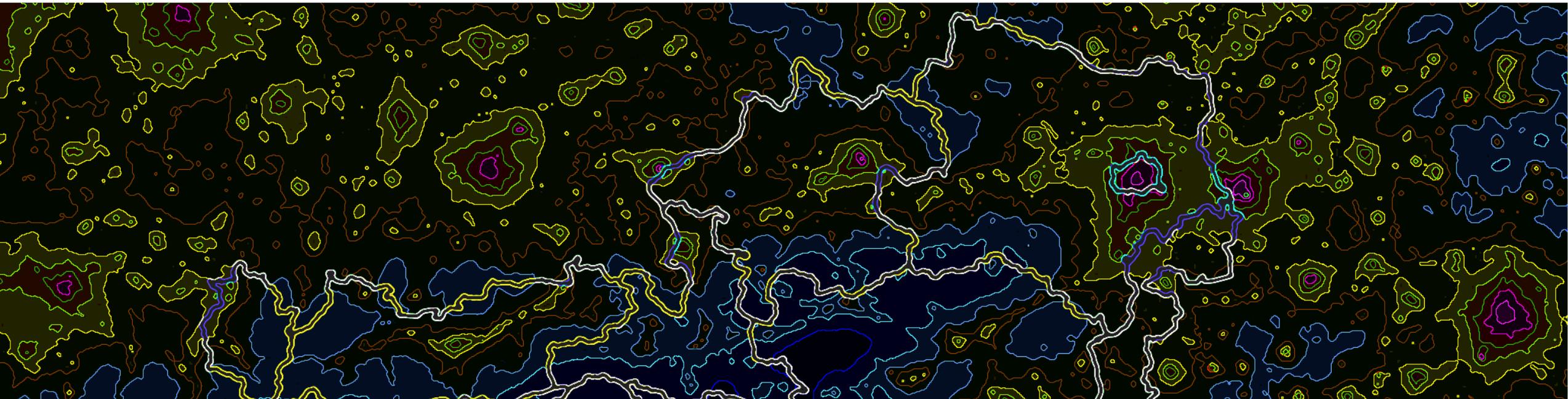


# ‘Skypollution’

How artificial light and satellite networks are impacting our night skies and research

Dr. Stefan Wallner

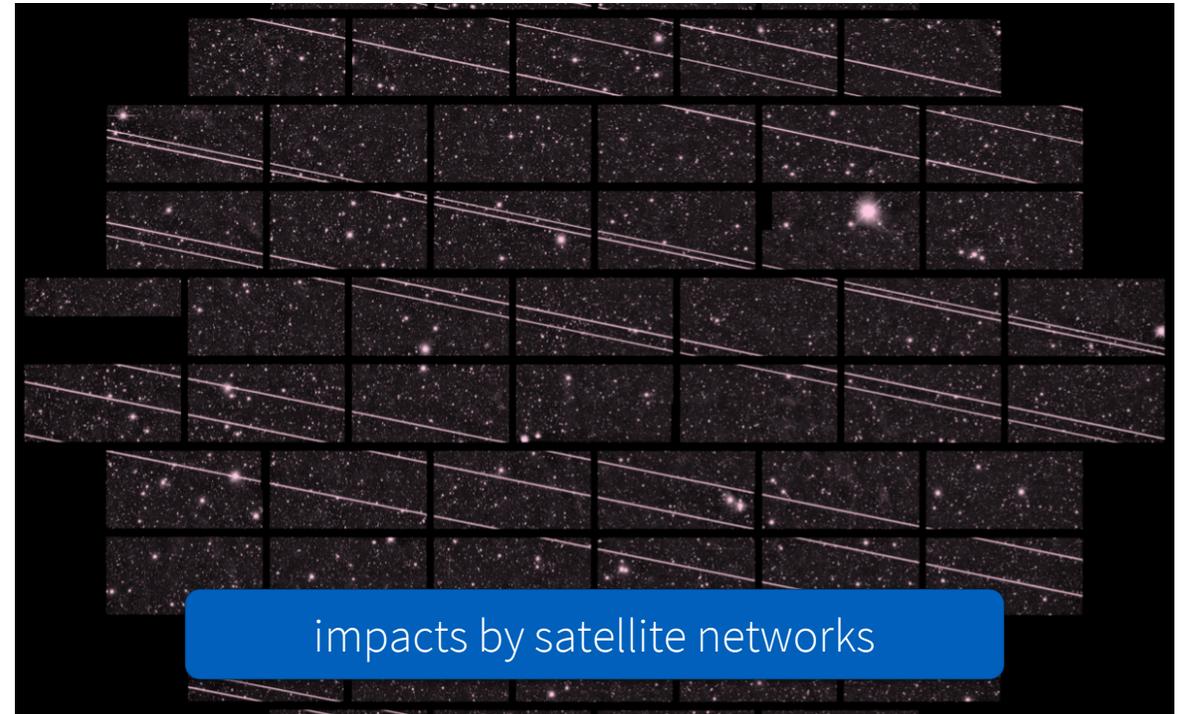
Department of Astrophysics, University of Vienna  
ICA, Slovak Academy of Sciences



