Astronomy and the climate crisis

Burtscher, L.H.

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Leo Burtscher
(Leiden Observatory / Leiden University, The Netherlands)
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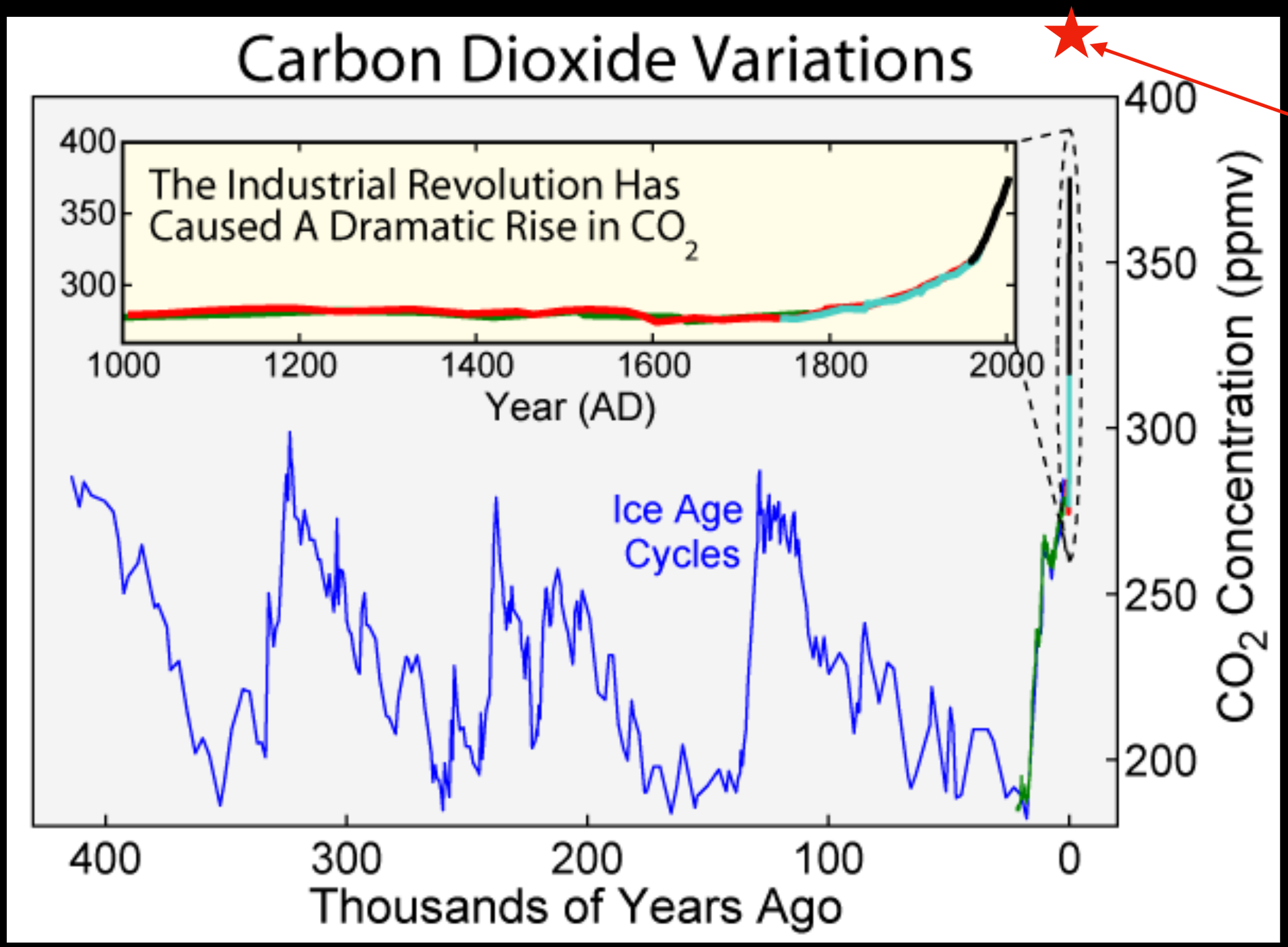
@LeoBurtscher, @Astro4Earth
astronomersforplanet.earth

NASA/Bill Anders (edited by LB)

What is the climate crisis?

