Are relationships between artificial light emission and land use dependent on community size?

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This is a web-safe version of the talk. The data are preliminary, and some information necessary for interpretation has been removed. Please feel free to contact me if you have questions:

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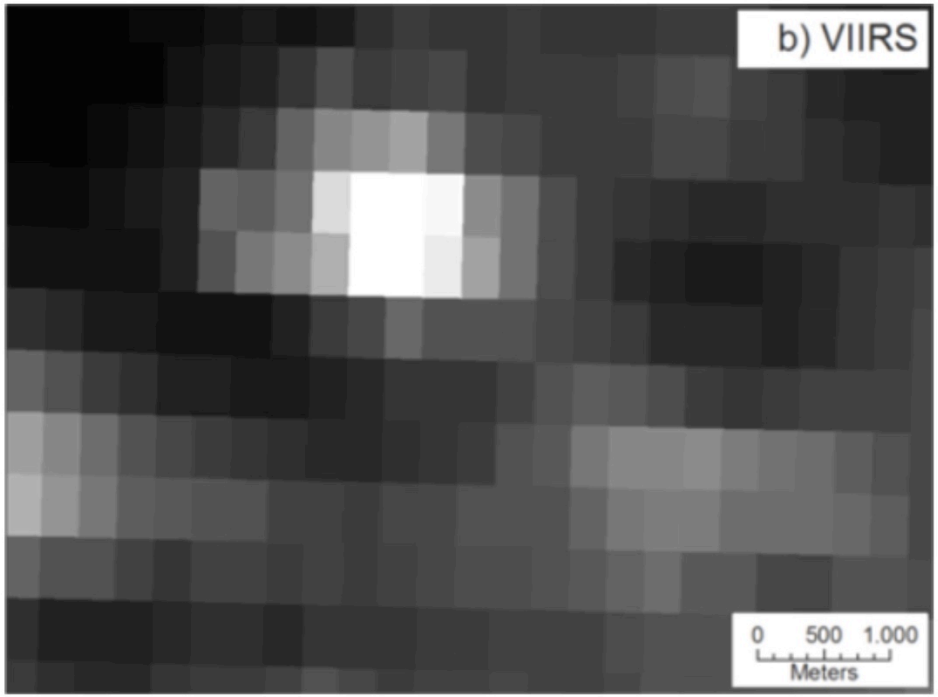
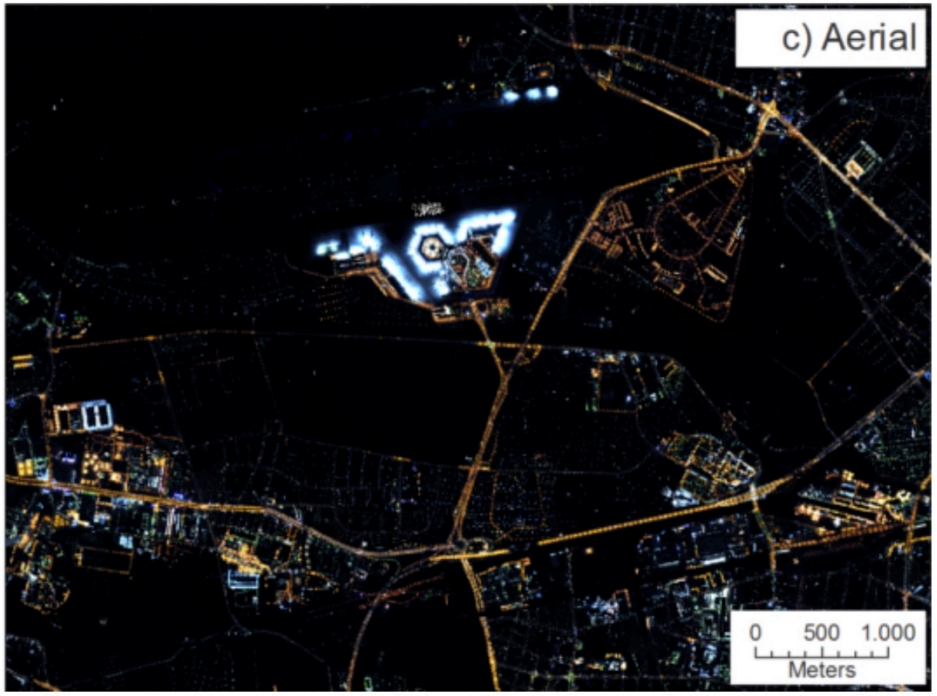
NOAA/NASA VIIRS D

