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Supplementary Materials for

Environmental risks from artificial nighttime lighting widespread and increasing across Europe

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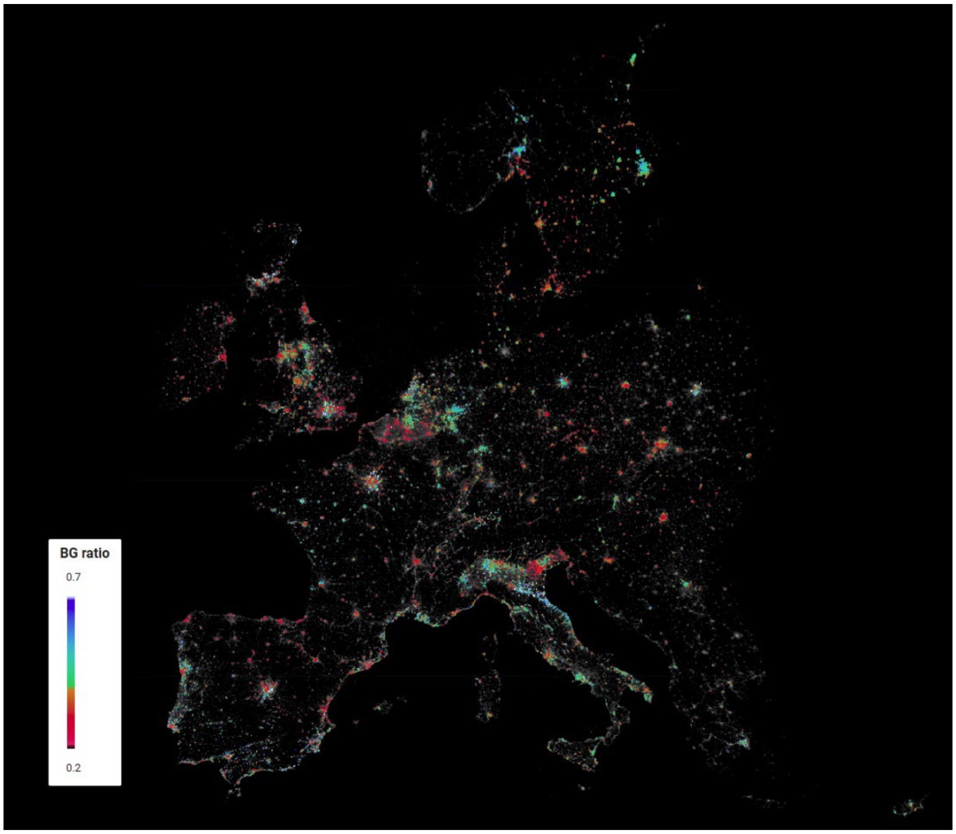
The PDF file includes:

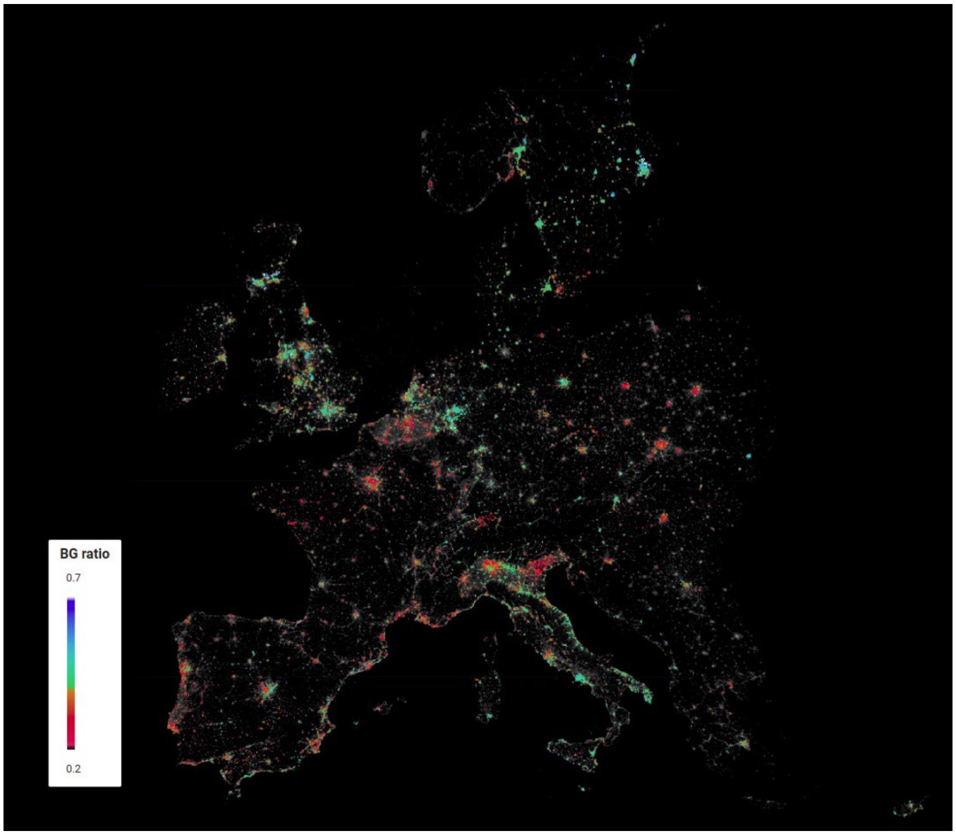
Figs. S1 to S3
Tables S1 and S2

Other Supplementary Material for this manuscript includes the following:

Data S1 and S2

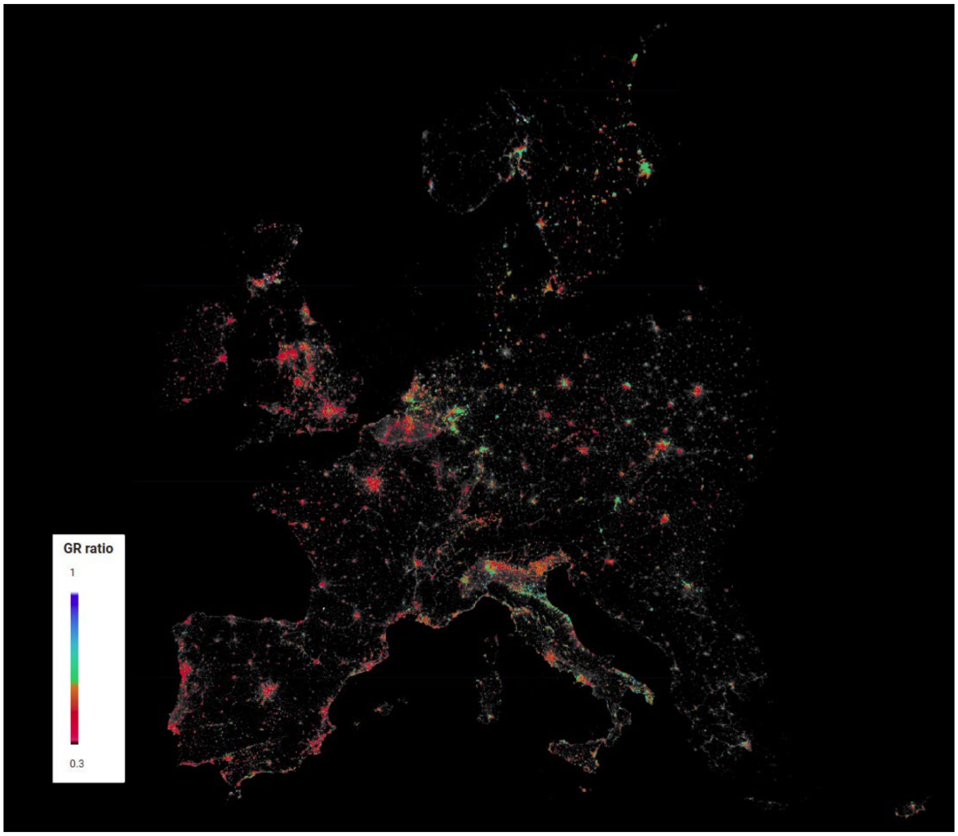


(a)



