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S2 dynamic range assessment – supporting S2 Next Gen

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The Sentinel-2 Next Generation (S2NG) mission

Follow-on to current S2 mission.

Key is “*enhanced continuity*”: Keep high L1+L2 data quality of S2 while improving where possible.

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Updates:

Some new bands

Improved spatial resolution

Tightening of cal/val requirements

Synergy with other missions

Current requirements for S2NG, enhancements highlighted →

Band	SSD current [m]	SSD [m]	C Wvl [nm]	BW [nm]	Lref	SNR
0		20	412	20	45.00	130
1 (H)	60	20	443	20	129.11	332
1a		20	475	20	90.70	190
2 (H)	10	5	490	65	128.00	106
2a		0	520	15	80.50	120
3 (H)	10	5	560	35	128.00	121
3a		20	620	30	29.80	200
3b		20	650	20	29.80	200
4 (H)	10	5	665	30	108.00	115
5 (H)	20	10	705	15	74.60	124
6 (H)	20	10	740	15	68.23	111
7 (H)	20	10	783	20	66.70	116
8 (H)	10	5	842	115	103.00	115
8a (H)	20	10	865	20	52.39	84
9 (H)	60	60	945	20	8.77	166
9a		60	985	20	56.40	90
10 (H)	60	60	1375	30	6.00	400
11 (H)	20	10	1610	90	4.00	84
12a	20	10	2130	50	1.70	50
12b	20	10	2210	50	1.70	50
12c	20	10	2260	50	1.70	50

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New bands

B0 @ 412nm:

Main application: Water color

B1a @ 475nm:

Main application: Vegetation (carotenoids), water color.

B2a @ 520nm:

Main application: Land status and vegetation parameters.

B3a @ 620nm, B3b @ 650nm:

Main application: Water quality, cyanobacteria

B9a @ 985nm:

Multi-use band: Leaf water content, water vapor column, snow grain size, etc

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Modified band

B12 -> B12a/b/c @ 2130, 2210, 2260nm

S2NG has no dedicated B12 like S2

Instead, three new bands – optimised for non-productive vegetation analysis

Also useful for methane detection.

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Other new / updated features for S2NG

Focus on data quality:

Fundamental part of the mission – improved on ground characterisation and uncertainty analysis.

Tight requirements on band performance.

More cal/val information for users.

Focus on interoperability:

Including interoperability during development. Synergy with other Copernicus missions, Landsat, etc.

Will be looking at ways to make data more accessible and cloud-compatible.

New observations:

Potential twilight data collects to support sea ice / snow monitoring in polar regions.

Night-time observation scenarios under consideration.

Expanded coverage mask, including all maritime EEAs.

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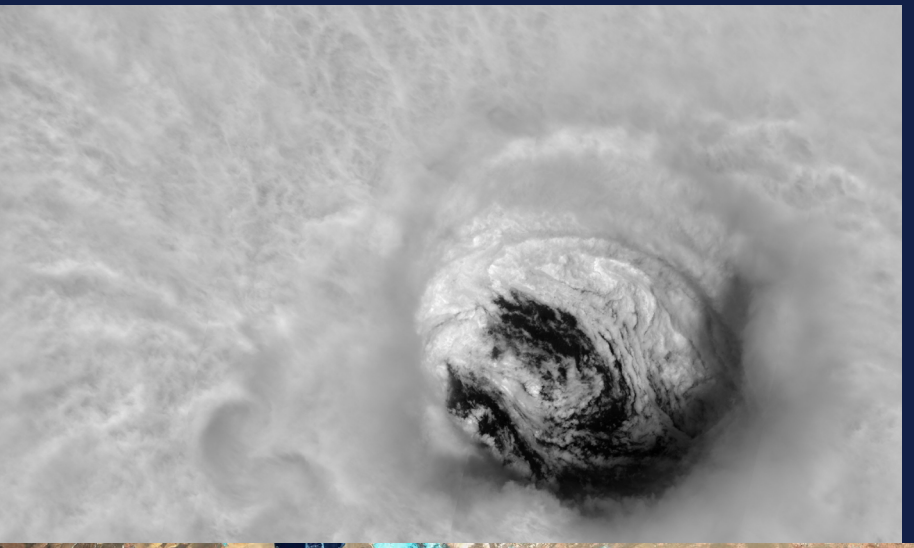
Open to ideas!



Please contact me with your thoughts, feedback, etc on what we optimise and update for S2NG!