VIIRS DNB has limited spatial resolution



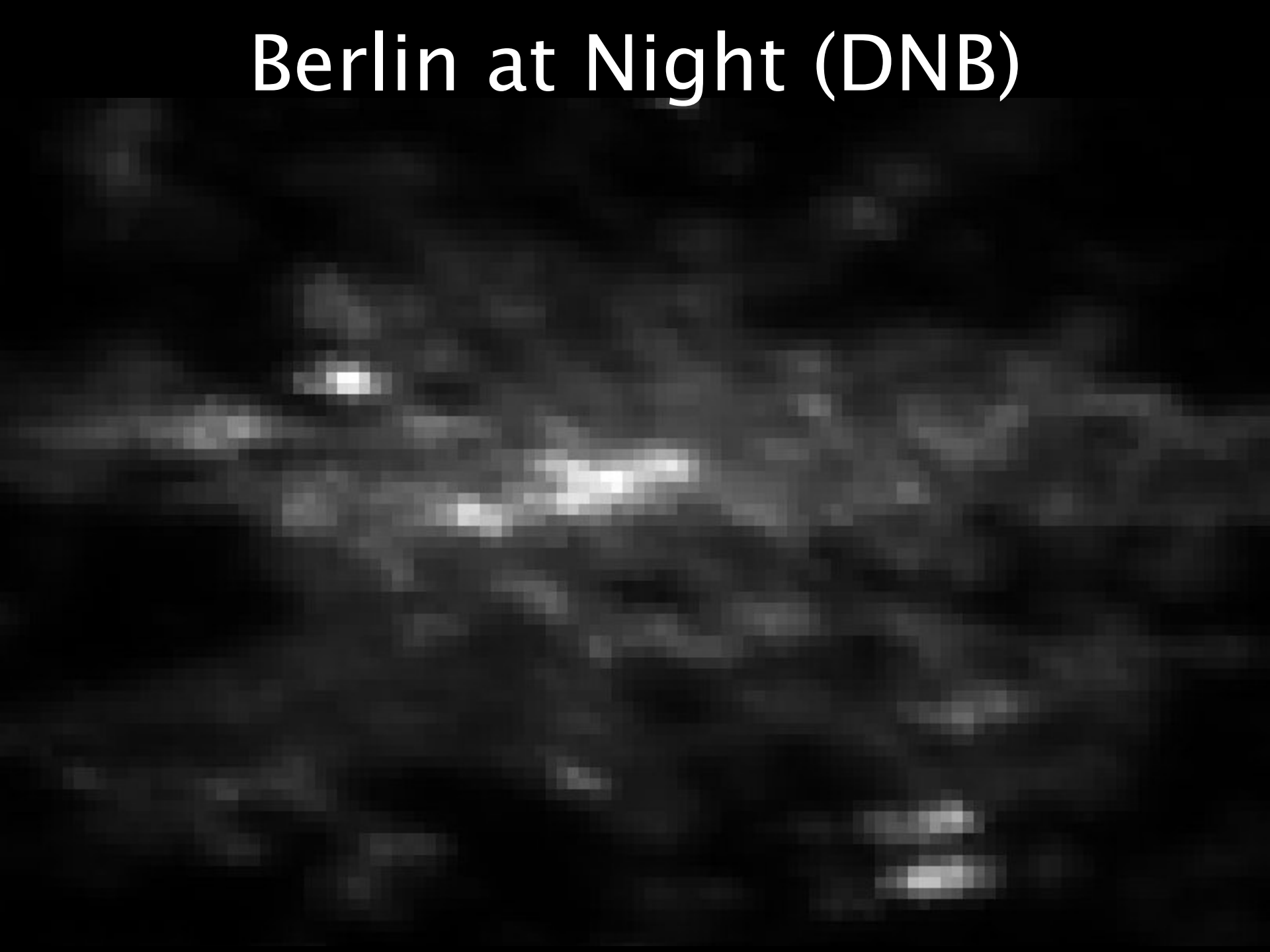


Kyba et al. 2015 (10.3390/rs70100001)

Astronaut Photographs

NASA Gateway to astronaut photography

Berlin at Night (DNB)



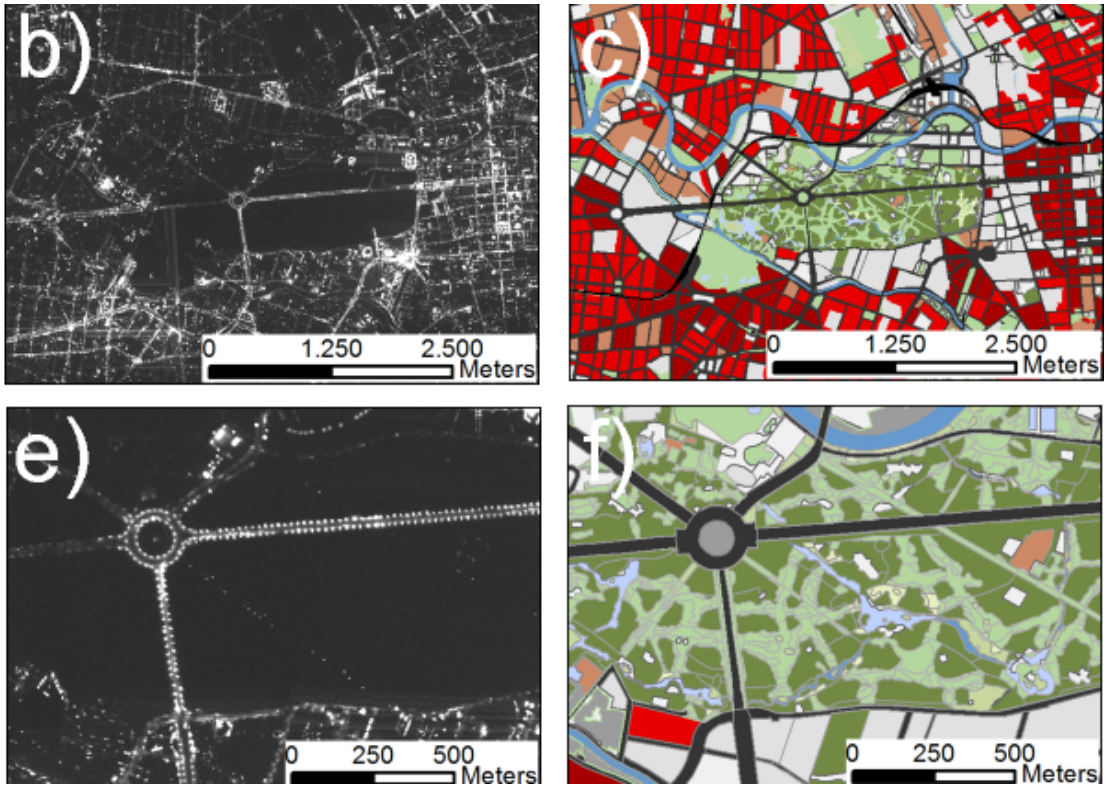

Berlin at night
(NightPod, 2013)

Berlin at night (2014)

Spatial Analysis

Aerial Photos

Land use maps



Kuechly *et al.* RSE, 2012

Cities at Night

Help us to locate cities

The first step is locate the city which appears in the picture. Here you can find where was the ISS at the moment when the picture was taken. Just click on any red dot and identify it http://crowdcrafting.org/app/LostAtNight