(b)

(c)



(d)

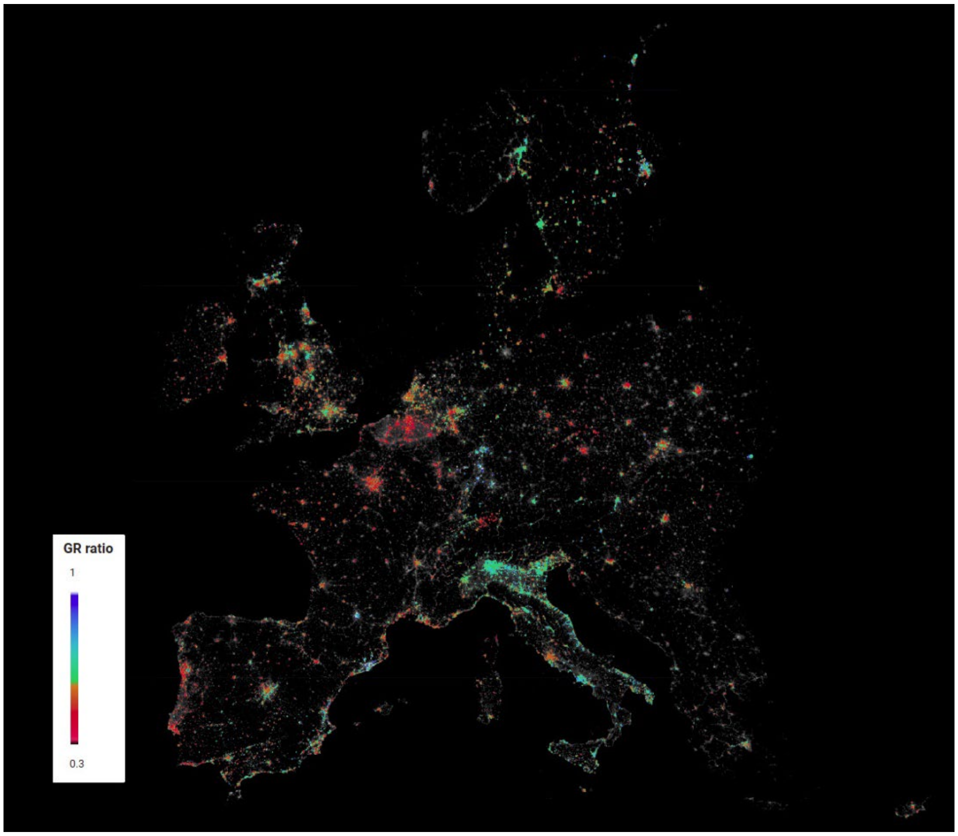


Fig. S1. Variation in (a) B/G pre-2013, (b) B/G post-2013, (c) G/R pre-2013 and (d) G/R post-2013.