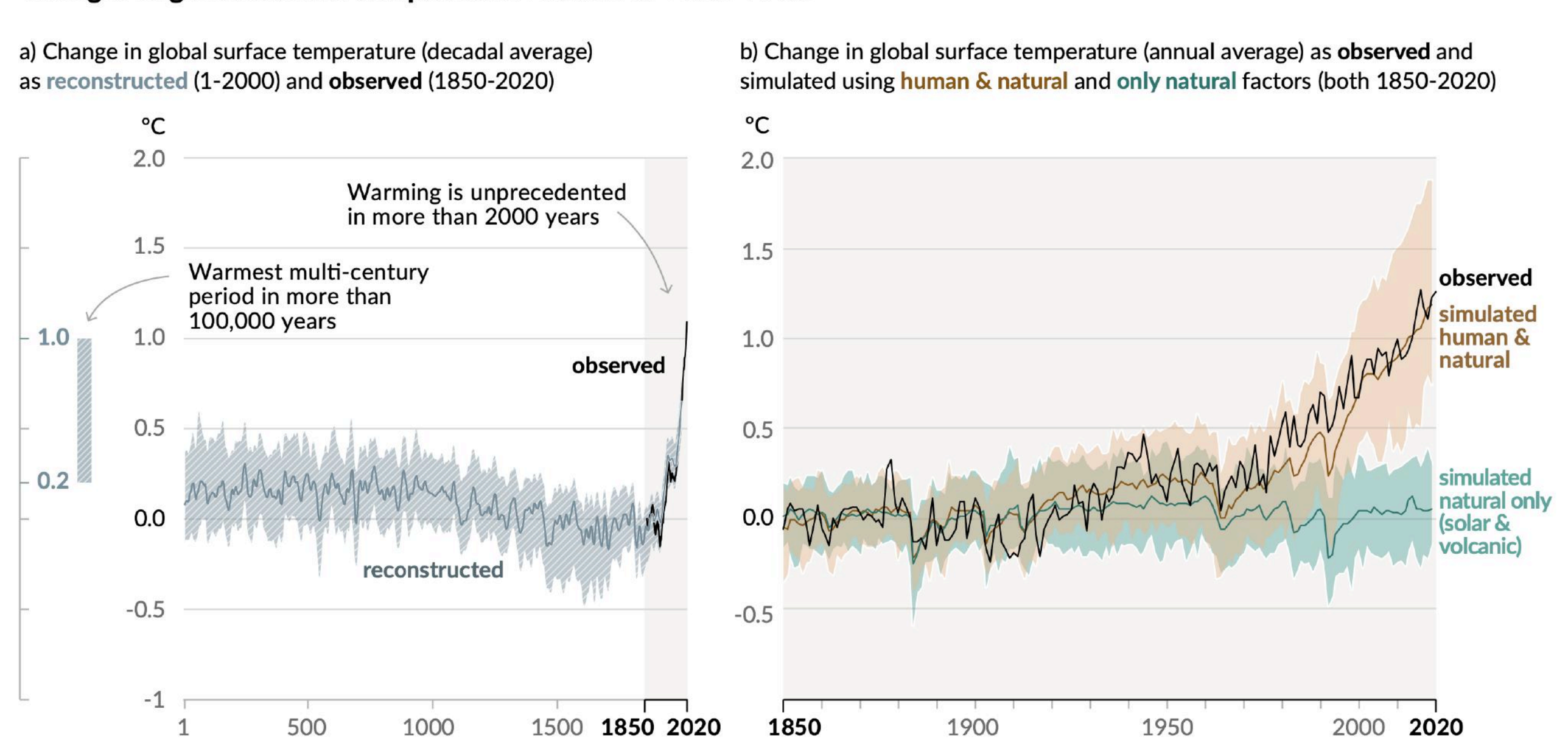


Latest number (Jan 2022): 416,7 ppm

co2.earth

Bild: Robert A. Rohde / Global Warming Art project

It’s us



IPCC AR6 WR1, Figure SPM.1b, p. SPM-7

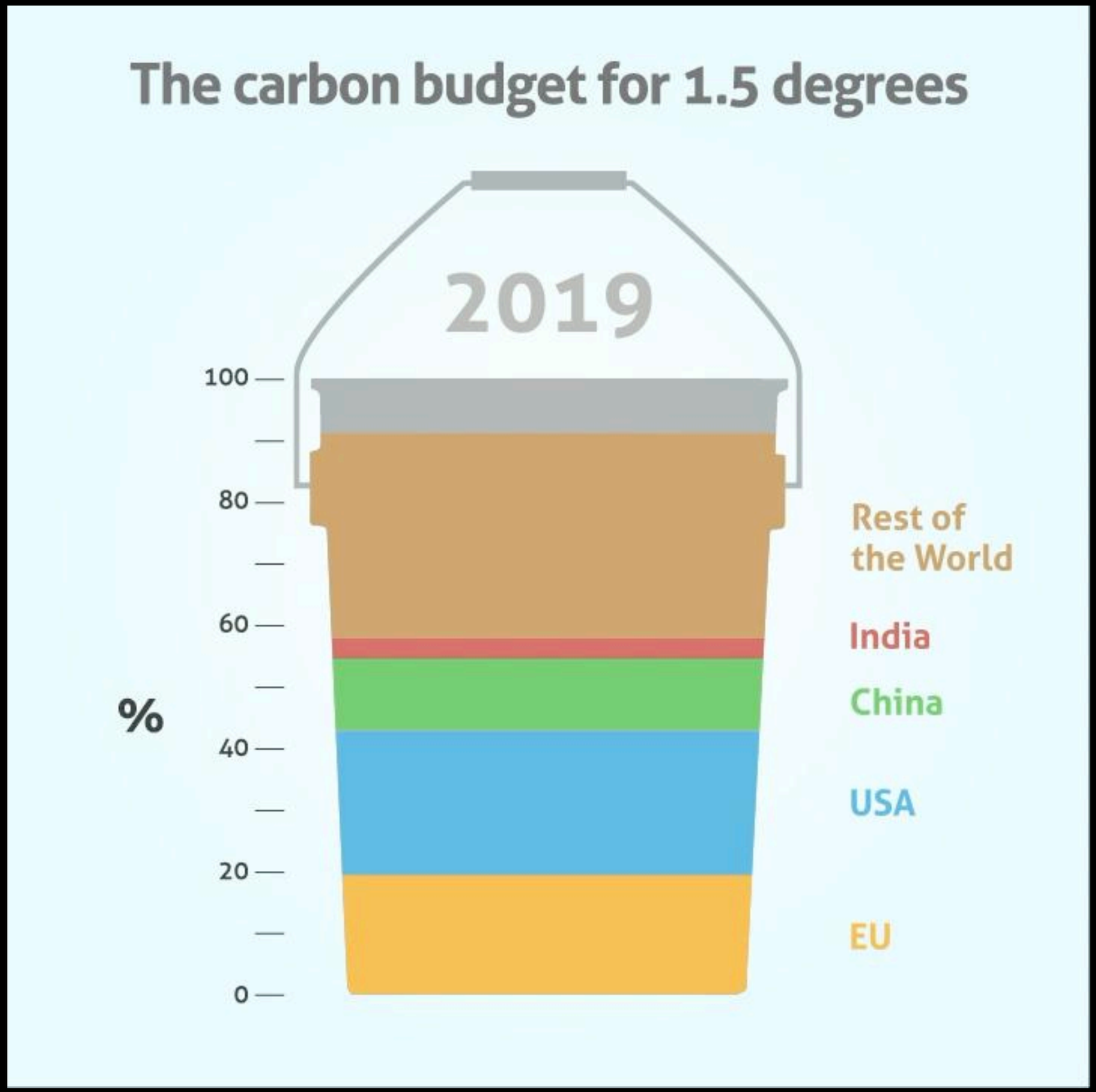
It’s bad

Flooding in Germany, July 2021

„Firenados“ in California, July 2021

worldweatherattribution.org estimate the likelihood of