Analysis

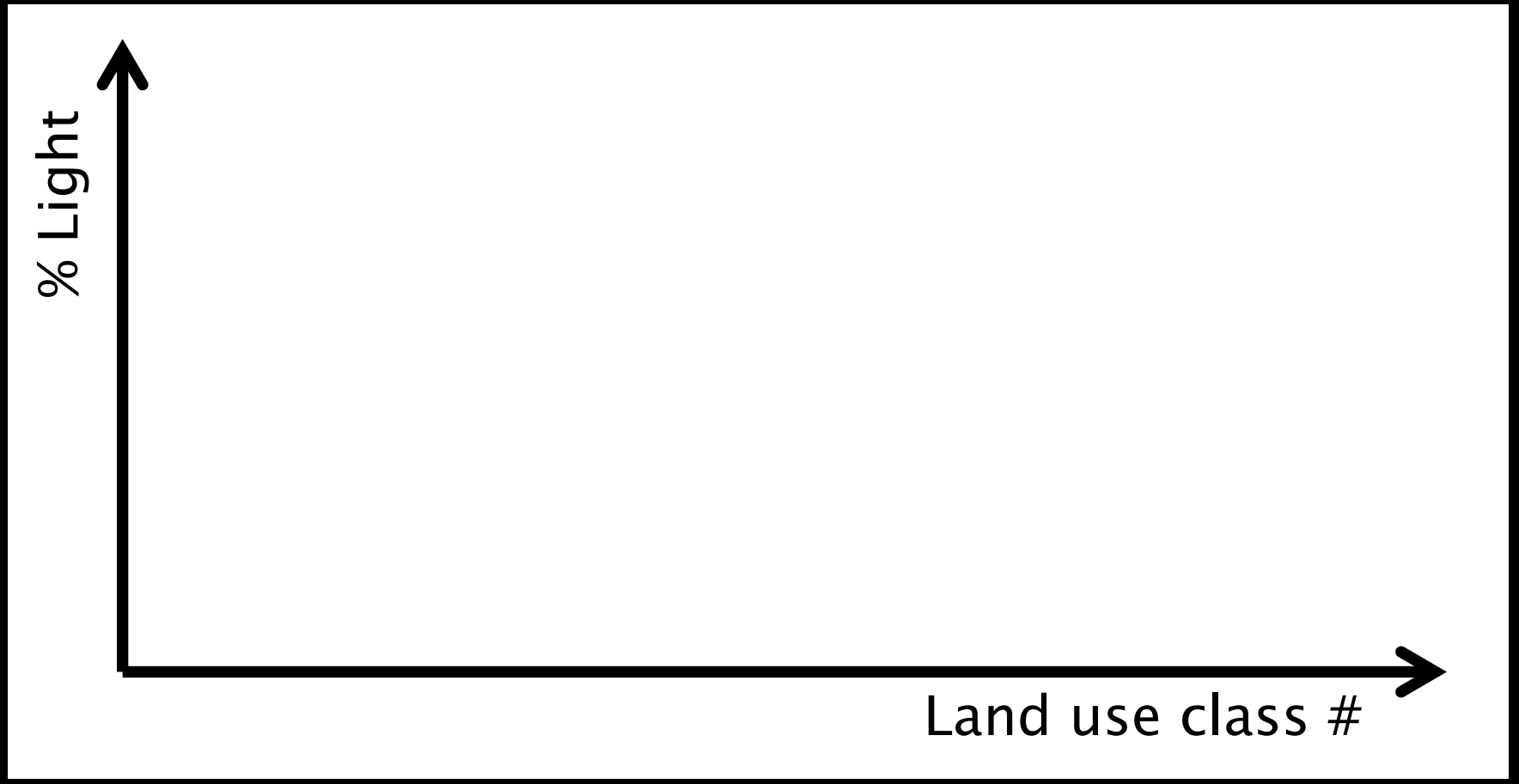
Part A

- 24 (radiometrically calibrated) ISS photos from 22 European cities
- Photos taken from Feb 2011–Mar 2016, mostly from 2012 and 2013
- European Environmental Agency “Urban Atlas” land use