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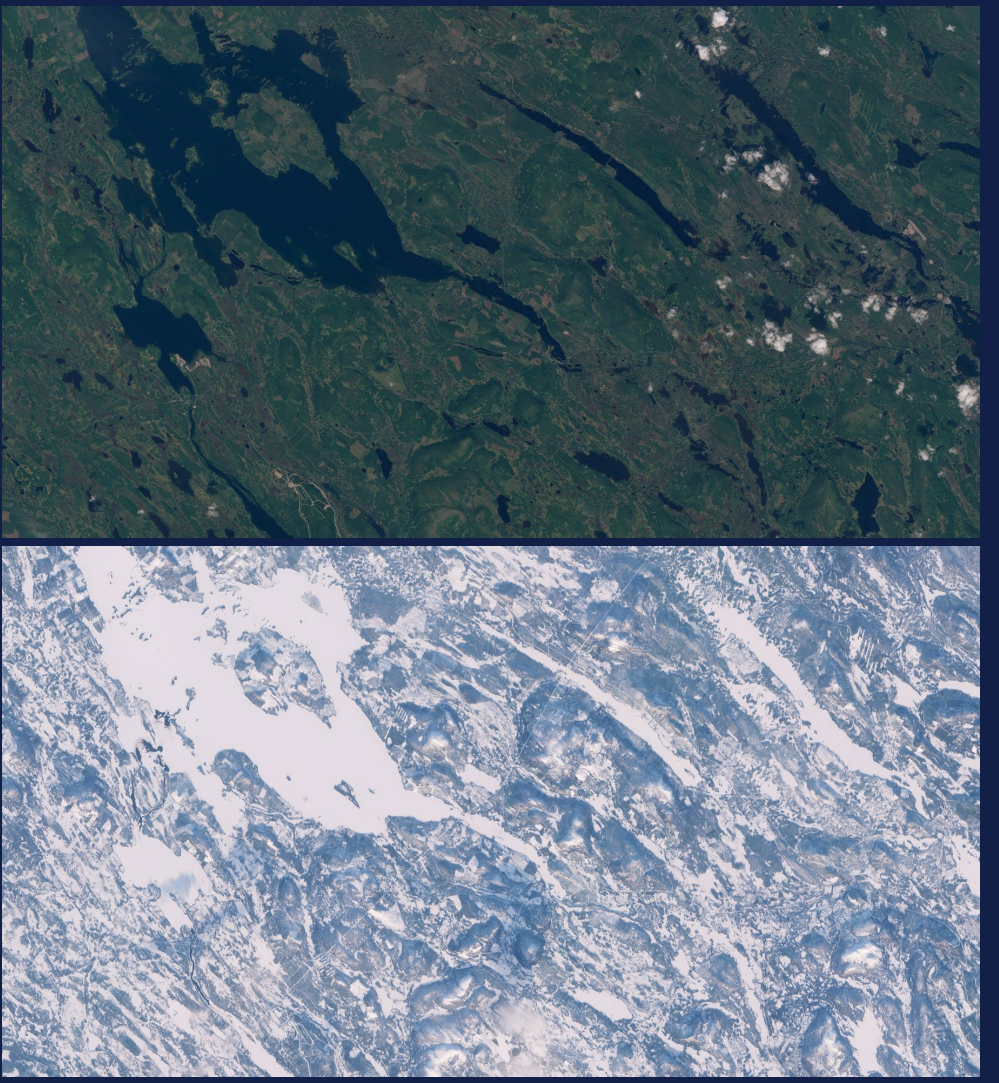
Dynamic range – current gen and next gen

What is dynamic range?



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Dynamic range – current gen and next gen

What is dynamic range?