## What is 'Skypollution'?



Jeremy Stanley (2021)



Martínez-Vázquez et al. (2019)

## Satellite networks – in a nutshell

...up to 100 000 satellites in large constellations could be launched into Earth orbit in the coming decade

...many will be located in low-earth orbits (<800km), 60 000 between 300 – 1200km

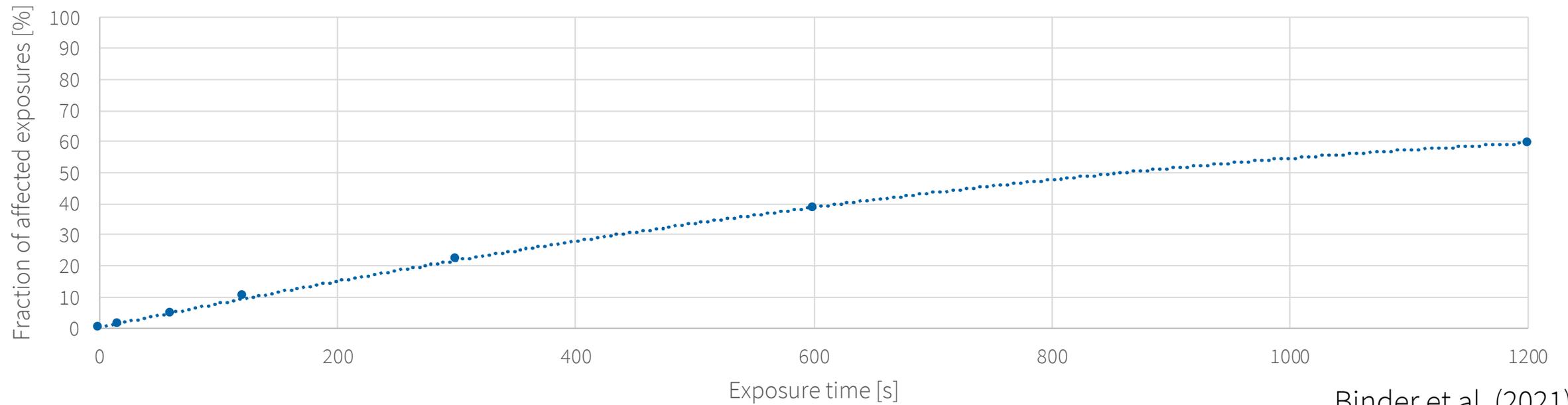
...major impacts on astronomical observations due to satellite streaks

...biggest problem: no/only few information on satellites before they are in orbit

e.g. Williams et al. (2021)

# Simulated streak probability

Simulated streak probability for Leopold Figl Observatory, Austria  
1.5m mirror telescope, FoV:  $5.6 \times 3.8$  arcmin<sup>2</sup>  
Number of total satellites included: 52 704  
Sky sector  $>30^\circ$  above horizon, Sun altitude  $<-18^\circ$   
2021-06-21 22:40:04 UTC