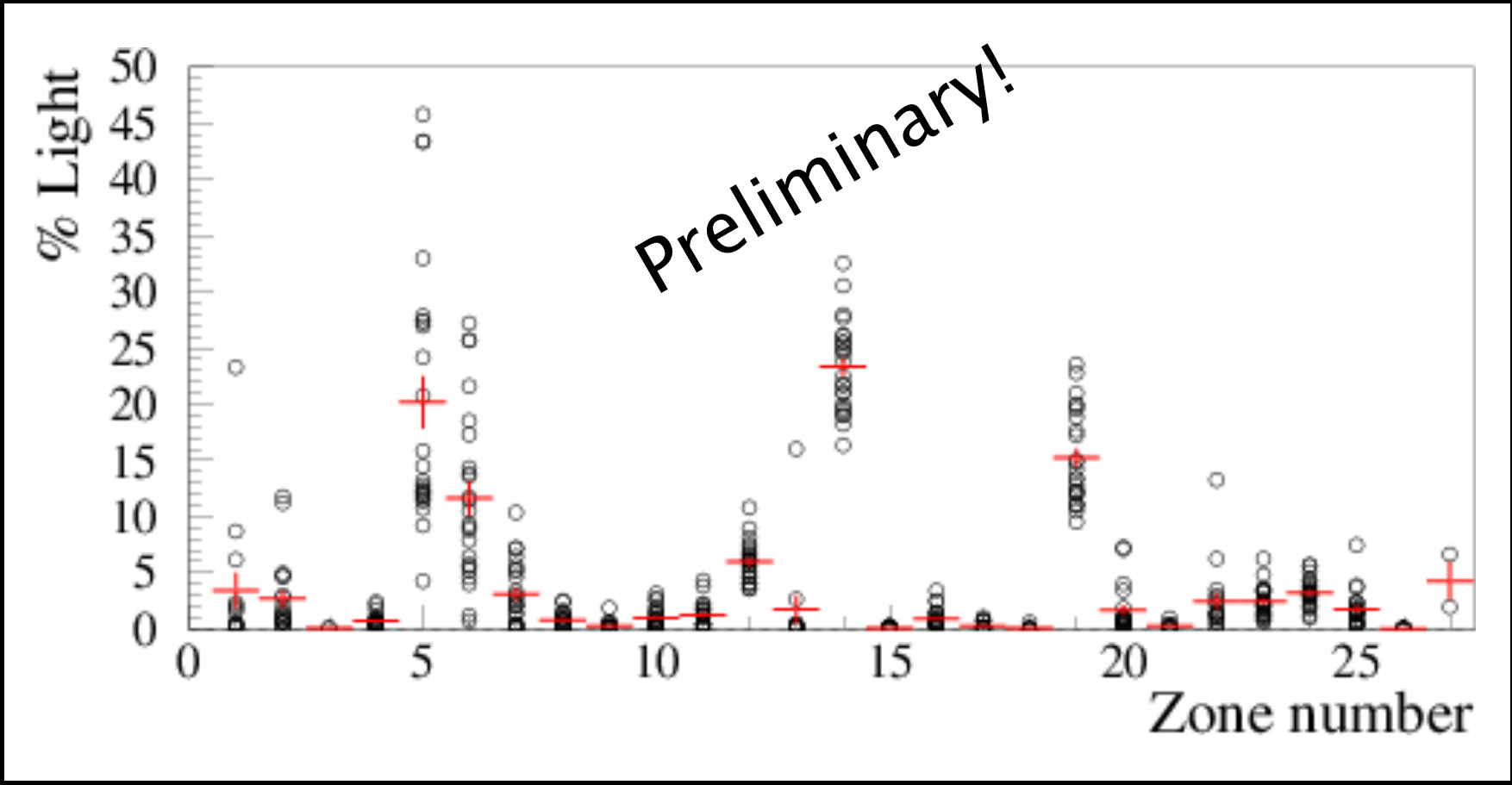
Part B

- Aerial photographs of Upper Austria

Fractional emission by class



Fractional emission by class



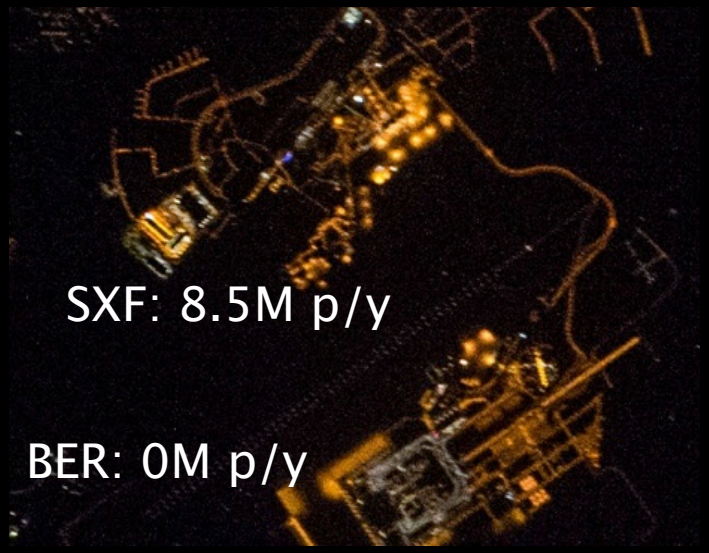