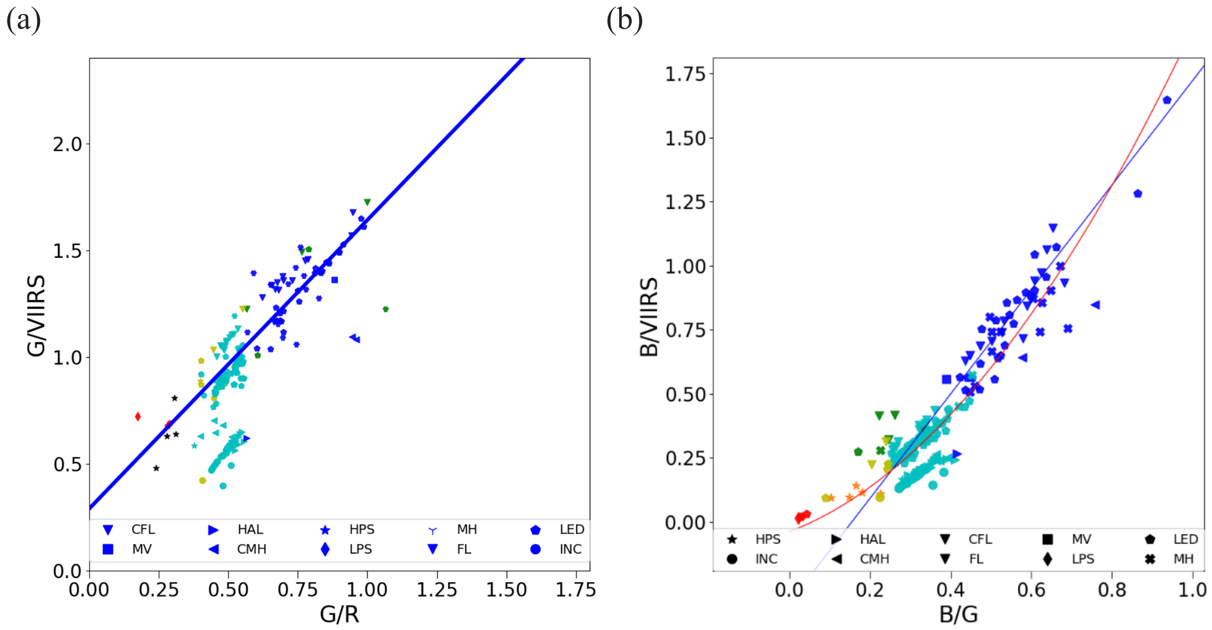


Fig. S2. Relationships between the ratios of (a) G and (b) B bands with VIIRS intensity and the (a) G/R and (b) B/G band ratios determined for the spectra of different kinds of lamps (different symbol shapes; HAL - Halogen, MH - Metal Halide, CMH - Ceramic Metal Halide, CFL - Compact Fluorescent, FL - Fluorescent, HPS - High Pressure Sodium, LPS - Low Pressure Sodium, and INC – Incandescent). Symbol colours represent different broad classes of blue content (see *18*). See (*18*) for further details.

