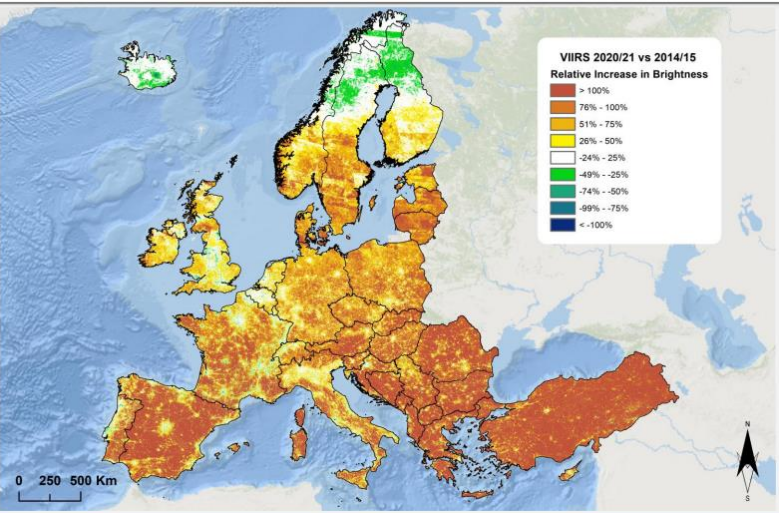
ETC-HE Report 2022/X

Review and Assessment of Available Information on Light Pollution in Europe



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European Topic Centre
Human health and the environment

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Modelling Light Pollution with Remote Sensing Data