individual extreme weather events in the current vs. pre-industrial climate

We need to act now



What can astronomers do?

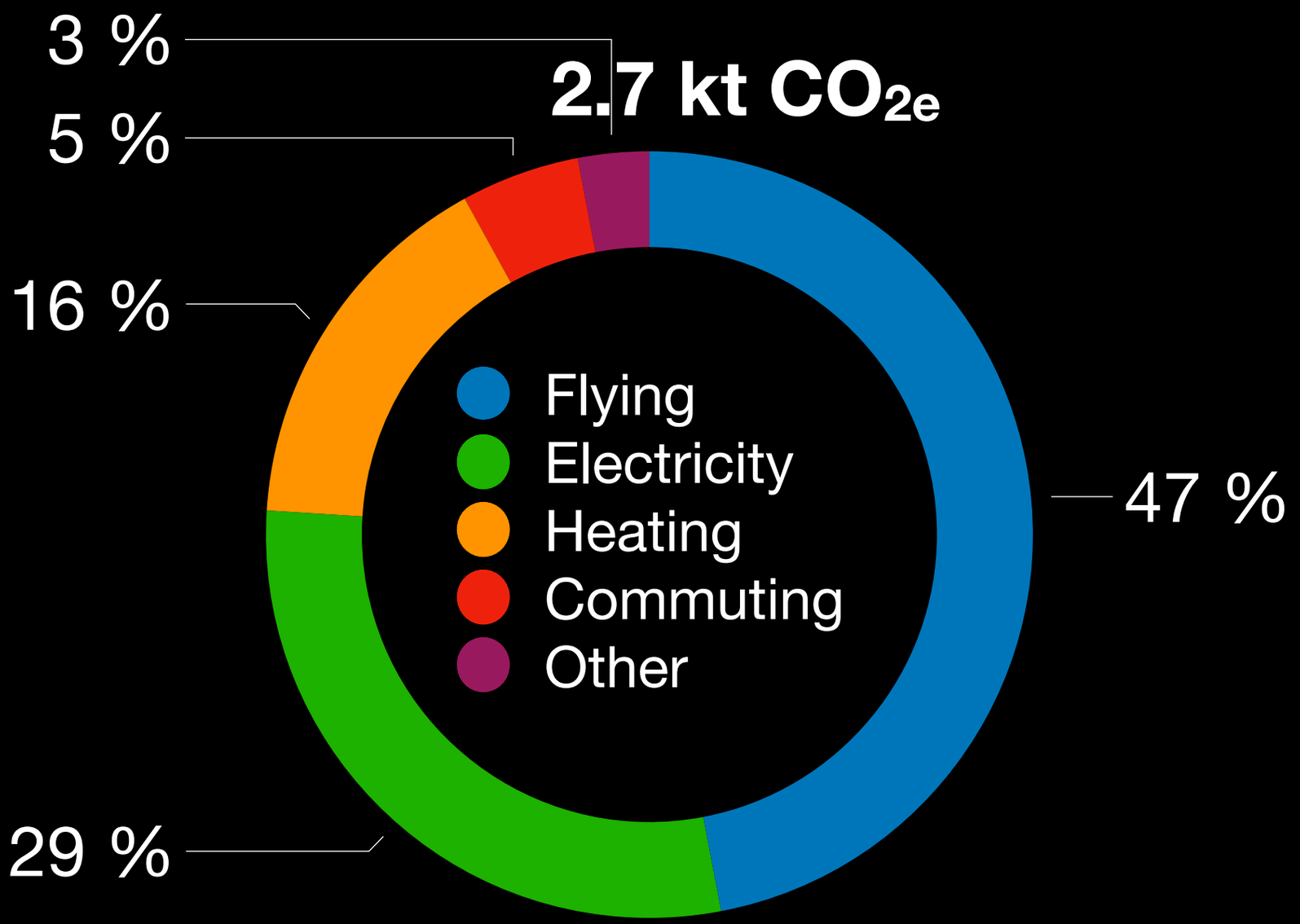
1. Reduce our own carbon emissions and lead by example.
2. Convey the astronomical perspective creating awe, empathy and a feeling of global citizenship.
3. Lend your trusted voice to the public debate.