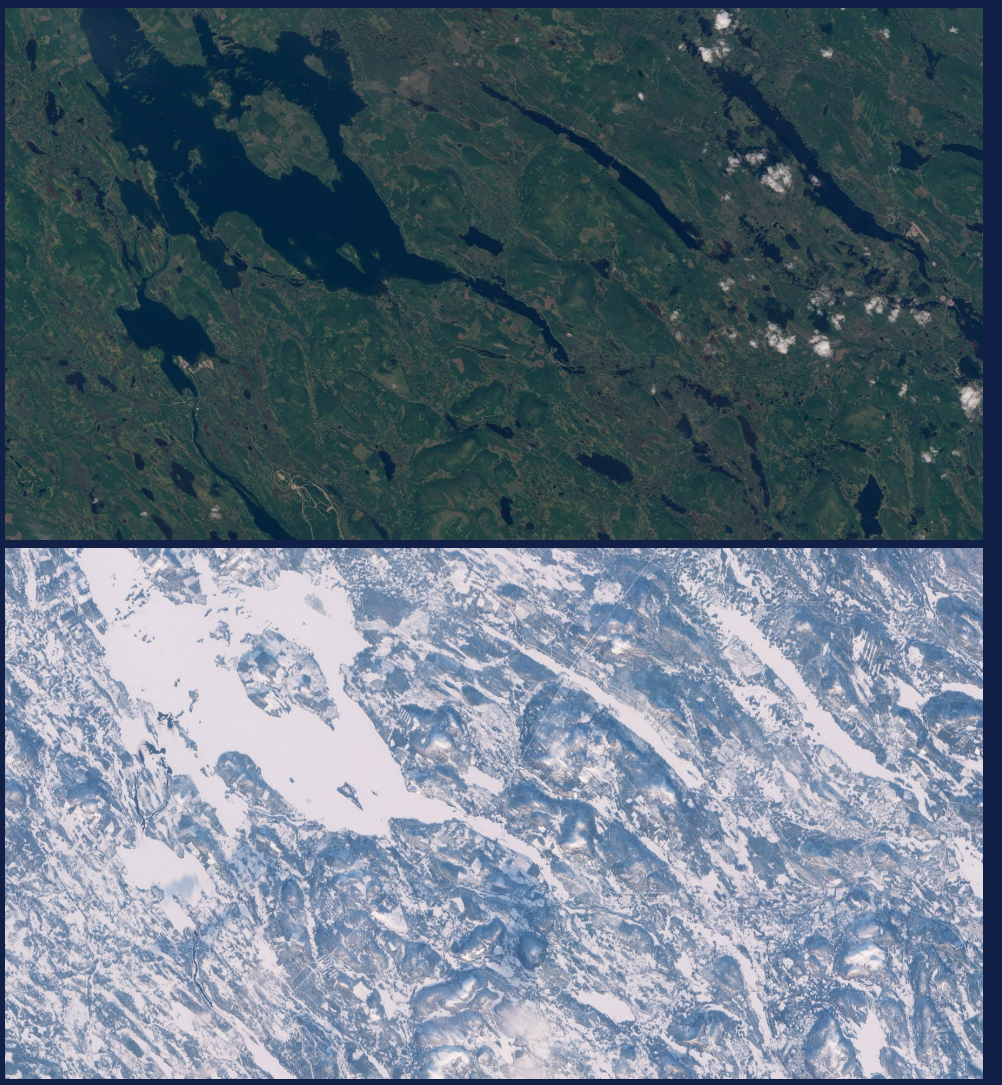
The range of radiances over which a channel is sensitive.

For current gen:

L_{min}: *Minimum radiance where a signal is detectable from noise.*

L_{ref}: *The reference radiance, for which the SNR is defined.*

L_{max}: *The maximum radiance, above which saturation may occur.*



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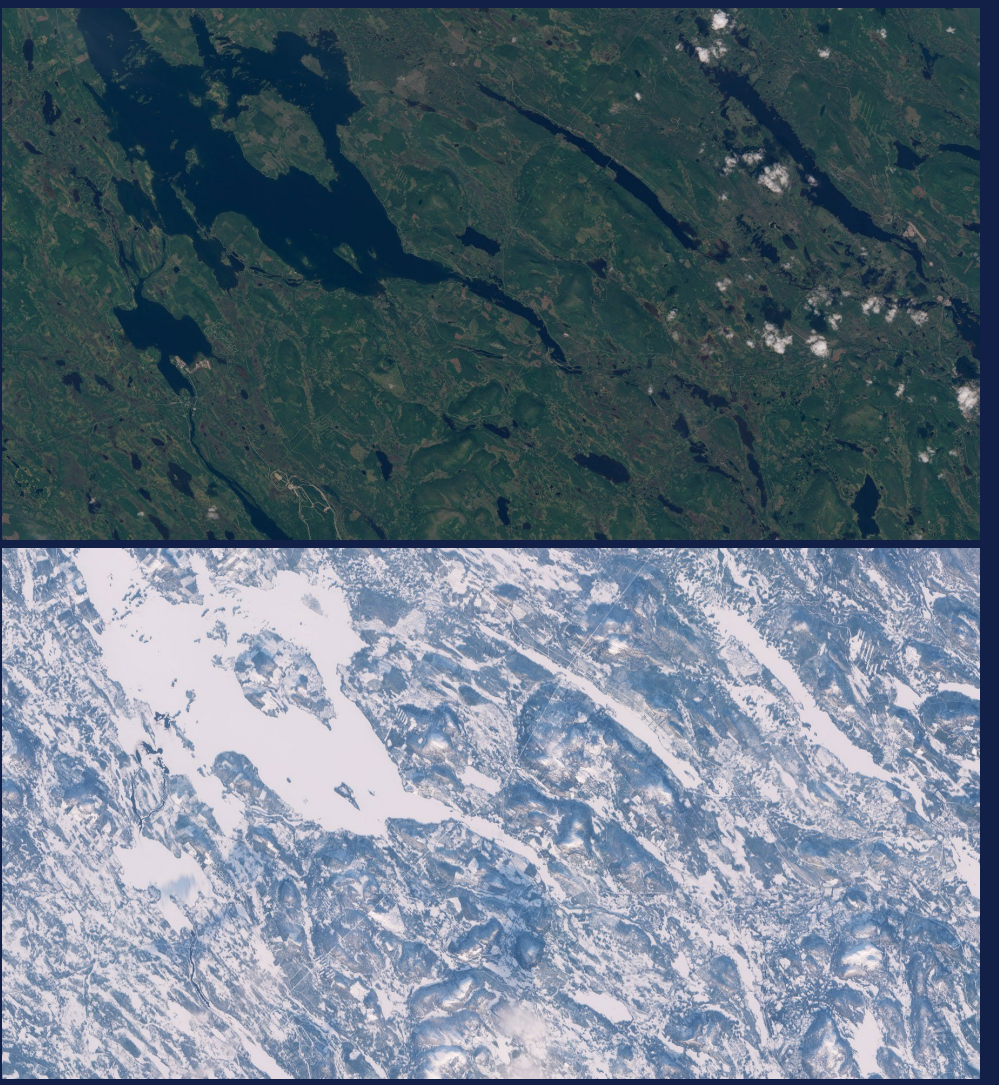
For next gen, one more:

L_{low}: *The lowest radiance where calibration requirements apply.*



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Dynamic range – analysis

Goal

To assess current gen dynamic range in all channels and ensure next gen performance meets current gen, allowing baseline continuity of user applications.

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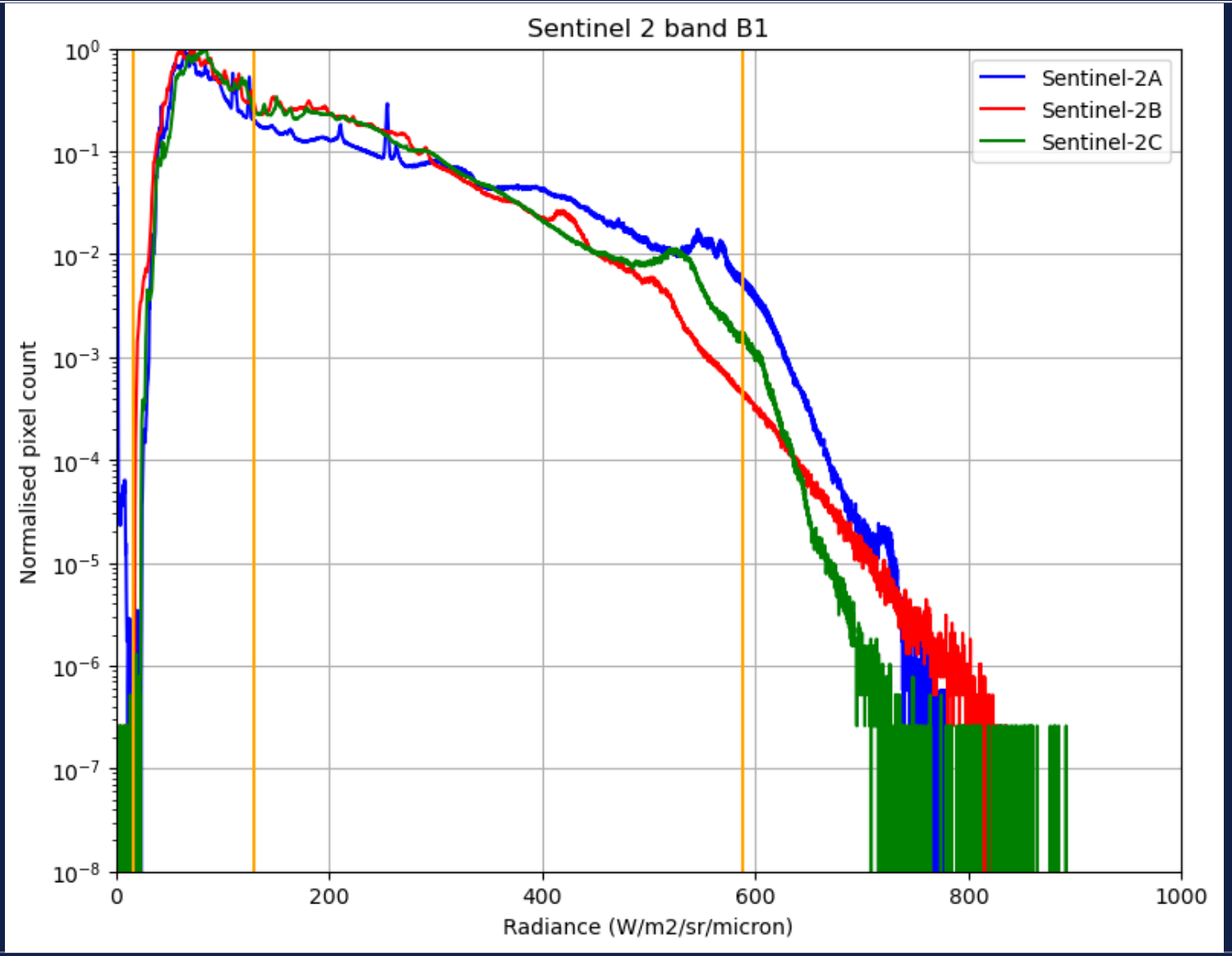
Dynamic range – B1



