

Scene Examples

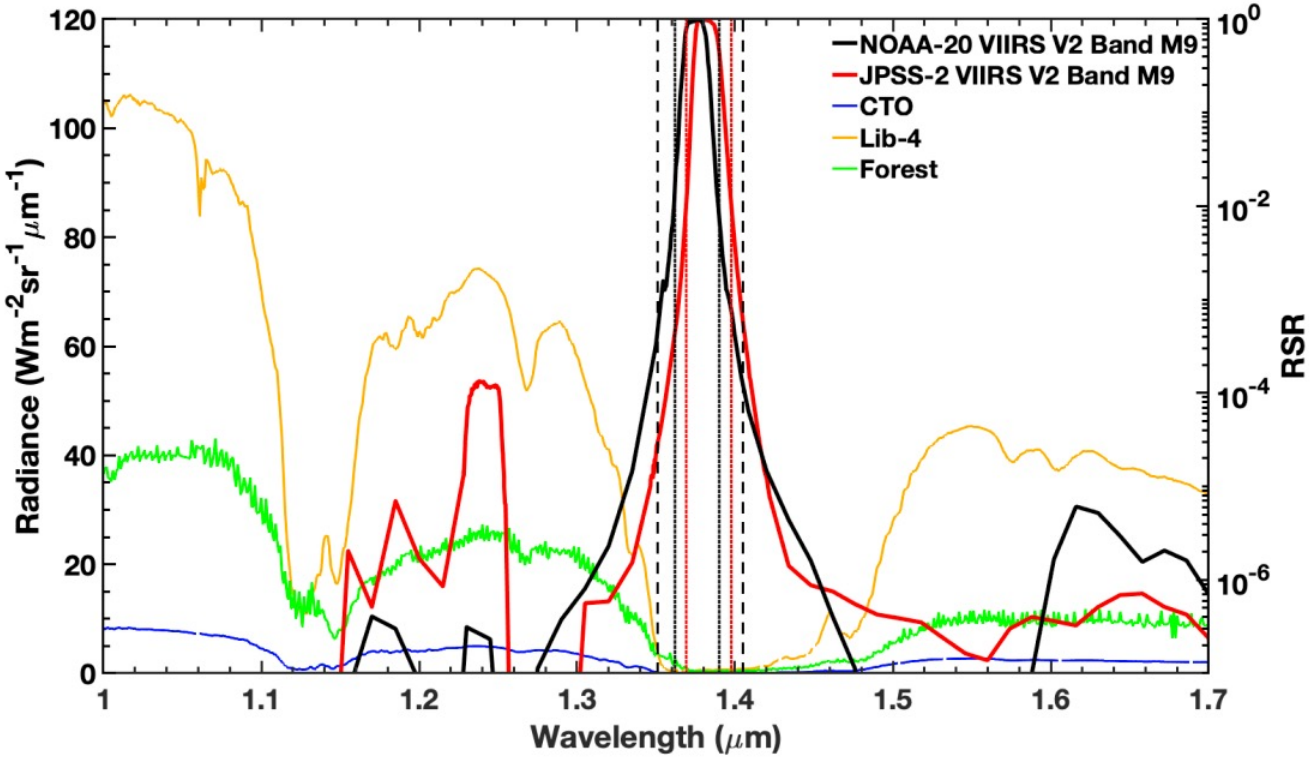


S-NPP VIIRS NG band M5 RSR with Clear-sky Tropical Ocean and Forest



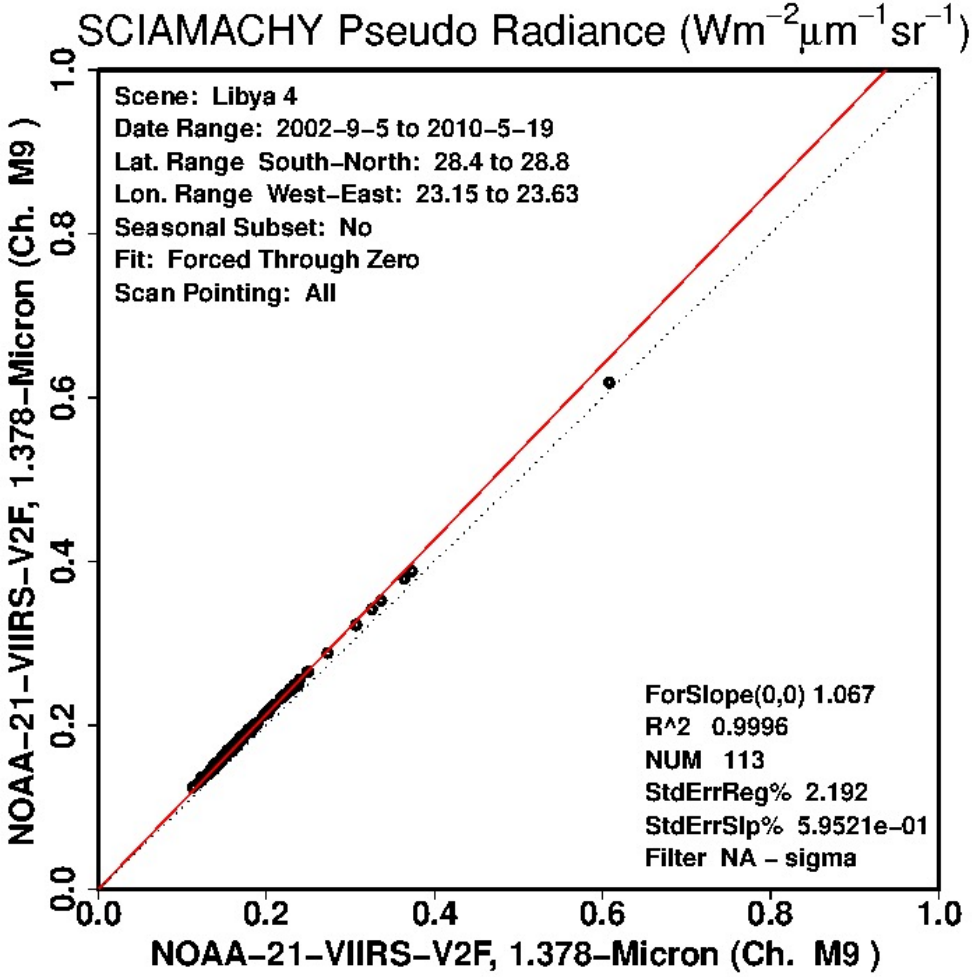
(2.6% spectral band adjustment)

Scene Examples



NOAA-20 and JPSS-2 VIIRS band M9 RSR with Libya-4

Black and red dotted lines show measured lower and upper 1% response limits for NOAA-20 and JPSS-2, respectively



(6.7% spectral band adjustment)

Conclusions

- Examination of OOB contribution can be valuable, especially for VIIRS I1 and M5 bands
- OOB influence may impact certain environmental retrieval applications, e.g., NDVI determinations, atmospheric transmissivity estimates
- In practice, the contributions may be small relative to overall uncertainty
  - Nevertheless, important to quantify
  - Quality Assurance
- **Tool could find use in characterizing scene-dependent OOB contribution pre-launch (e.g., JPSS-2)**