NASA/ESA

Our own carbon footprint

MPIA, Heidelberg

MPIA sustainability group, Number for 2018



Not included

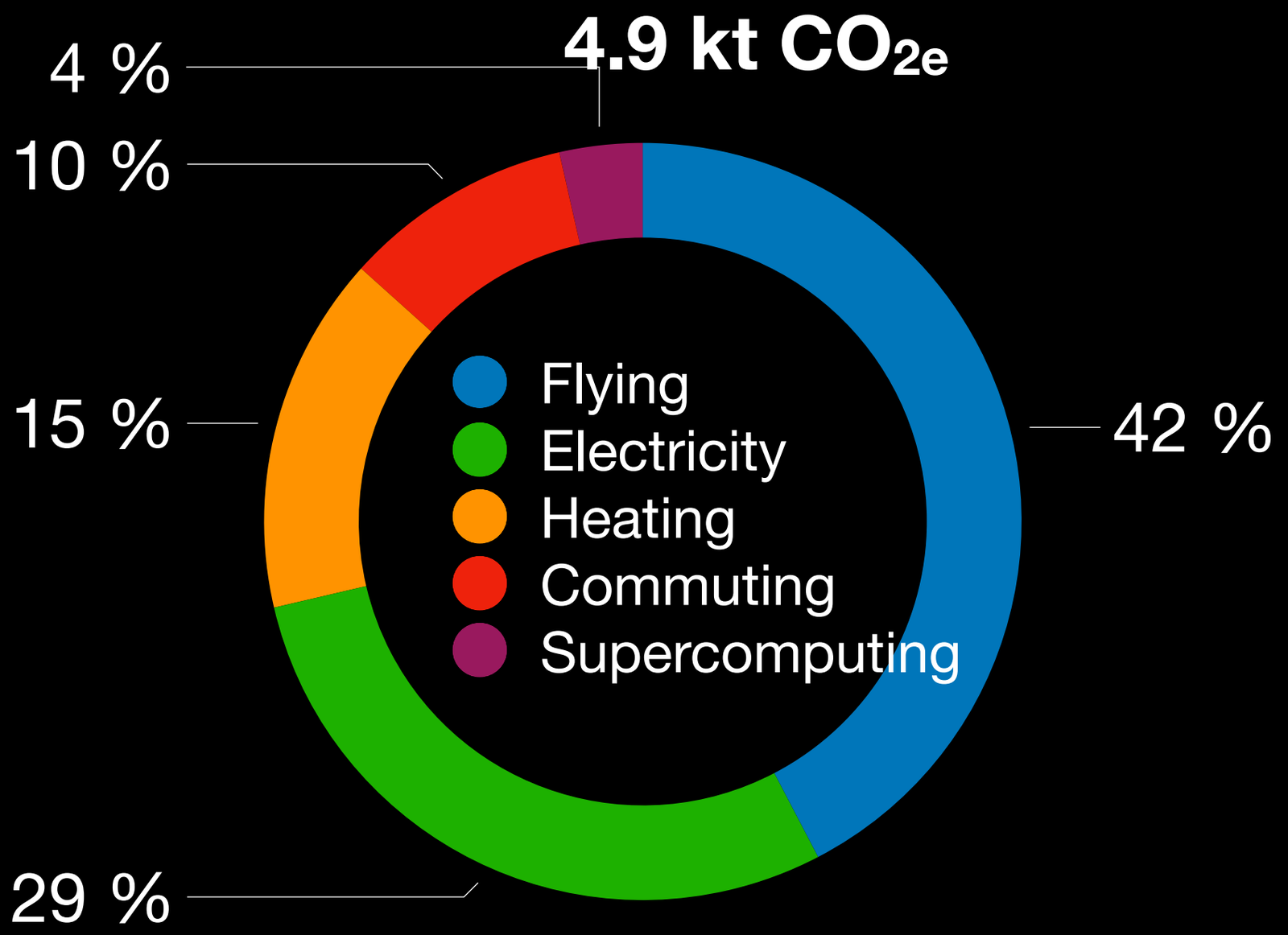
- Hotel use
- Construction / renovation work
- Use of observatories
- Train trips

- With ~300 employees, this corresponds to ~ 9t CO_2eq work-related emissions per employee.
- With 593 refereed/review articles in 2018 (1st + co-author), this corresponds to ~ 4.6t CO_2eq per article.
- This can be compared to 11t CO_2eq per German citizen or 1.6t CO_2eq per capita in India.