Kaja Widmer

October 2022

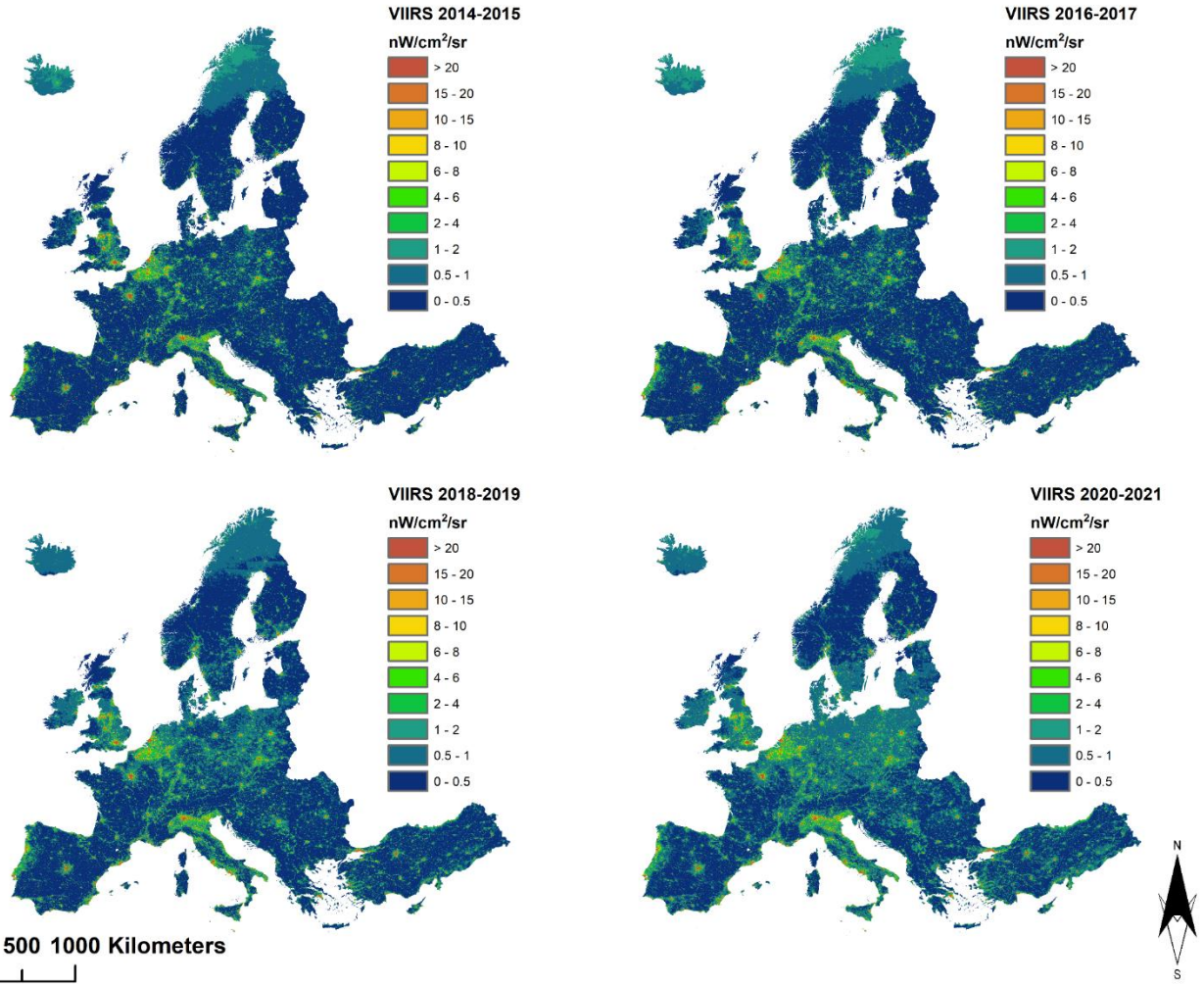
Remote Sensing Data Sources

- Data on spatial distribution of light emissions collected with satellite sensors

- Operational Linscan System of Defense Meteorological Satellite Program (DMSP/OLS)
  - 1992 - 2013
  - Unit: digital numbers (DN)
  - Longest time-series of visible and near-infrared emissions

- Visible Infrared Imaging Radiometer Suite (VIIRS)
  - 2012 - today
  - Unit: nanowatts per centimetre squared per steradian ($nW/cm^2/sr$)
  - Highest spatial resolution

Most recent trends



Comparison of 2-year-average light emissions in Europe from 2014 to 2021

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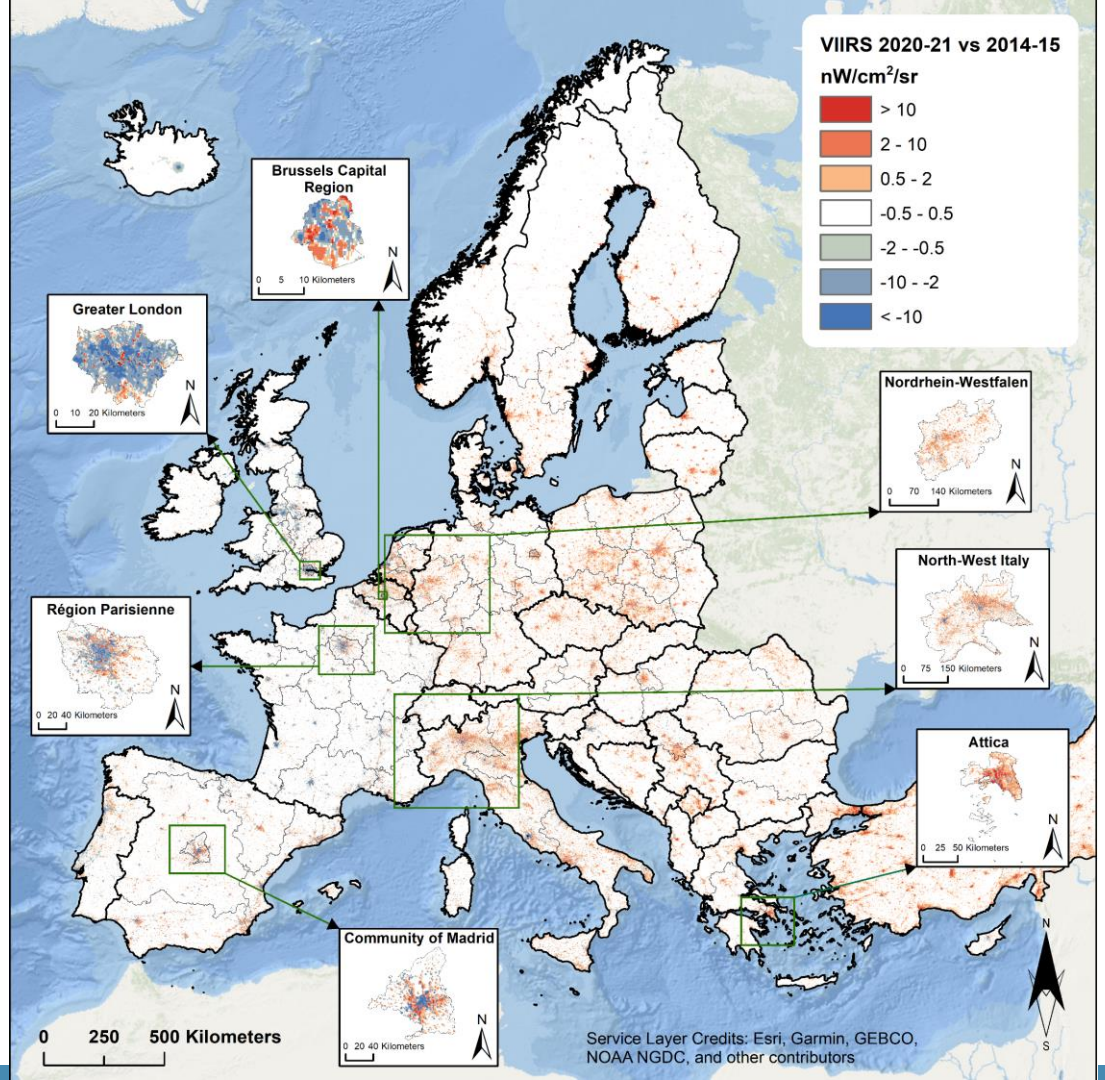
Most recent trends