Frankfurt, Germany

Airports

FRA: 48M passengers/year

TXL: 21M p/y

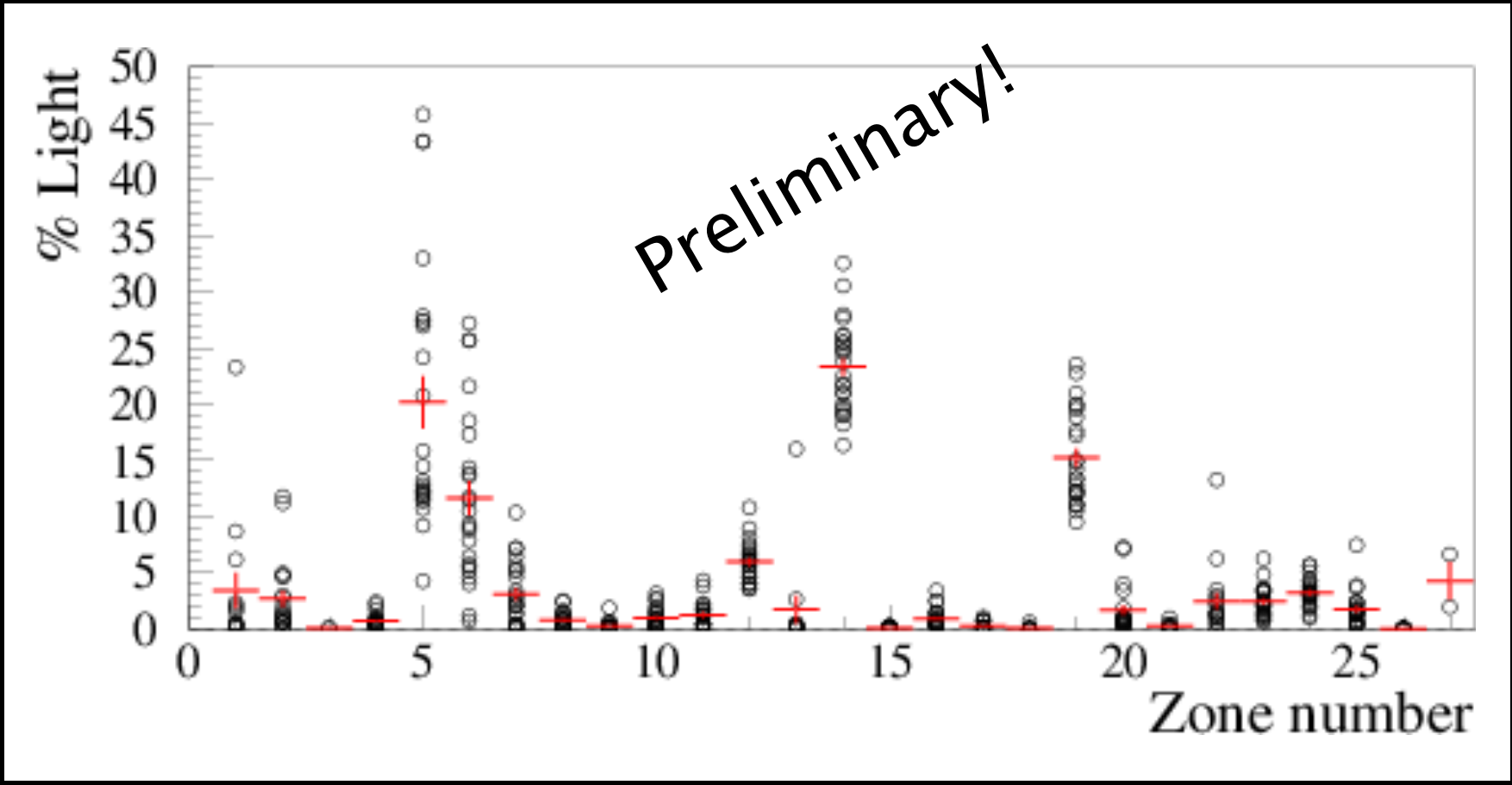
LHR: 75M p/y



SXF: 8.5M p/y

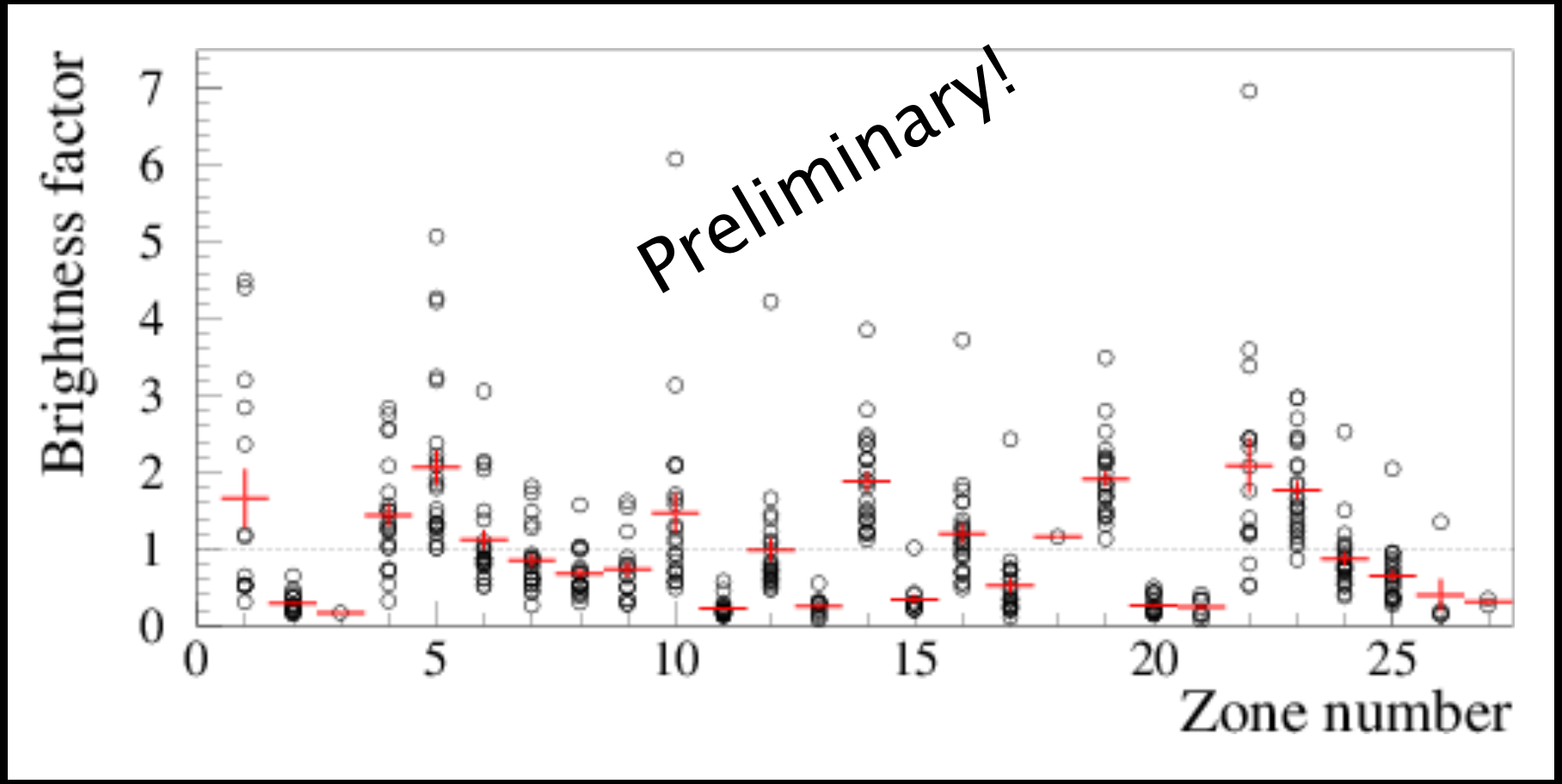
BER: 0M p/y