Jahnke et al. 2020

Astronomy research in NL

Raad van de Astronomie „Green team“, numbers for 2019

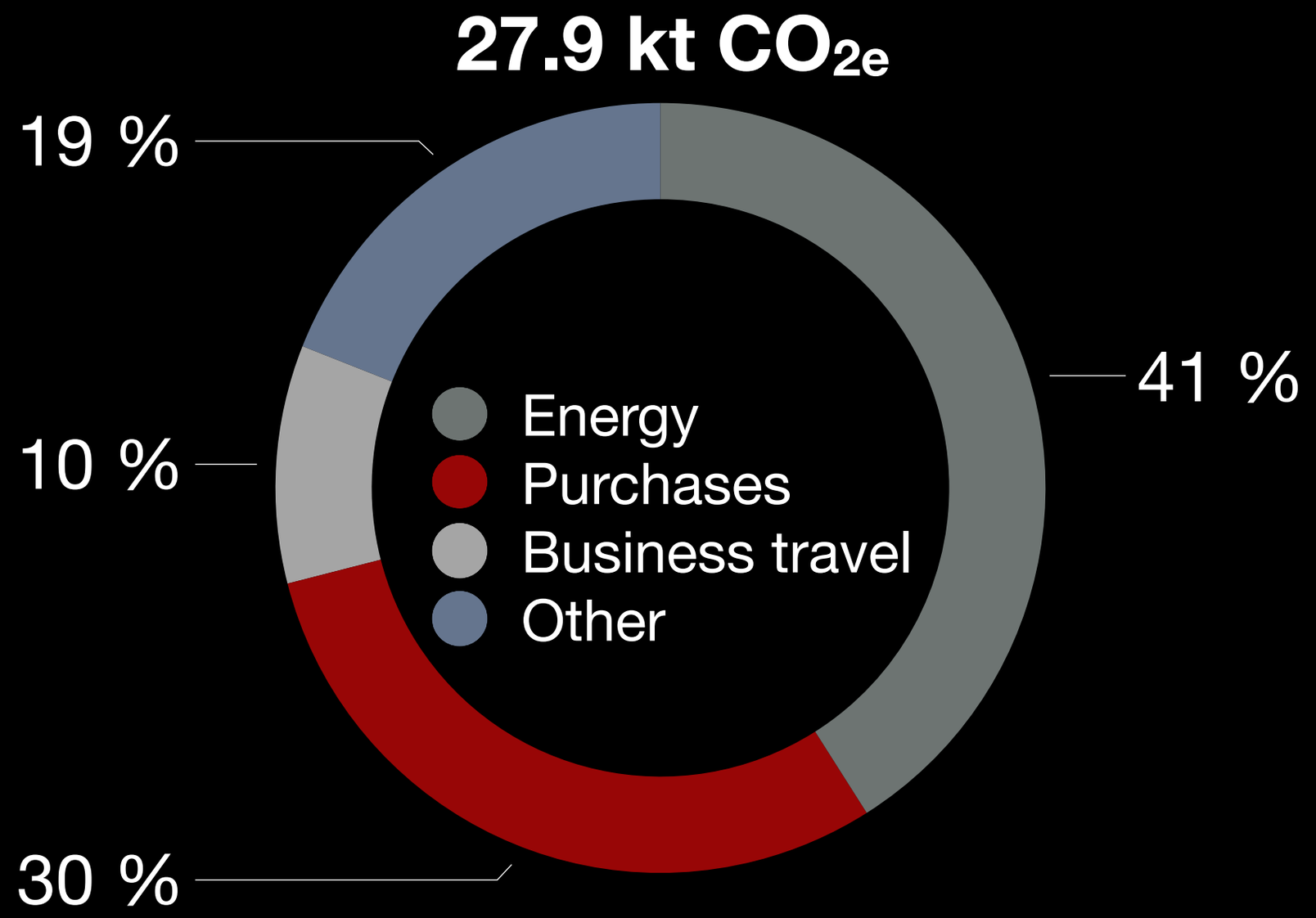


- With ~1040 research staff, this corresponds to ~ 4.7t CO_2eq work-related emissions per employee.
- Counting renewable energy as 0 emission.

van der Tak, F., LB et al. 2021

ESO's carbon footprint in 2018

Numbers for 2018



See also the CFHT's carbon footprint project; N. Flagey et al. Nature Astronomy Sep 2020: 63% electricity at the summit, 25% travel