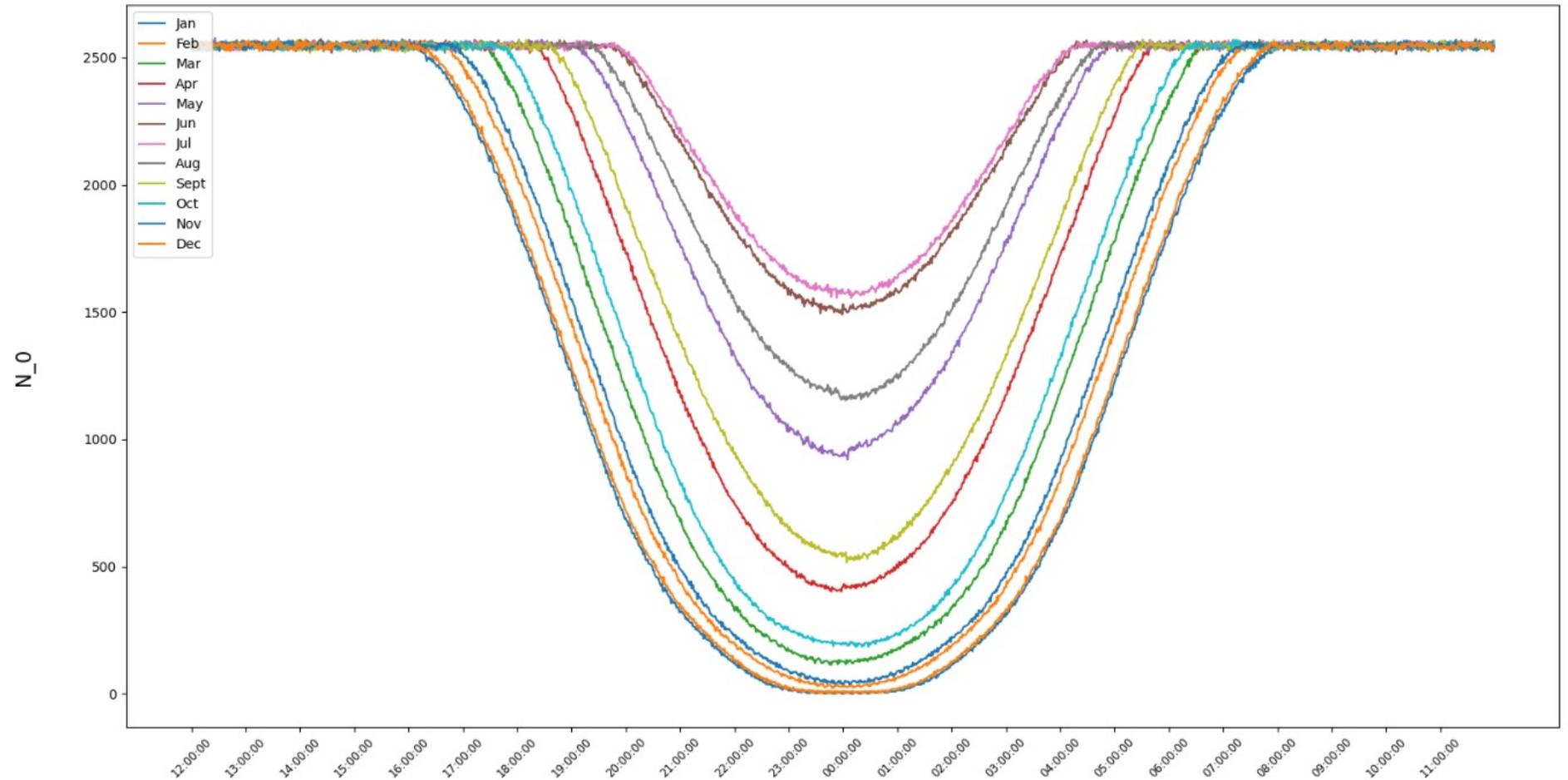
Binder et al. (2021)