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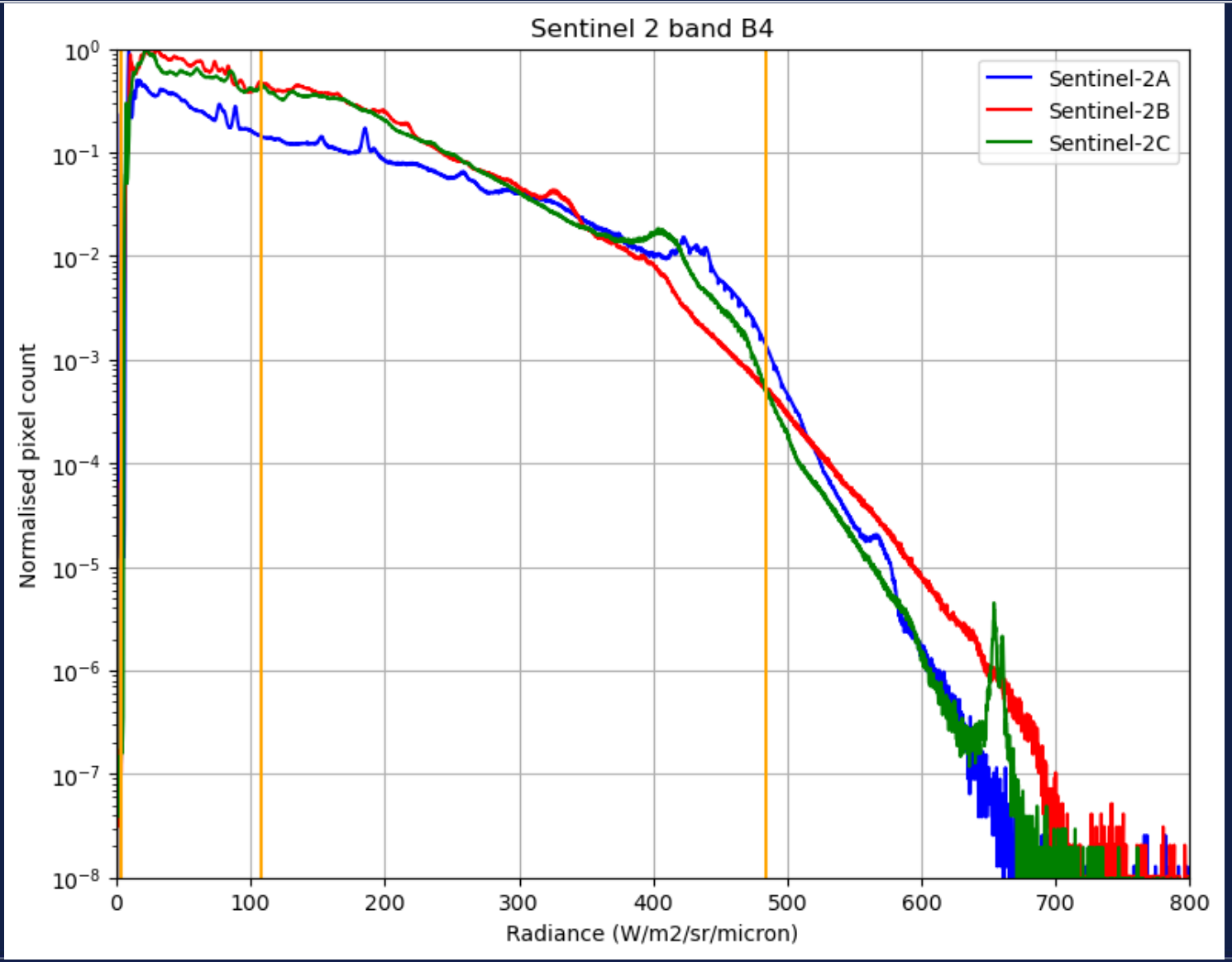
Dynamic range – B4