In summary: our emissions stem mostly from electricity & flights

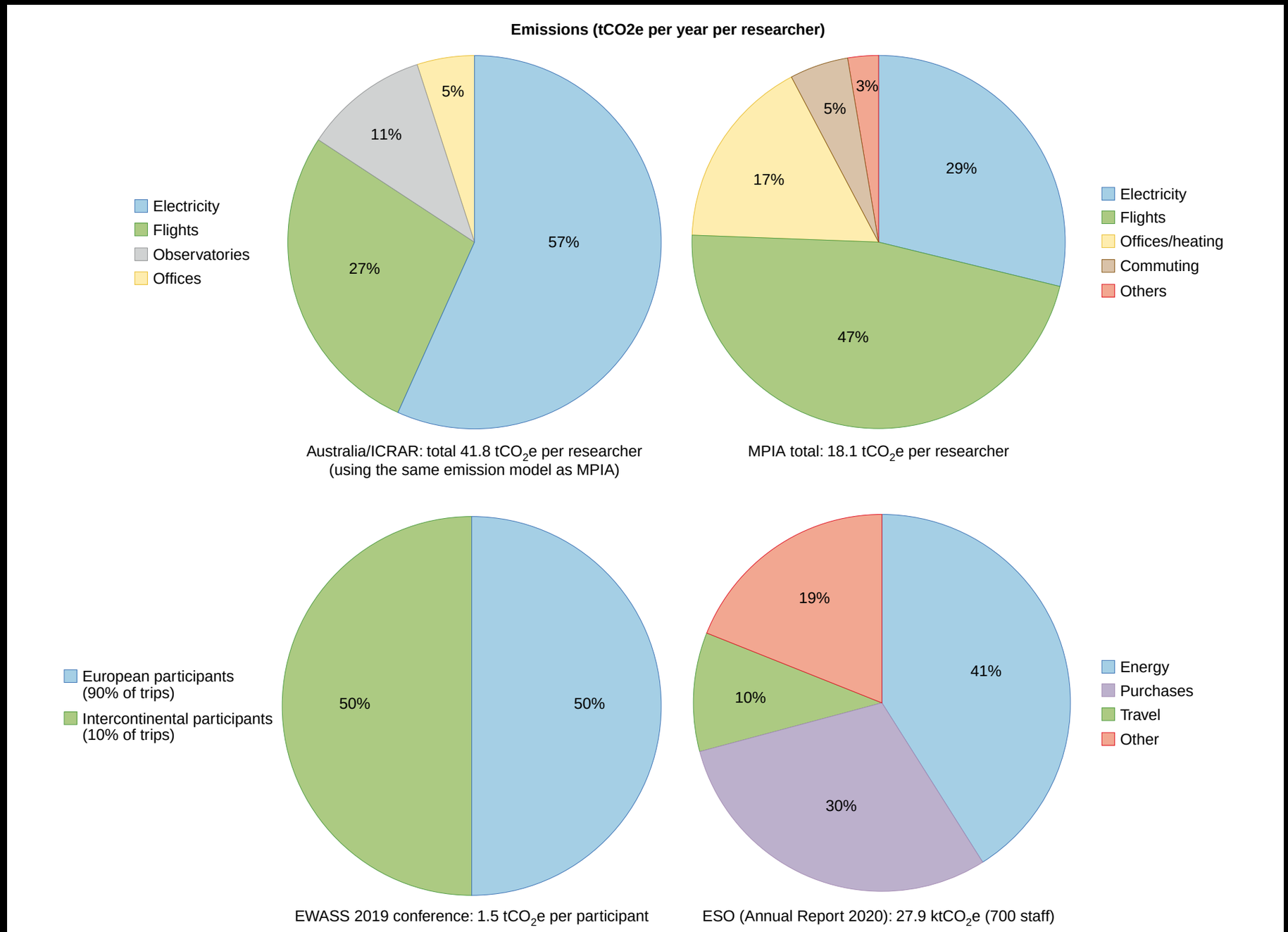
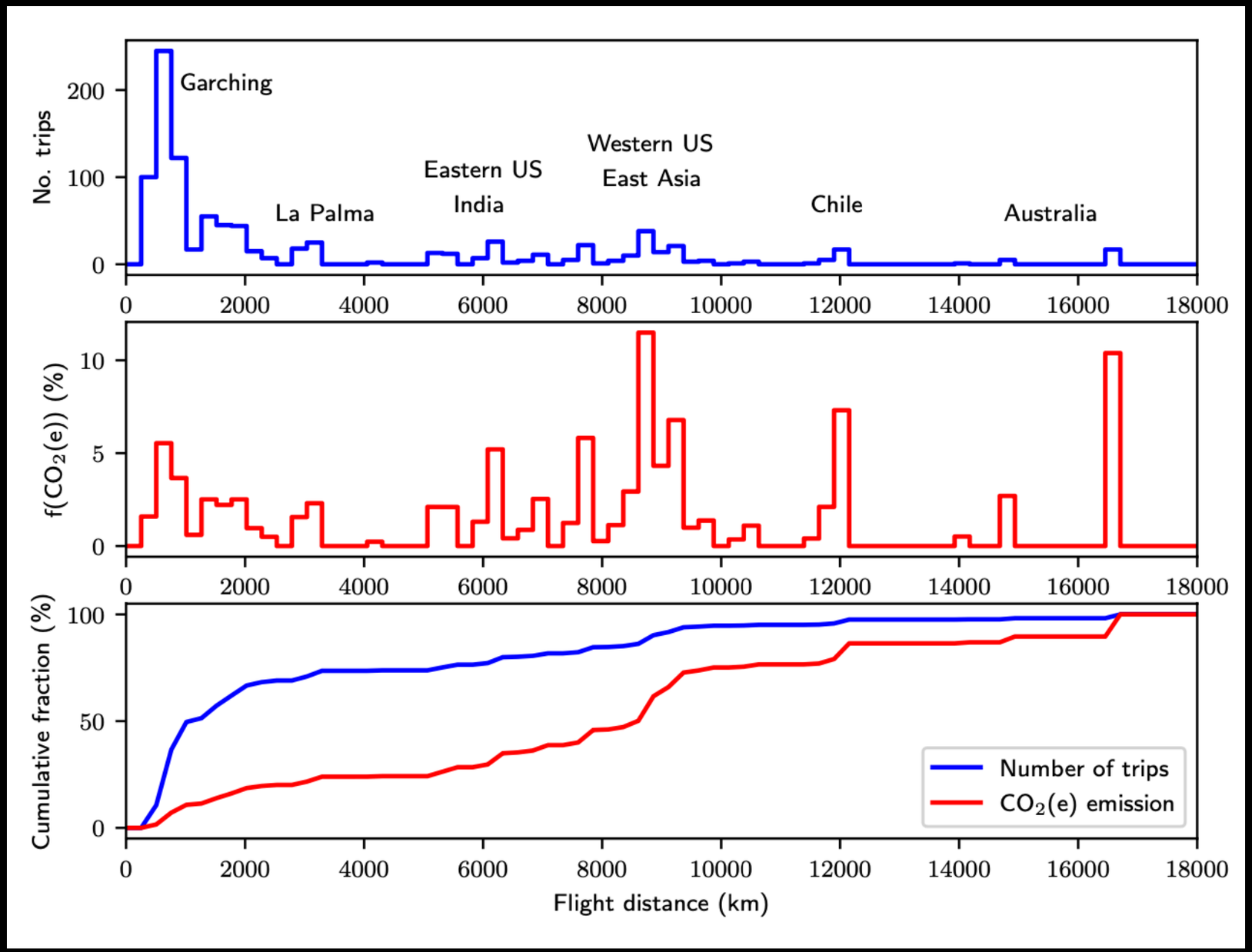


Fig. 3 | Carbon budgets for astronomical research activity. The carbon footprint of astronomical research activity as determined for the International Centre for Radio Astronomy Research (ICRAR) in Perth, Australia[14] (top left), for the Max Planck Institute for Astronomy (MPIA) in Heidelberg, Germany[15] (top right), for the annual meeting of the European Astronomical Society (EAS) 2019 in Lyon, France[5] (bottom left), and for the European Southern Observatory (ESO)[13] (bottom right).

Stevens+ 2020, Jahnke+ 2020, Flagey+ 2020, Aujoux+ 2021, ESO Annual Report 2020, Burtscher+ 2020, **2021**

Institute travel

The long-distance trips matter most.