## What about times without satellites?

...will become extremely rare

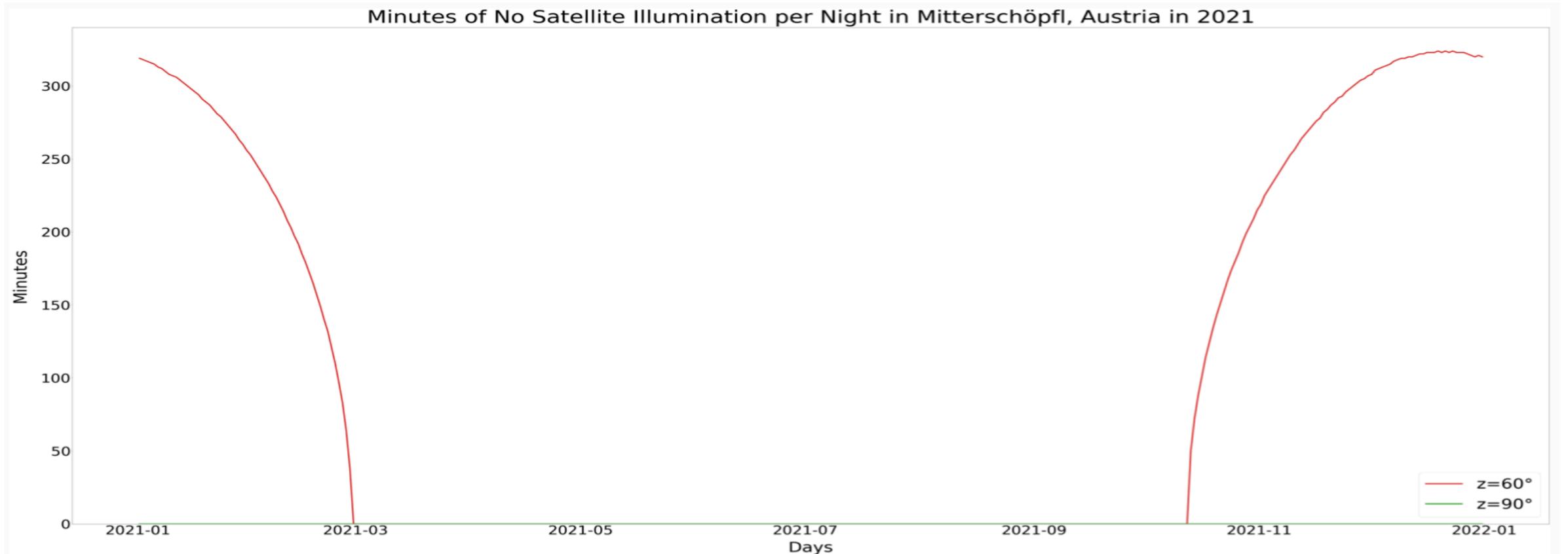
...must be planned around winter times (bad meteorological conditions!)

shadowing effects are included ->



Binder et al. (2021)

## A more detailed look



Seiser (2021)