The differences in brightness in EEA38 between the averaging periods of 2014/15 & 2020/21

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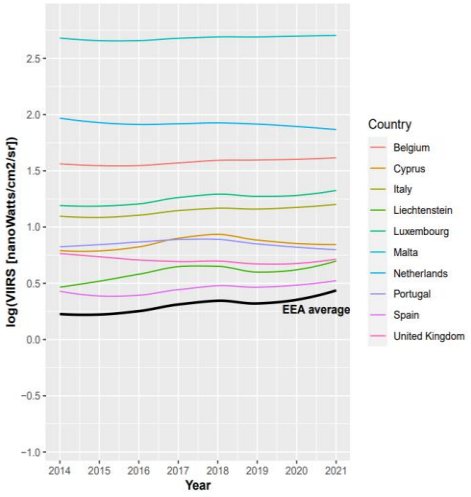
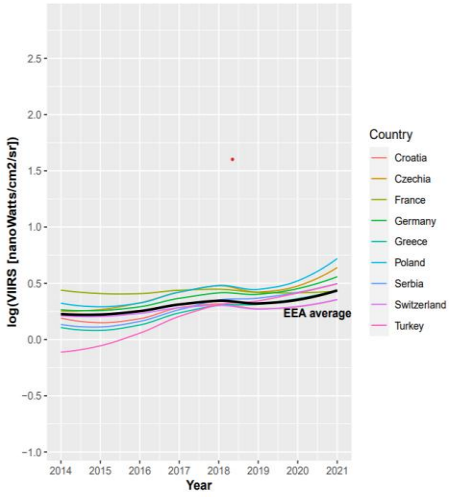
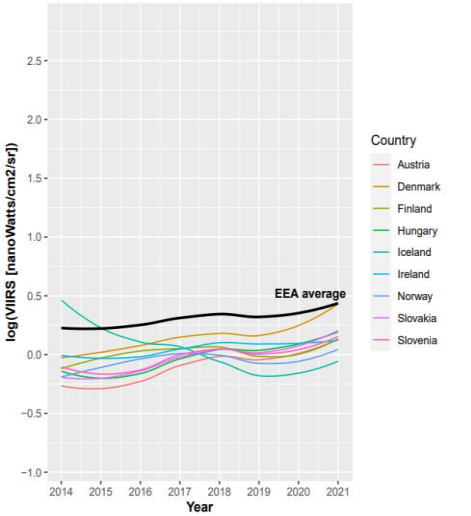
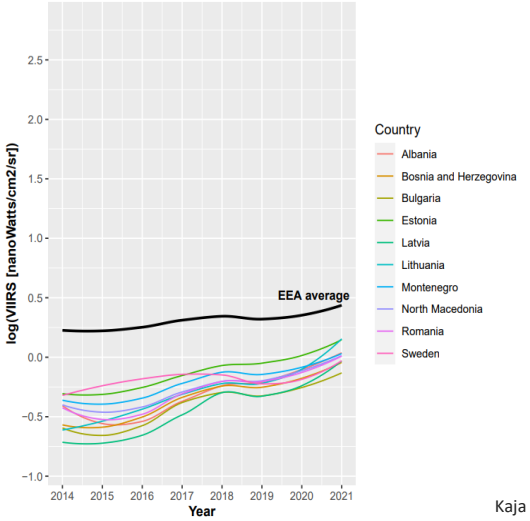
A comparison of EEA countries