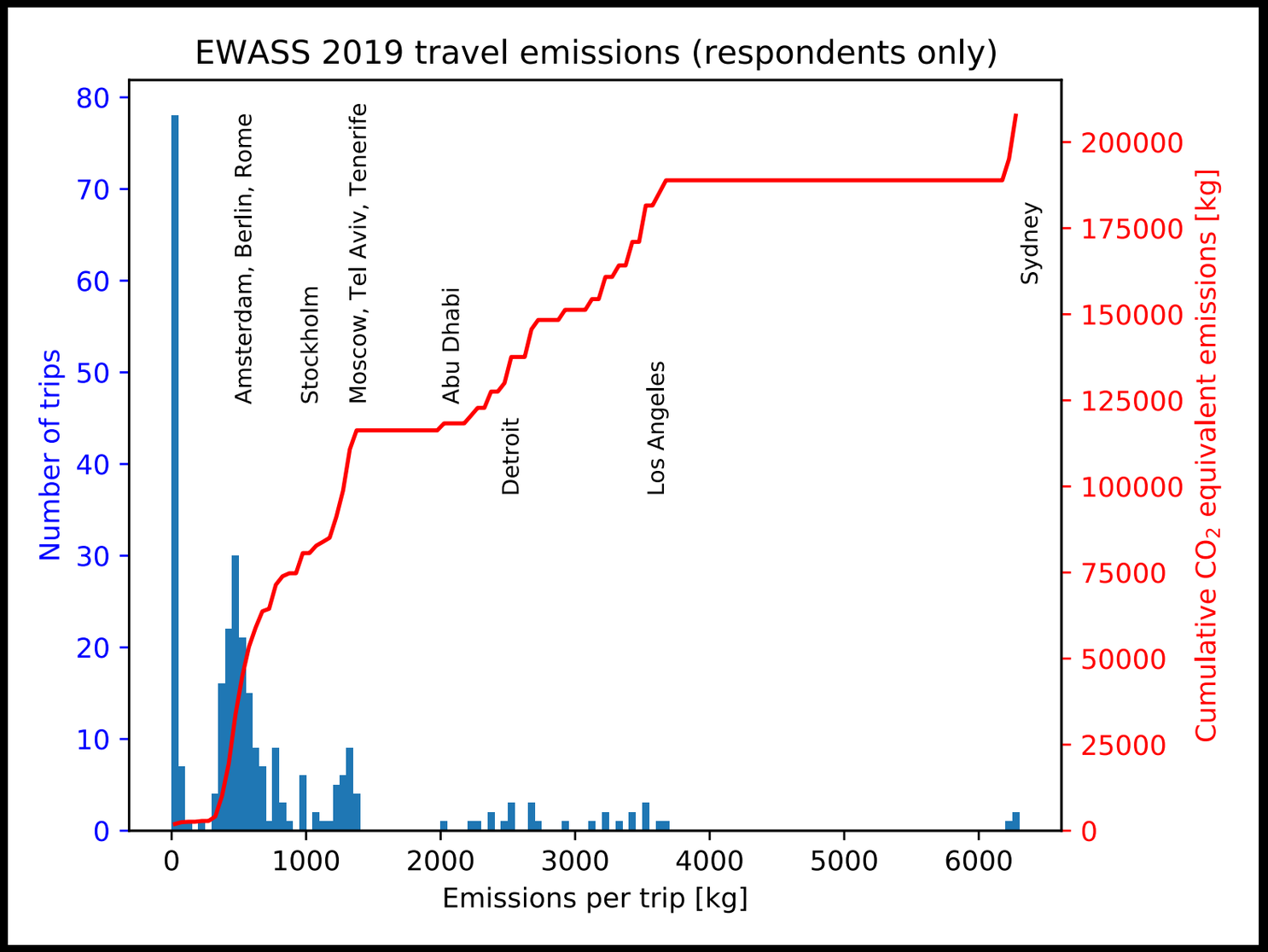


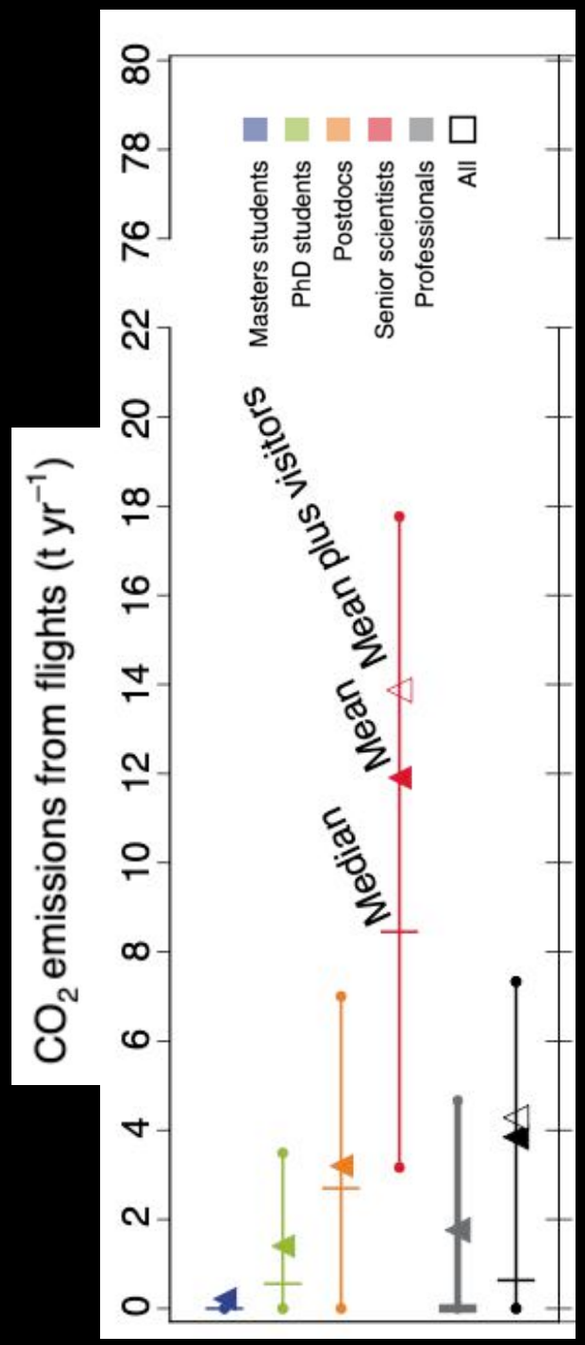
Number of trips and fractional contribution to CO2 budget for Leiden Observatory staff in 2019