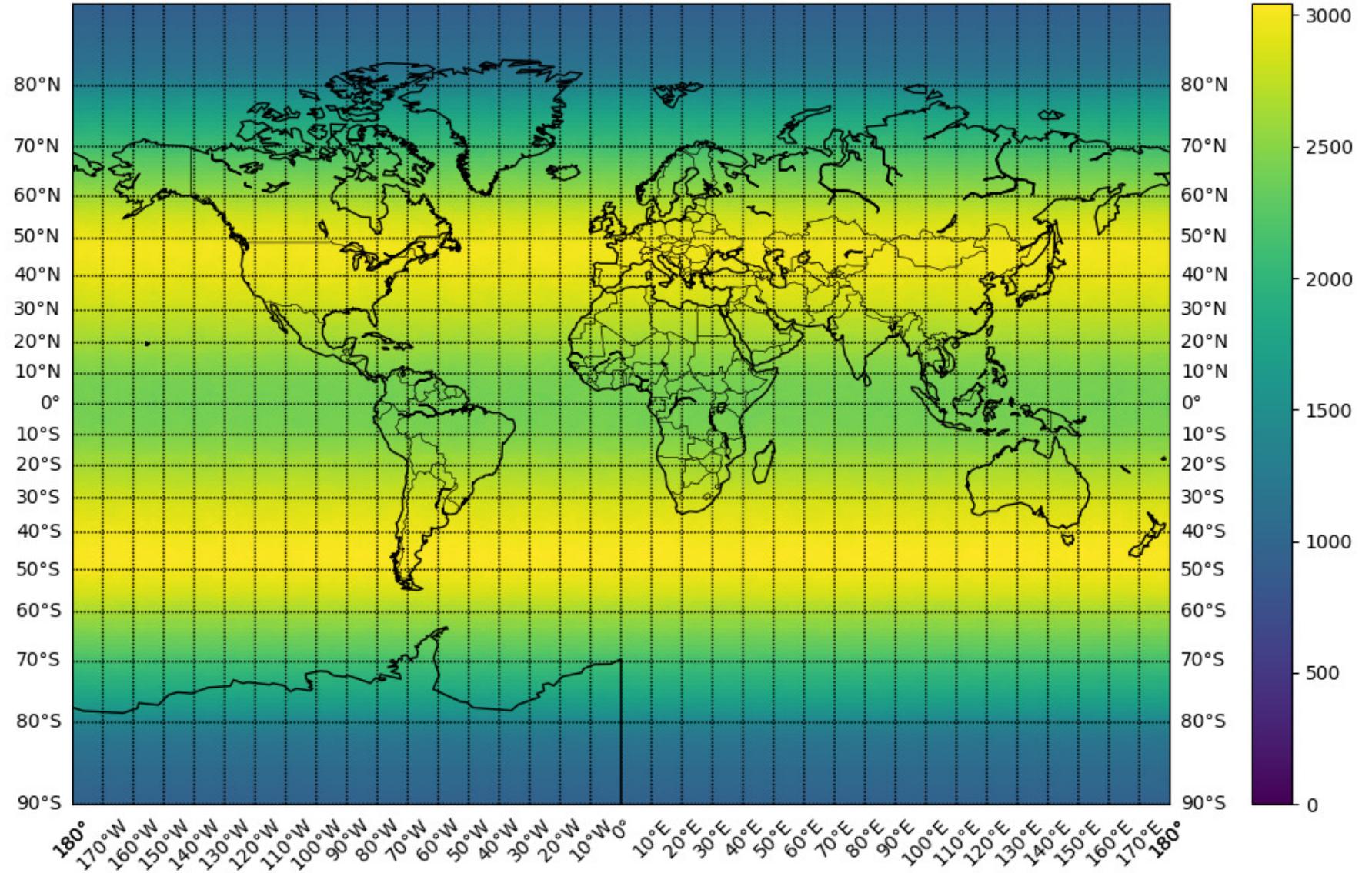


## Worldwide effects

Simulation including  
52 704 satellites

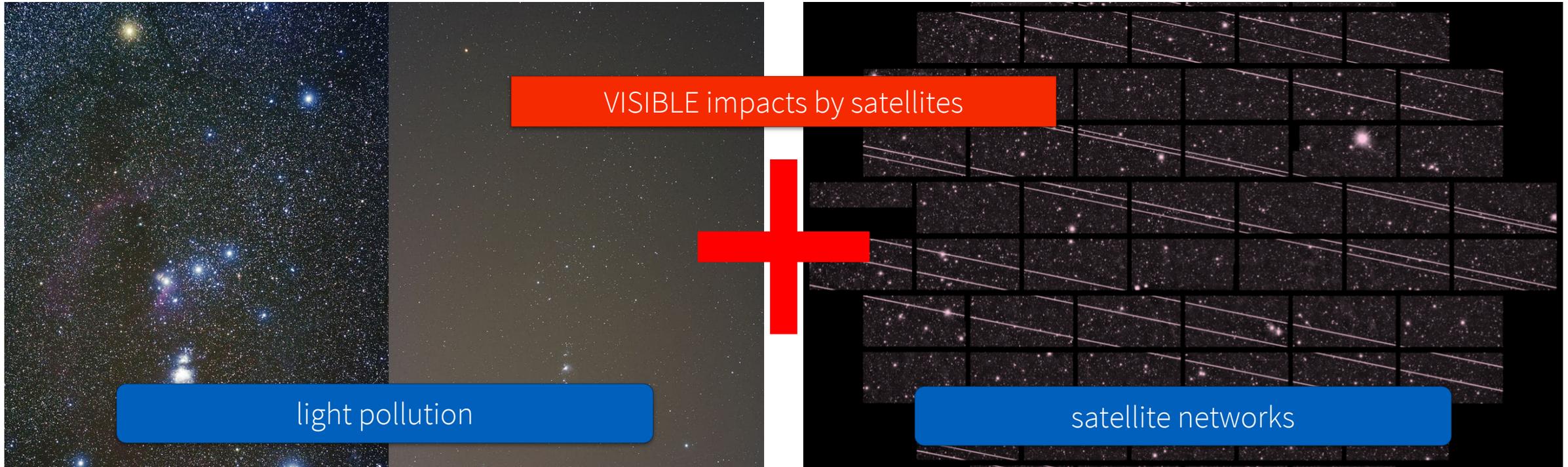
(Starlink, OneWeb, Kuiper  
System, GW-A59, GW-2)