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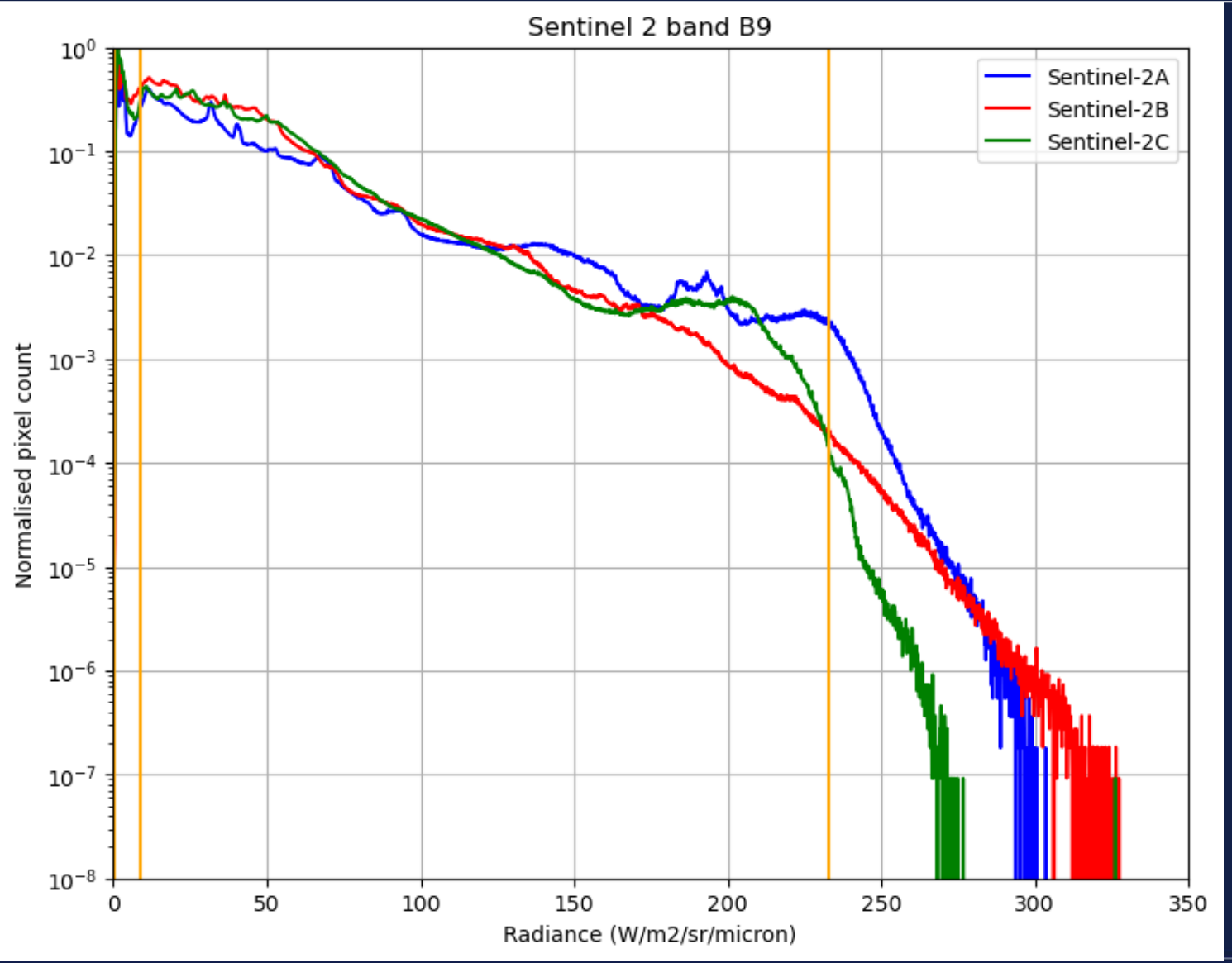
Dynamic range – B9