Fractional emission by class



Brightness factor

Brightness factor

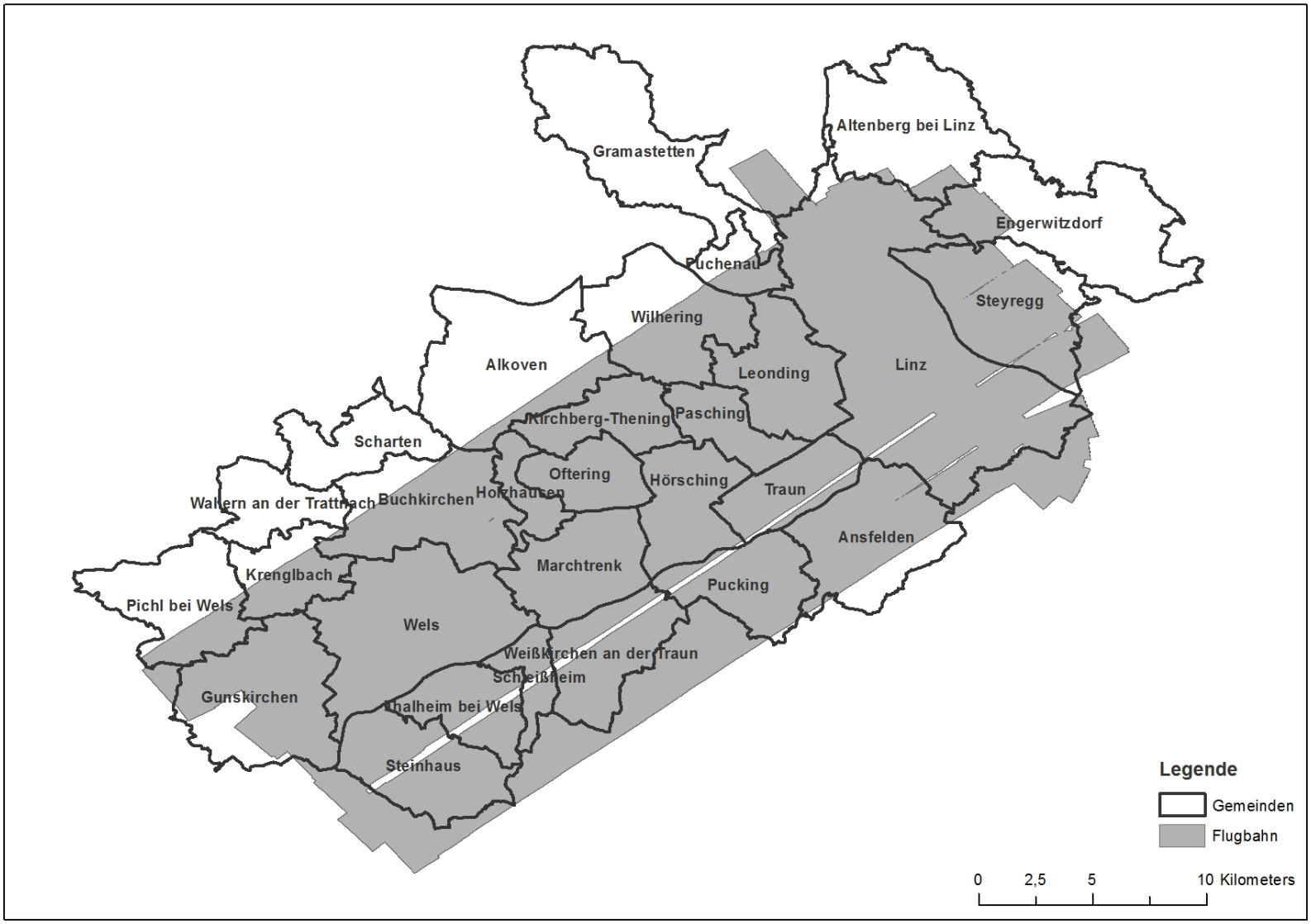


Street area radiance

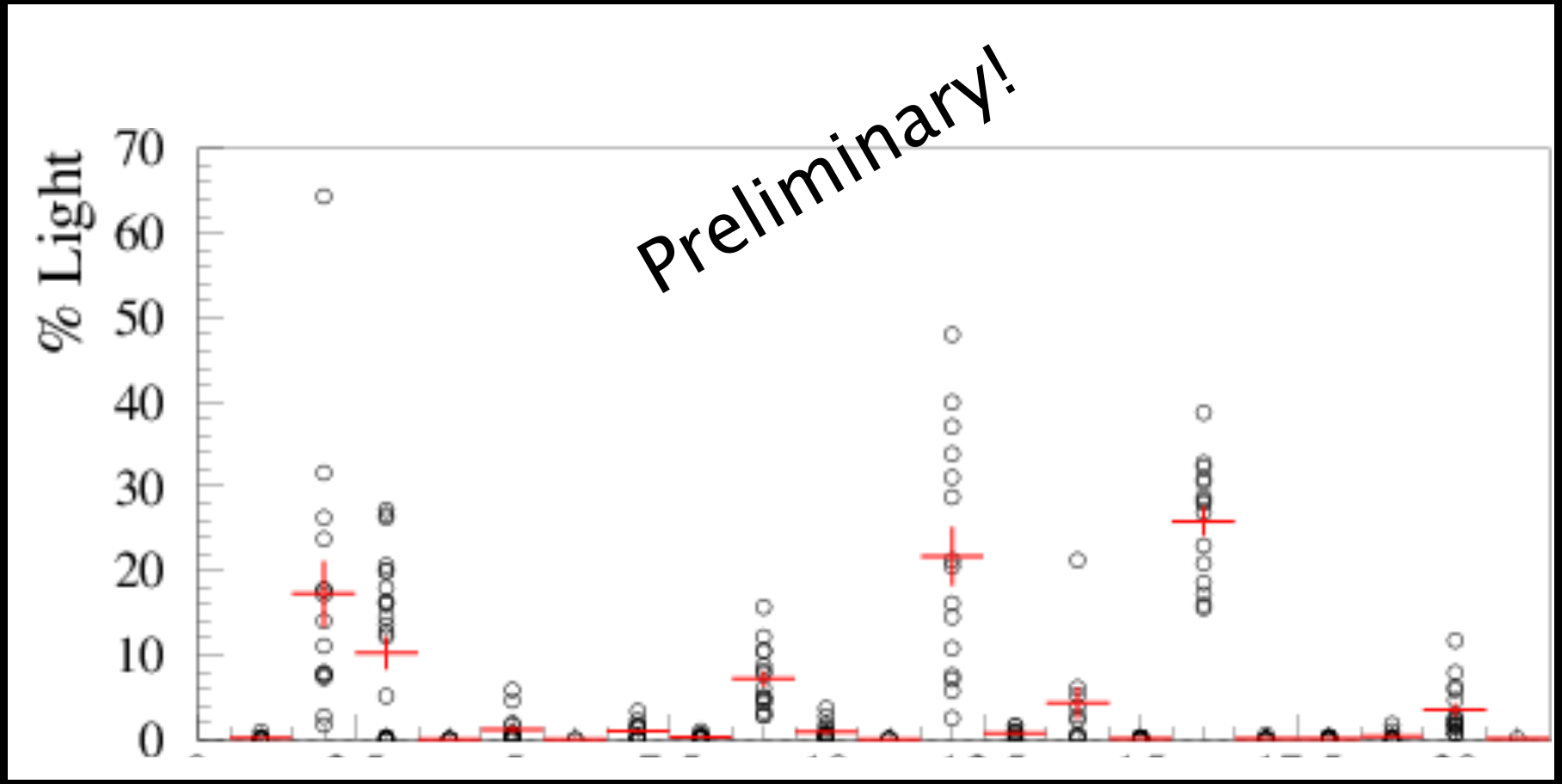
Preliminary!