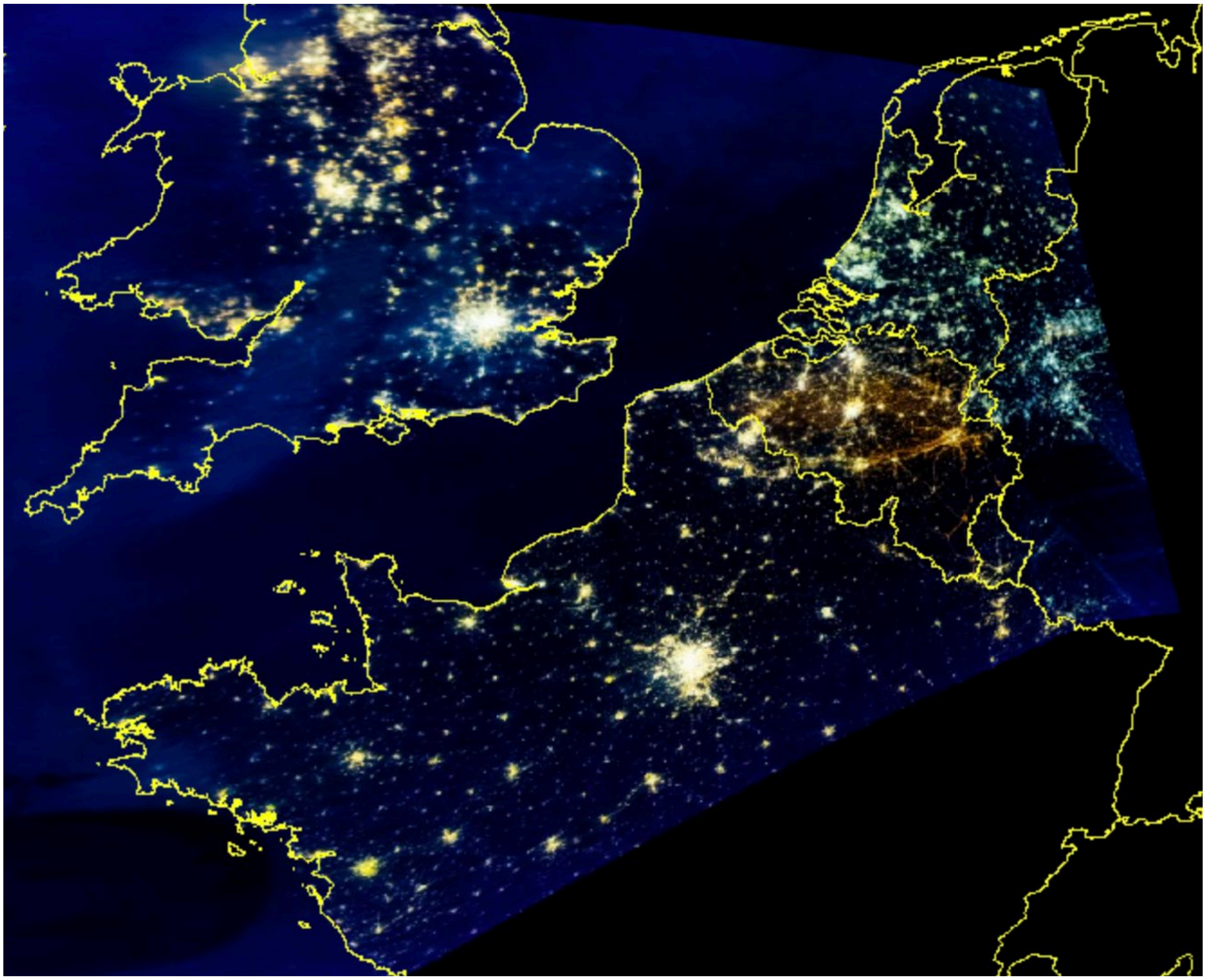


Fig. S3. Reprojected version of Fig. 3 with country boundaries.

Table S1. Changes in colour ratios of nighttime light emissions for different European countries. For each country the median and I.Q.R. of blue/green (B/G) and green/red (G/R) ratios are given for 2012-2013 and 2014-2020, the Kruskal-Wallis Chi-squared values testing whether the ratio values (per pixel) for the two time periods originate from the same distribution, and the associated significance levels.