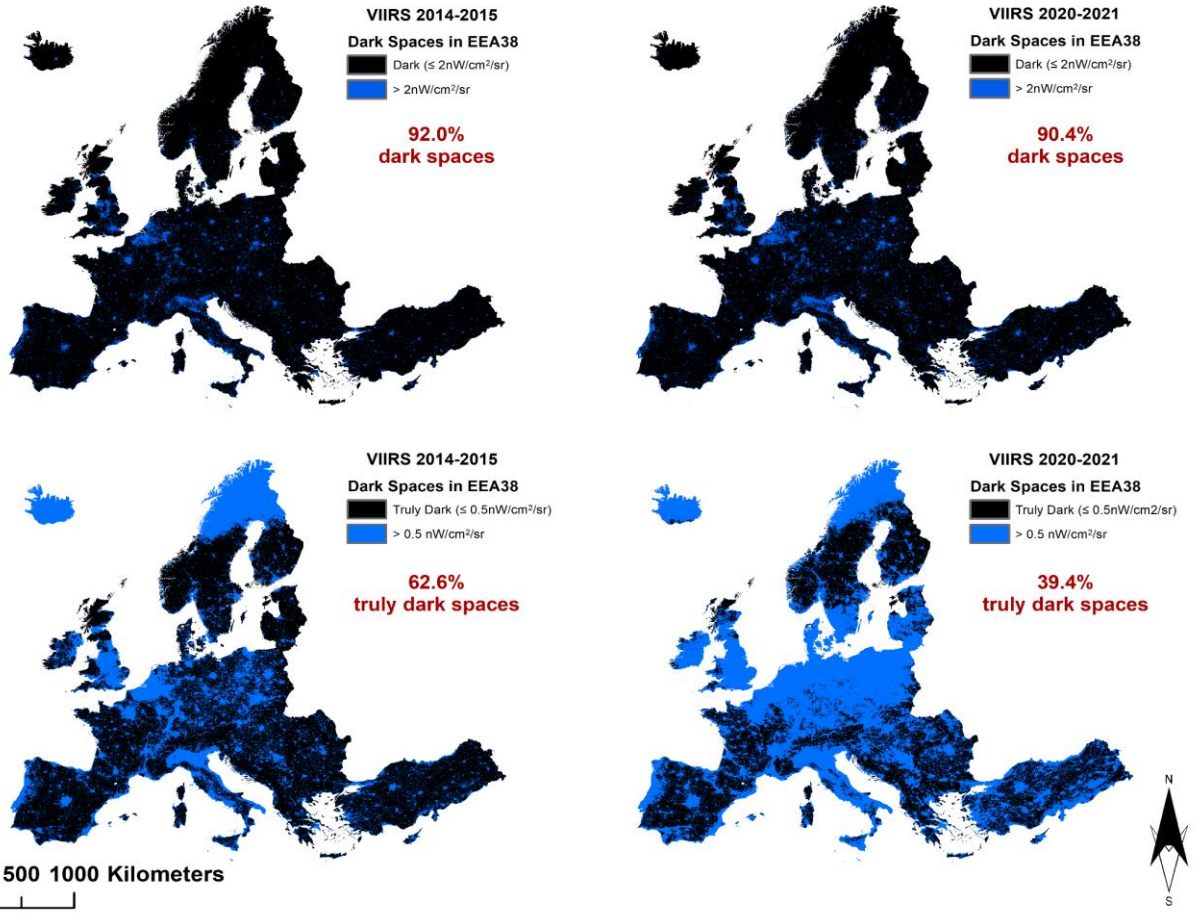






Annual mean VIIRS light emission trends during 2014 - 2021

Signals capturing changes in LP



Upper maps: "ecologically safe" areas (< 2 nW/cm^2/sr)

Lower maps: "truly dark" spaces (< 0.5 nW/cm^2/sr)

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Thank you for your attention