- Large range
- Brightest: Lyon, Paris, Lisbon, Athens, Bordeaux
- Faintest: Berlin, Cardiff, Budapest, Munich, London
- No significant relationship with city size

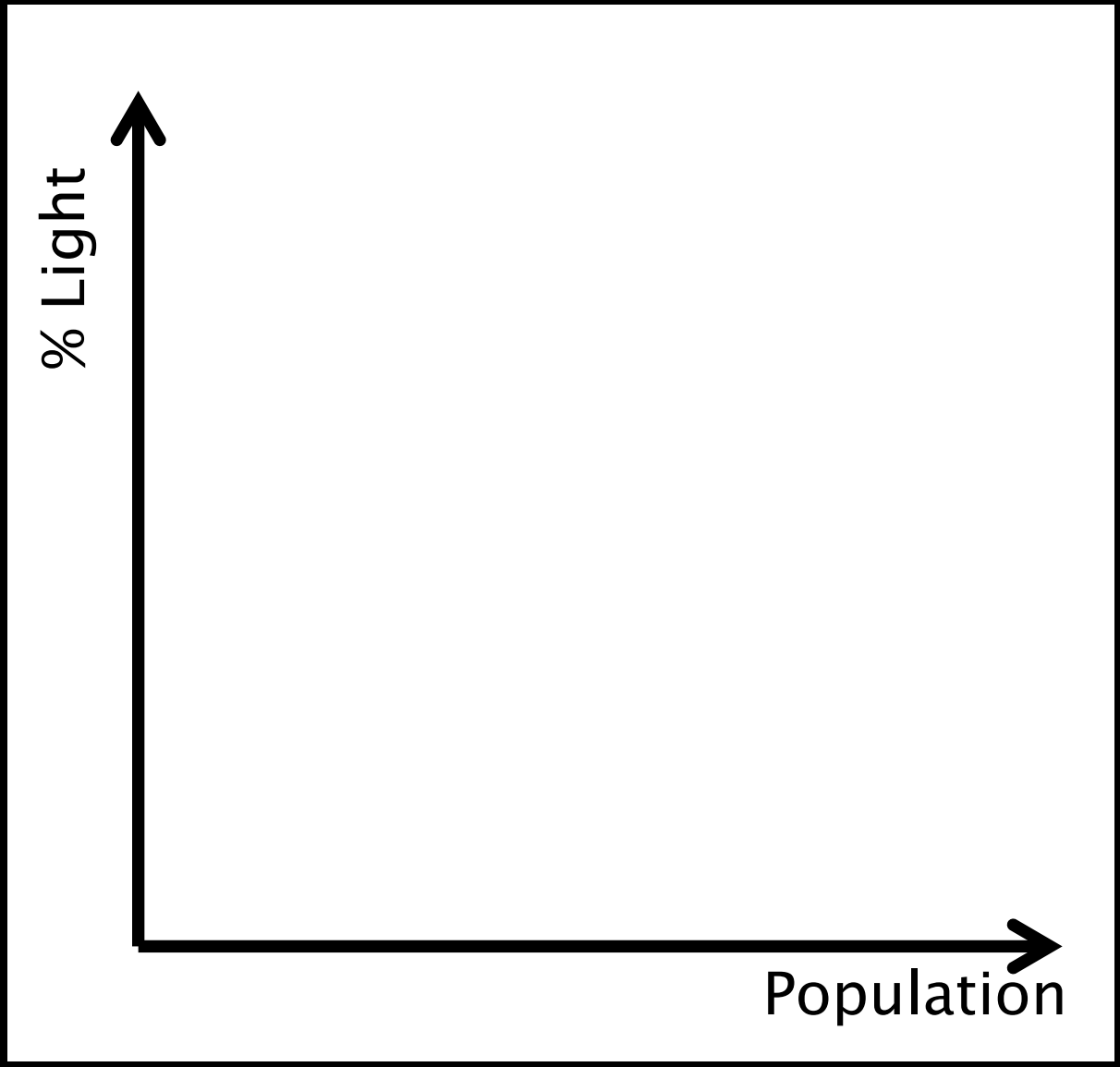
Flight over Upper Austria



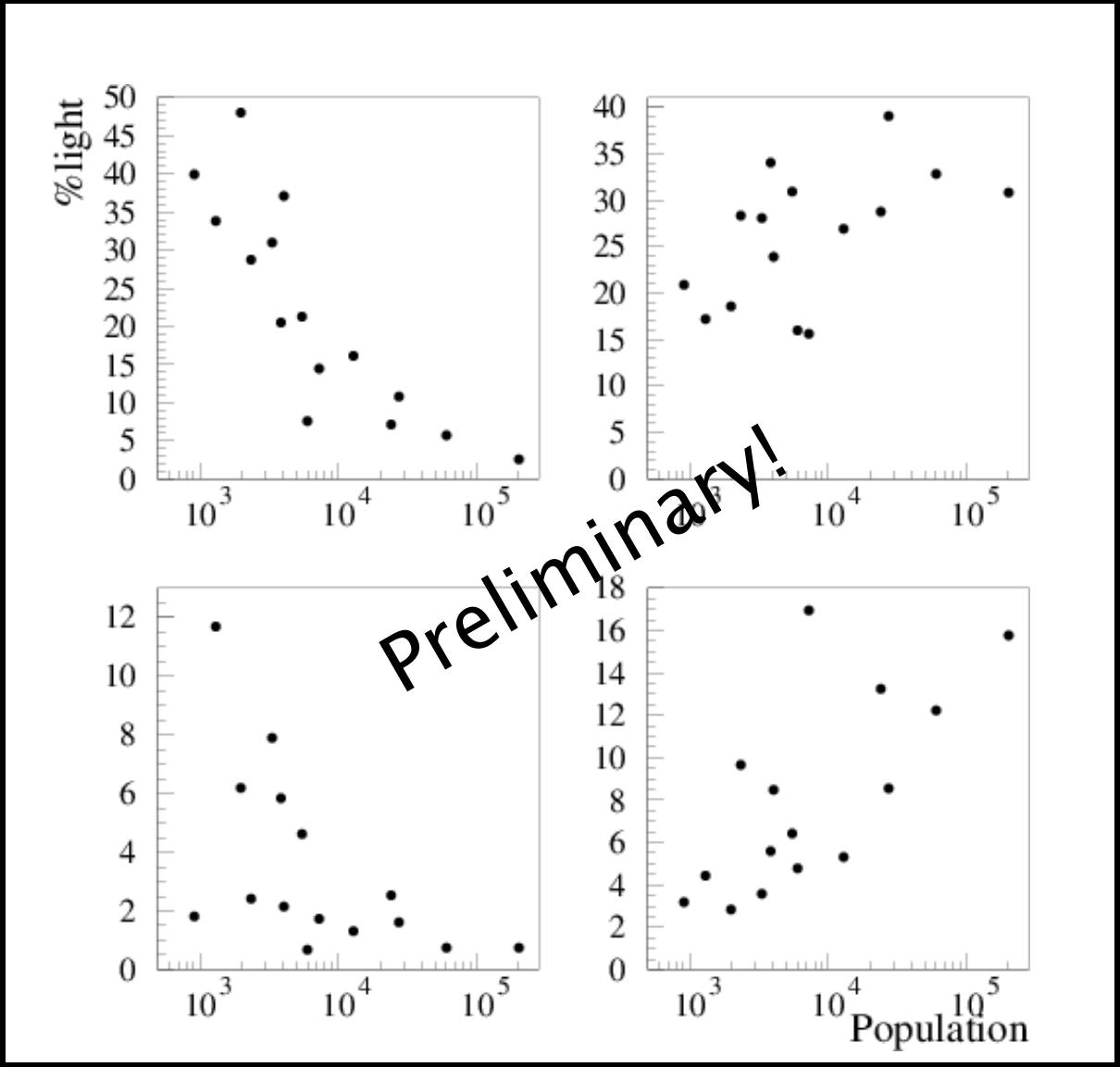
Linz land use



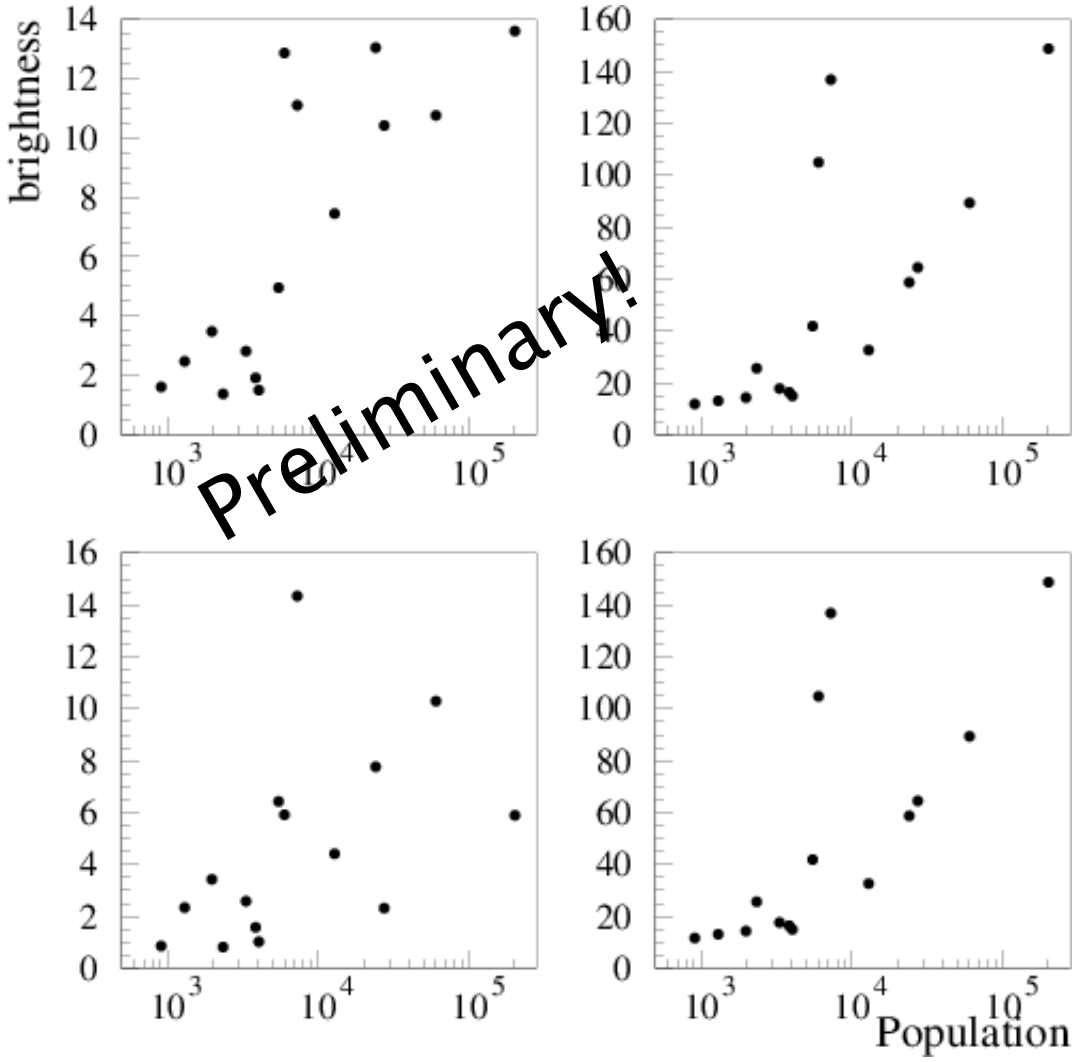
Linz total light & land use



Linz total light & land use



Brightness vs population



Conclusions

- Some sources of light emission are fairly similar between different communities (e.g. streets), while others can be quite different (e.g. ports)
- Typical light sources differ between urban and rural areas
- Equal light emission in VIIRS DNB does not imply equal (or even similar) conditions on the ground
- City-level analyses should consider using ISS photos rather than VIIRS DNB

Acknowledgements

- Coauthors
- COST Action LoNNe (ES1204)
- Government of Upper Austria

(Ask me about…

color ratios
class area vs light output
medium vs large cities)