Country	**B/G ratio**				**G/R ratio**			
	pre-2013	**post-2013**	**K-W**	**p-value**	**pre-2013**	**post-2013**	**K-W**	**p-value**
Albania	0.38± 0.18	0.41± 0.12	14.11	<0.001	0.53± 0.23	0.63± 0.28	57.87	<0.001
Austria	0.41± 0.10	0.41± 0.17	1.42	0.23	0.60± 0.11	0.65± 0.23	337.15	<0.001
Belgium	0.3± 0.16	0.31± 0.15	2.91	0.09	0.45± 0.15	0.44± 0.14	146.86	<0.001
Bosnia & Herzegovina	0.49± 0.15	0.51± 0.11	43.04	<0.001	0.61± 0.17	0.67± 0.22	40.04	<0.001
Bulgaria	0.33± 0.11	0.47± 0.12	283.61	<0.001	0.54± 0.26	0.61± 0.24	59.89	<0.001
Croatia	0.33± 0.09	0.33± 0.12	4.80	<0.03	0.48± 0.11	0.5± 0.17	79.74	<0.001
Czech Rep.	0.31± 0.10	0.32± 0.14	137.27	<0.001	0.45± 0.12	0.47± 0.16	219.48	<0.001
France	0.34± 0.16	0.29± 0.15	4400.39	<0.001	0.45± 0.16	0.49± 0.17	2011.91	<0.001
Germany	0.38± 0.14	0.40± 0.18	94.10	<0.001	0.55± 0.17	0.56± 0.21	292.37	<0.001
Greece	0.37± 0.20	0.32± 0.17	191.68	<0.001	0.55± 0.24	0.53± 0.19	75.10	<0.001
Hungary	0.31± 0.07	0.32± 0.11	14.59	<0.001	0.47± 0.10	0.52± 0.16	848.95	<0.001
Ireland	0.28± 0.13	0.35± 0.17	947.69	<0.001	0.39± 0.13	0.49± 0.17	2036.93	<0.001
Italy	0.38± 0.21	0.38± 0.16	249.75	<0.001	0.55± 0.20	0.64± 0.23	11867.79	<0.001
Lithuania	0.35± 0.04	0.40± 0.076	109.61	<0.001	0.43± 0.25	0.51± 0.11	37.14	<0.001
Luxembourg	0.35± 0.09	0.32± 0.15	31.36	<0.001	0.39± 0.14	0.49± 0.18	303.04	<0.001
Montenegro	0.33± 0.06	0.51± 0.11	173.07	<0.001	0.47± 0.07	0.52± 0.31	7.23	<0.01
Netherlands	0.38± 0.16	0.38± 0.15	0.03	0.86	0.53± 0.17	0.54± 0.16	16.45	<0.001
Poland	0.34± 0.09	0.31± 0.13	824.59	<0.001	0.49± 0.16	0.52± 0.17	408.62	<0.001
Portugal	0.38± 0.24	0.32± 0.11	2530.39	<0.001	0.44± 0.16	0.47± 0.16	352.27	<0.001
Romania	0.30± 0.11	0.42± 0.21	741.24	<0.001	0.54± 0.17	0.63± 0.29	112.03	<0.001
Serbia	0.41± 0.12	0.37± 0.092	255.50	<0.001	0.57± 0.13	0.55± 0.17	35.45	<0.001
Slovakia	0.36± 0.10	0.37± 0.17	0.32	0.57	0.48± 0.11	0.55± 0.22	214.62	<0.001
Slovenia	0.37± 0.09	0.39± 0.098	49.54	<0.001	0.55± 0.11	0.61± 0.21	227.63	<0.001
Spain	0.30± 0.19	0.34± 0.17	1080.73	<0.001	0.48± 0.22	0.54± 0.25	2677.89	<0.001
Switzerland	0.31± 0.21	0.31± 0.17	1.61	0.20	0.48± 0.20	0.51± 0.2	174.88	<0.001
UK	0.33± 0.2	0.39± 0.16	3532.42	<0.001	0.46± 0.16	0.54± 0.2	9290.65	<0.001

Table S2. Changes in Melatonin Suppression Index (MSI) for different European countries. For each country the median and I.Q.R. MSI estimated based on blue/green (B/G) and green/red (G/R) ratios are given for 2012-2013 and 2014-2020, the Kruskal-Wallis Chi-squared values testing whether the ratio values (per pixel) for the two time periods originate from the same distribution, and the associated significance levels.