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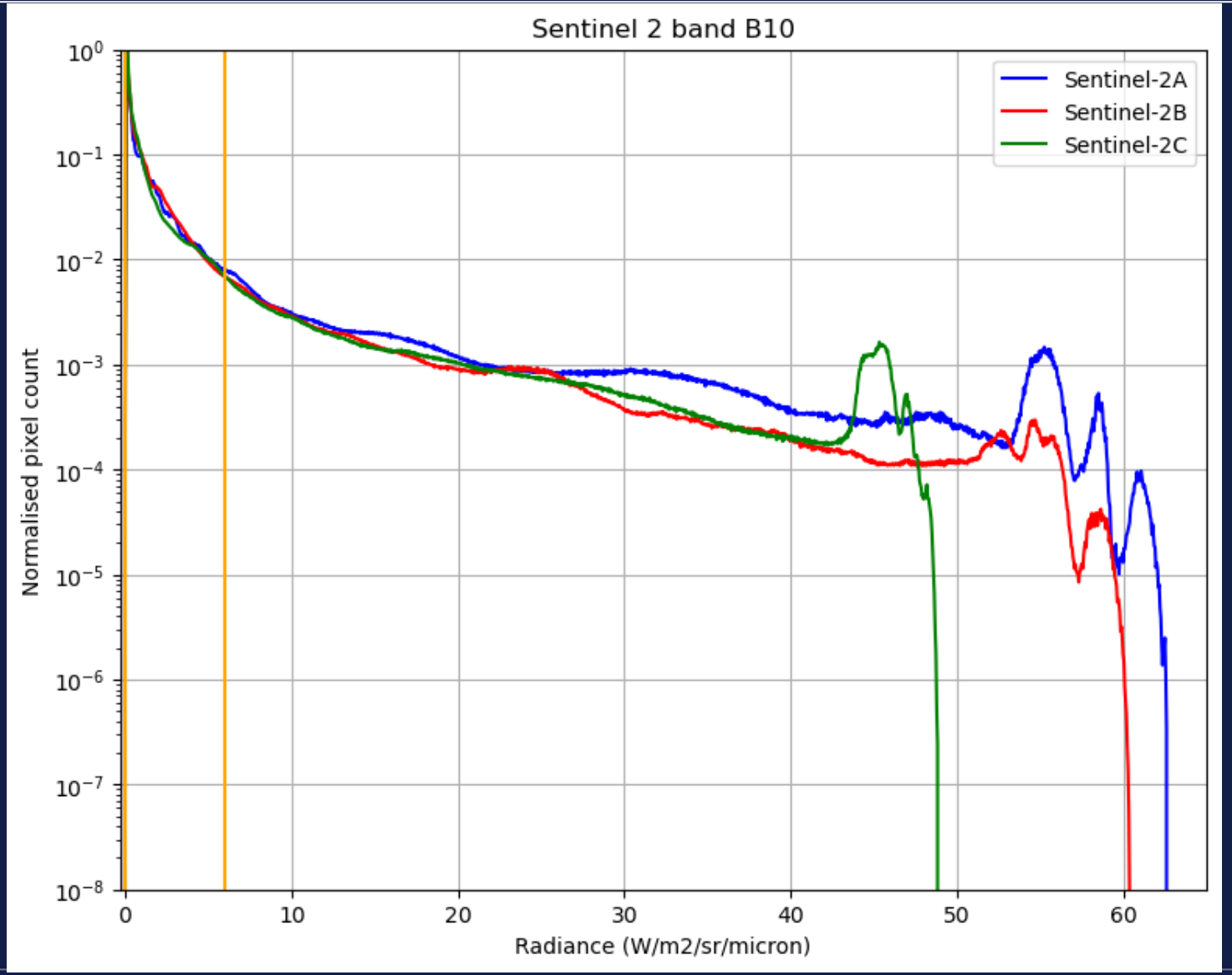
Dynamic range – B10