Number of satellites  
above horizon at any  
time, if all reach their  
final positions ->



Wallner et al. (2021)

## What we must avoid - I

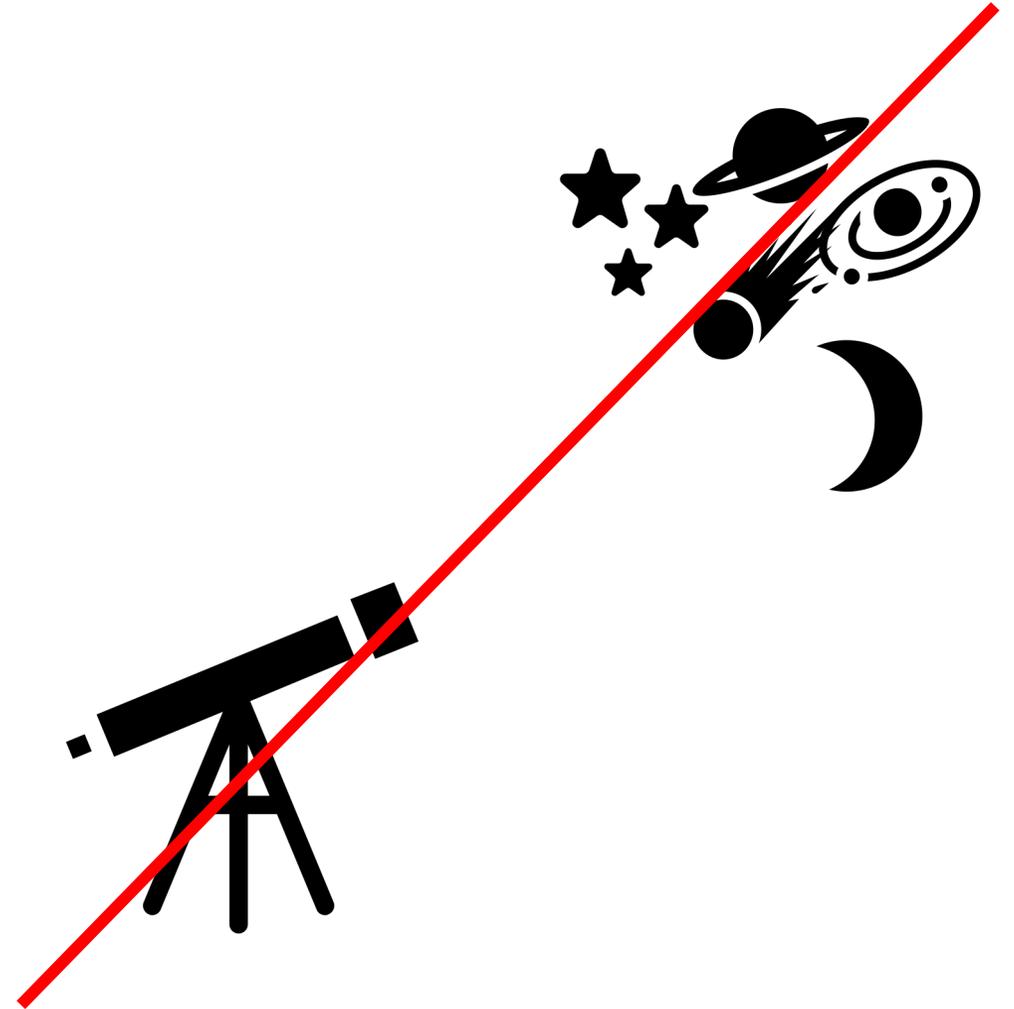


## What we must avoid - II

...the 'death' of observational astronomy

⇒ the answer does not have to be 'no satellites'!

BUT: to ensure both, we need necessary information on upcoming satellites



## Some recommendations...

There is the strong need of international agreements, legal frameworks and/or licensing requirements for satellites

...on visibility impacts:

- design missions with a maximum value of their appearance: fainter than visual magnitude 7 during ALL flight phases

...on satellite networks:

- promulgate necessary information on satellites such as surface reflectance, antenna parameters, predicted/real-time ephemerides
- work together with astronomical community

Most important: reliable information!

Thank you!

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