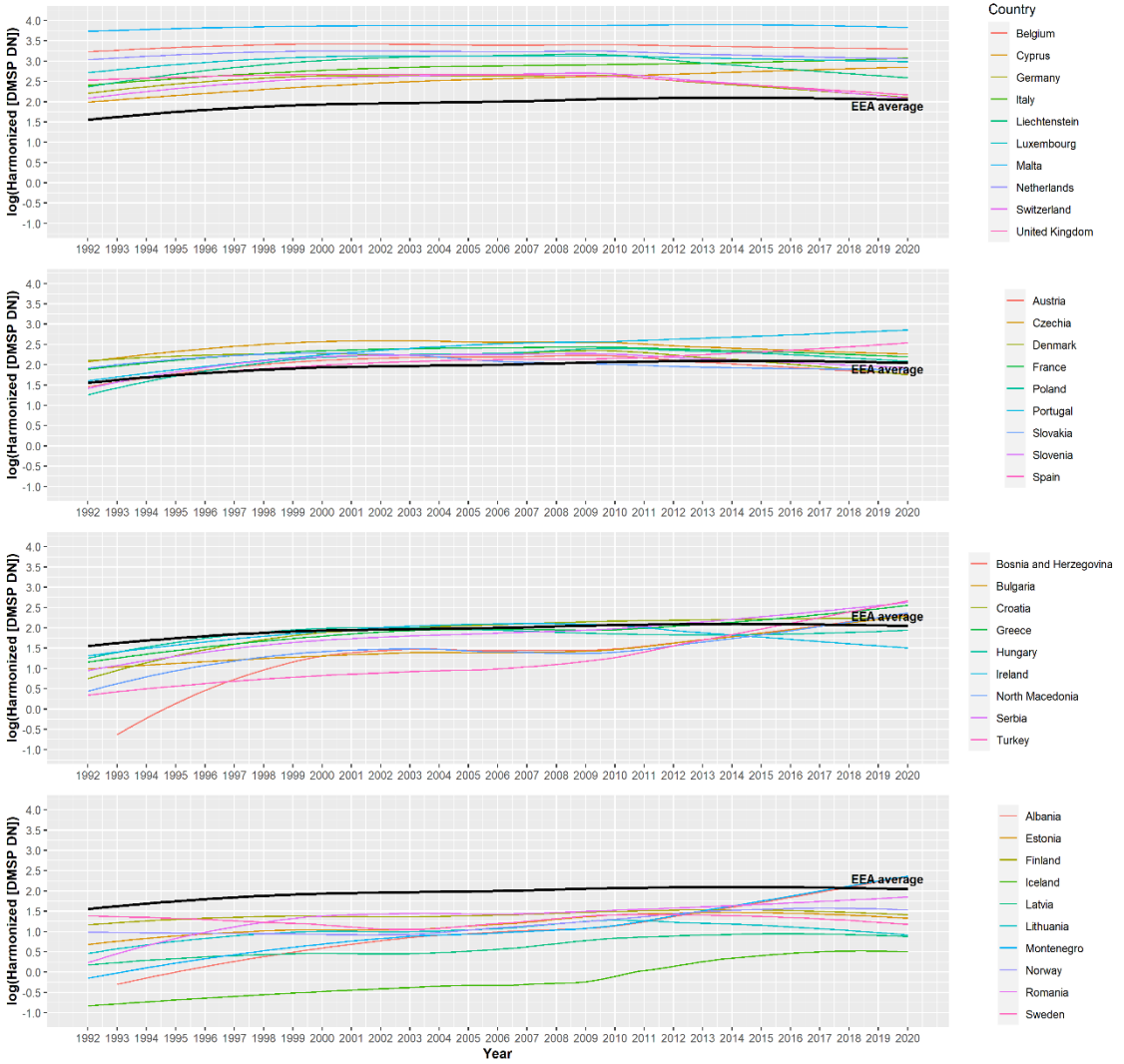
Thresholds to classify ecological light emissions

Light emission ($nW/cm^2/sr$)	Description of light emission thresholds	Reference
< 0.5	Lowest light emission values	(Hügli, 2021)
0.5 – 2*	Very low light emission values	(Hügli, 2021)
2 - 10	Low light emission values	(Hale & Arlettaz, 2019)
10 - 20	Medium light emission values	(Hale & Arlettaz, 2019)
> 20	High light emission values	(Hale & Arlettaz, 2019)

*At light emissions above 2 $nW/cm^2/sr$ at least low levels of ecological impacts are expected (Hale et al., 2018)