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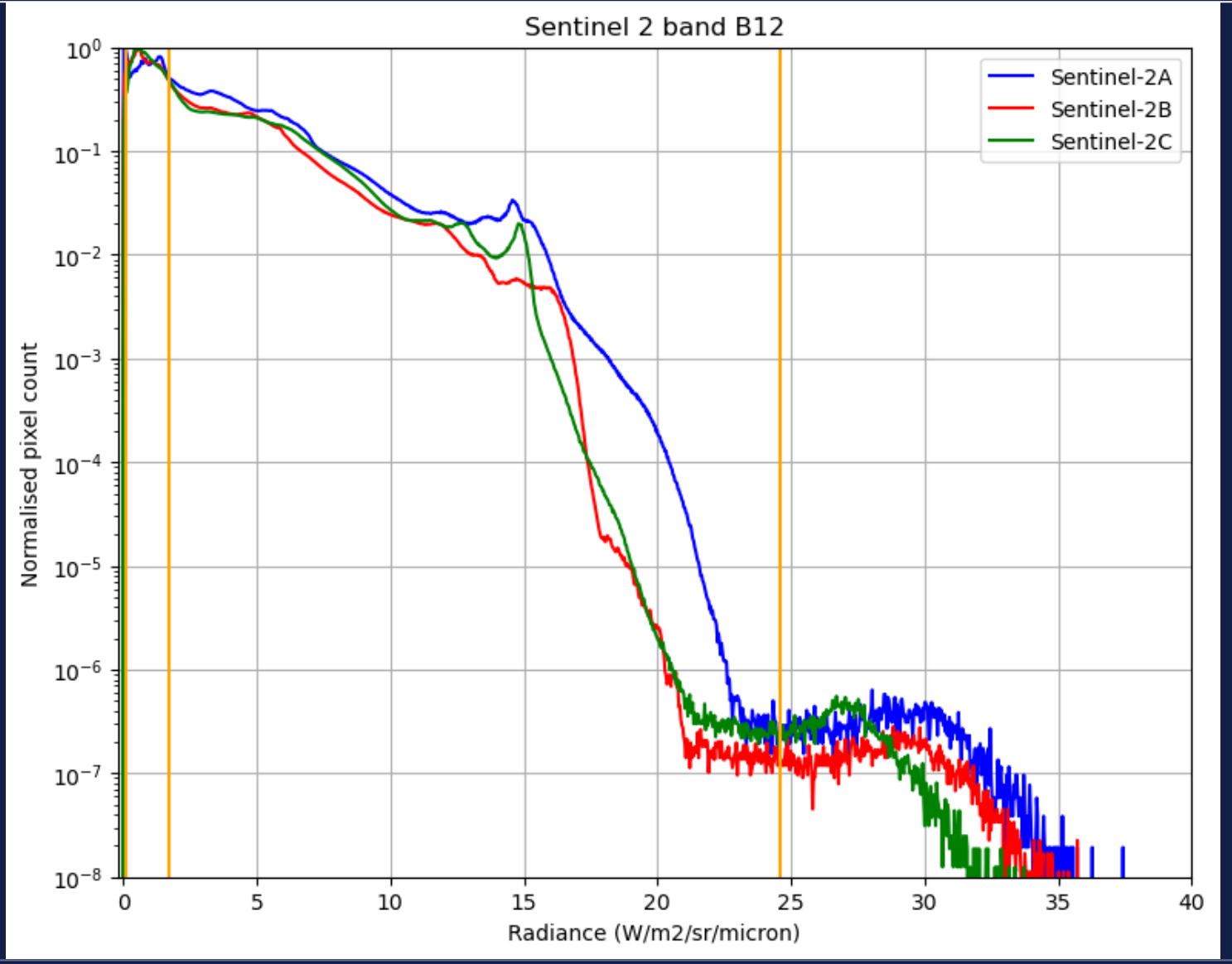
Dynamic range – B12



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Conclusions

Sentinel-2 first generation has excellent performance!

Often exceeding the mission requirements.

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Conclusions

Sentinel-2 first generation has excellent performance!

Often exceeding the mission requirements.

But…some opportunities for tuning bands on the next gen – B10 for example.

Some bands very tricky, like B12, due to need for both low and high radiance sensitivity – hard to optimised.