Country	**MSI B/G**				**MSI G/R**			
	pre-2013	**post-2013**	**K-W**	**p-value**	**pre-2013**	**post-2013**	**K-W**	**p-value**
Albania	0.44± 0.22	0.48± 0.15	14.11	<0.001	0.22± 0.13	0.28± 0.16	57.87	<0.001
Austria	0.48± 0.12	0.48± 0.2	1.14	0.28	0.26± 0.06	0.29± 0.13	337.15	<0.001
Belgium	0.34± 0.19	0.35± 0.19	3.11	0.08	0.18± 0.09	0.17± 0.08	146.86	<0.001
Bosnia & Herzegovina	0.58± 0.19	0.61± 0.14	43.04	<0.001	0.27± 0.10	0.30± 0.13	40.04	<0.001
Bulgaria	0.39± 0.13	0.56± 0.15	283.61	<0.001	0.22± 0.15	0.27± 0.14	59.89	<0.001
Croatia	0.39± 0.11	0.38± 0.15	4.67	0.03	0.19± 0.06	0.20± 0.10	79.75	<0.001
Czech Rep.	0.35± 0.12	0.37± 0.18	137.27	<0.001	0.17± 0.07	0.19± 0.10	219.48	<0.001
France	0.39± 0.20	0.34± 0.19	4137.33	<0.001	0.17± 0.09	0.2± 0.097	2011.91	<0.001
Germany	0.45± 0.18	0.47± 0.23	95.90	<0.001	0.23± 0.10	0.24± 0.12	292.37	<0.001
Greece	0.43± 0.25	0.37± 0.21	194.45	<0.001	0.23± 0.14	0.22± 0.11	75.10	<0.001
Hungary	0.36± 0.09	0.38± 0.13	14.59	<0.001	0.19± 0.05	0.22± 0.09	848.95	<0.001
Ireland	0.31± 0.16	0.41± 0.21	943.64	<0.001	0.14± 0.07	0.20± 0.10	2036.93	<0.001
Italy	0.45± 0.26	0.45± 0.19	233.38	<0.001	0.23± 0.12	0.28± 0.13	11867.79	<0.001
Lithuania	0.41± 0.05	0.47± 0.09	109.61	<0.001	0.16± 0.15	0.21± 0.06	37.14	<0.001
Luxembourg	0.41± 0.11	0.38± 0.18	31.36	<0.001	0.14± 0.08	0.20± 0.11	303.04	<0.001
Montenegro	0.39± 0.08	0.60± 0.13	173.07	<0.001	0.19± 0.04	0.21± 0.18	7.23	0.01
Netherlands	0.44± 0.20	0.45± 0.18	0.01	0.92	0.22± 0.10	0.23± 0.09	16.45	<0.001
Poland	0.39± 0.11	0.36± 0.17	804.71	<0.001	0.20± 0.09	0.21± 0.10	408.62	<0.001
Portugal	0.44± 0.30	0.36± 0.14	2571.09	<0.001	0.17± 0.09	0.18± 0.09	352.27	<0.001
Romania	0.35± 0.14	0.49± 0.26	741.24	<0.001	0.23± 0.10	0.28± 0.17	112.03	<0.001
Serbia	0.48± 0.15	0.43± 0.11	255.50	<0.001	0.25± 0.07	0.23± 0.10	35.45	<0.001
Slovakia	0.42± 0.13	0.43± 0.21	0.32	0.57	0.19± 0.07	0.23± 0.13	214.62	<0.001
Slovenia	0.43± 0.11	0.45± 0.12	49.54	<0.001	0.23± 0.06	0.26± 0.12	227.63	<0.001
Spain	0.35± 0.24	0.39± 0.20	1090.03	<0.001	0.19± 0.13	0.23± 0.14	2677.89	<0.001
Switzerland	0.36± 0.26	0.36± 0.21	2.78	0.10	0.19± 0.12	0.21± 0.12	174.88	<0.001
UK	0.38± 0.25	0.46± 0.20	3466.50	<0.001	0.18± 0.09	0.23± 0.12	9290.65	<0.001

Data S1 List of ISS images used to form final mosaiced maps.

Data S2 List of ISS images used in Fig. 4.