Historical trends

Harmonized data = VIIRS data converted into DMSP/OLS unit, 1 km^2 resolution



Annual mean light emission trends during 1992 – 2020 for each EEA38 country based on the harmonized historical dataset

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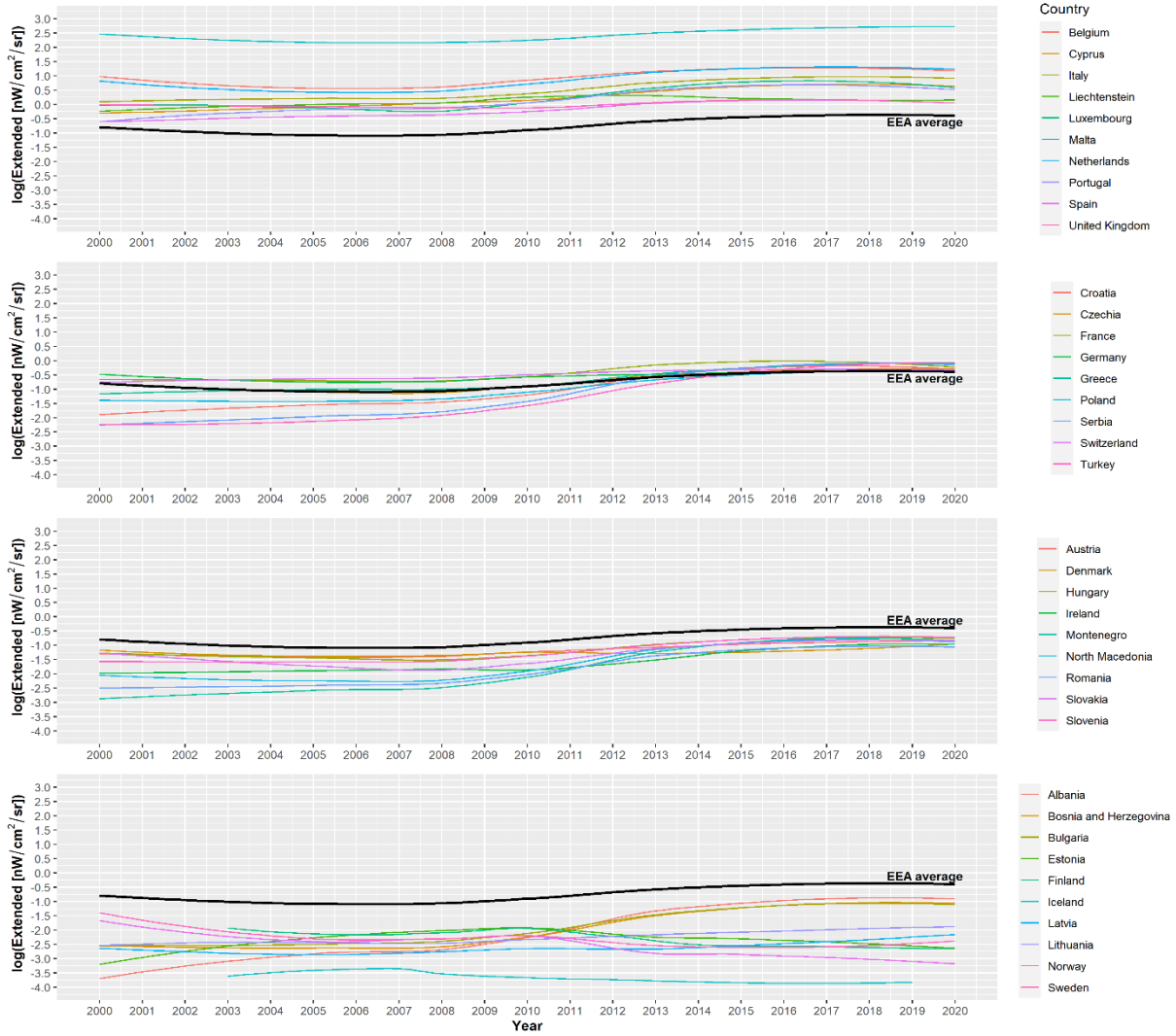
Historical trends

Extended data = DMSP/OLS data converted into VIIRS unit, 500 m^2 resolution



Annual mean light emission trends during 2000 – 2020 for each EEA38 country based on the extended historical time series data

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