van der Tak, F., LB et al. 2021

Astronomical conferences

A factor ~3000 lower emissions for (more inclusive) on-line meetings



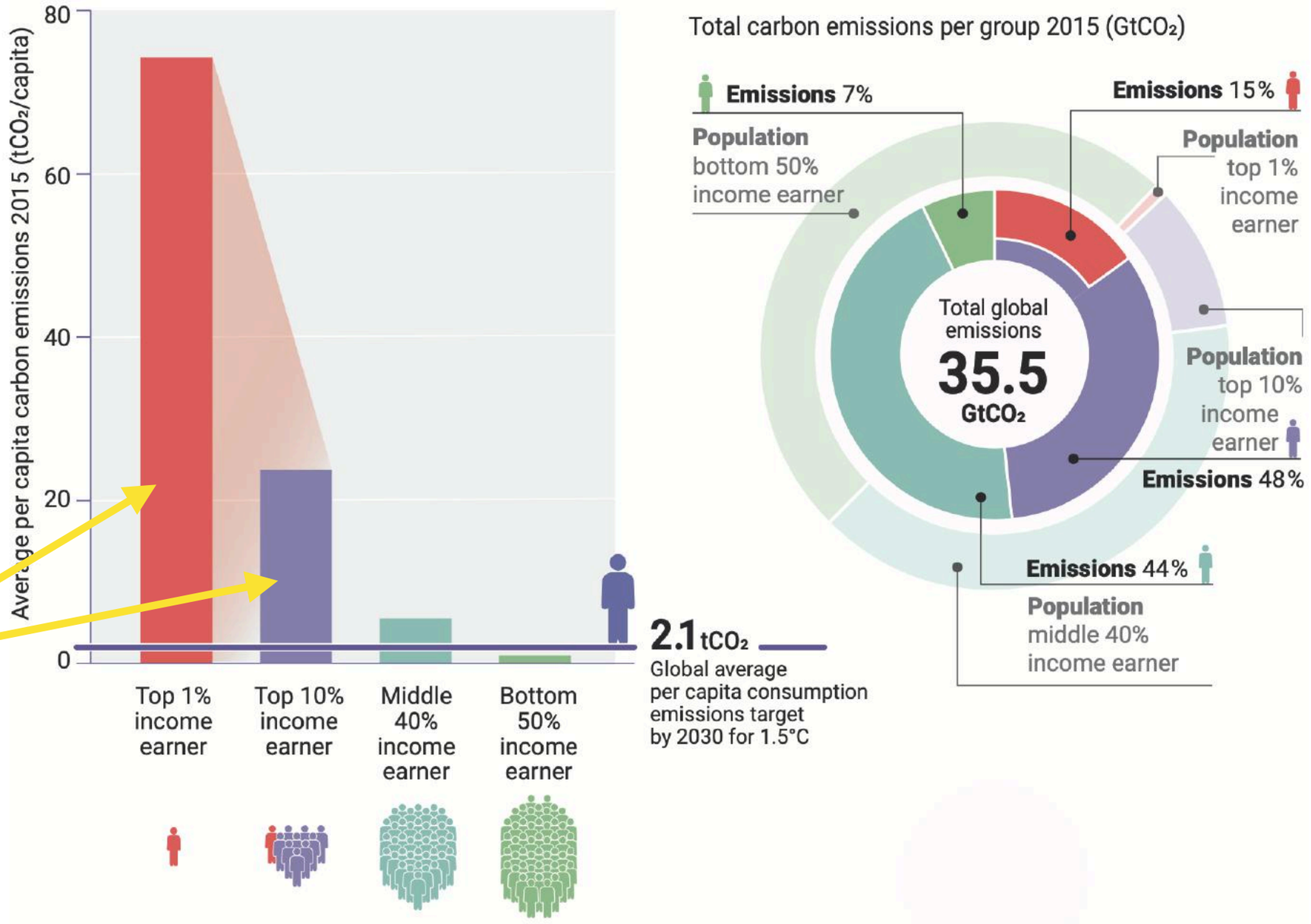


EAS 2020 (virtual) produced about 588 kg of emissions for 1777 participants – for EWASS 2019 it was 1.9 kt for 1240 participants

L. Burtscher et al., Nat. Astro (2020)
A. R. H. Stevens et al., Nat. Astro (2020)

Why should **we** care?

Figure 6.1. Per capita and absolute CO_2 consumption emissions by four global income groups in 2015



Note: Per capita CO_2 consumption emissions, and absolute CO_2 consumption emissions by four global income groups in 2015, compared with emissions reduction targets for 2030 for limiting warming to 1.5°C. Income thresholds in 2015 are according to US$ purchasing power parity in 2011: 1 per cent > US$109,000; 10 per cent > US$38,000; middle 40 per cent > US$6,000; poorest 50 per cent < US$6,000.

That's us!

UN Emissions Gap Report 2020, Chapter 6 (S. Capstick et al.)

But can we do more?

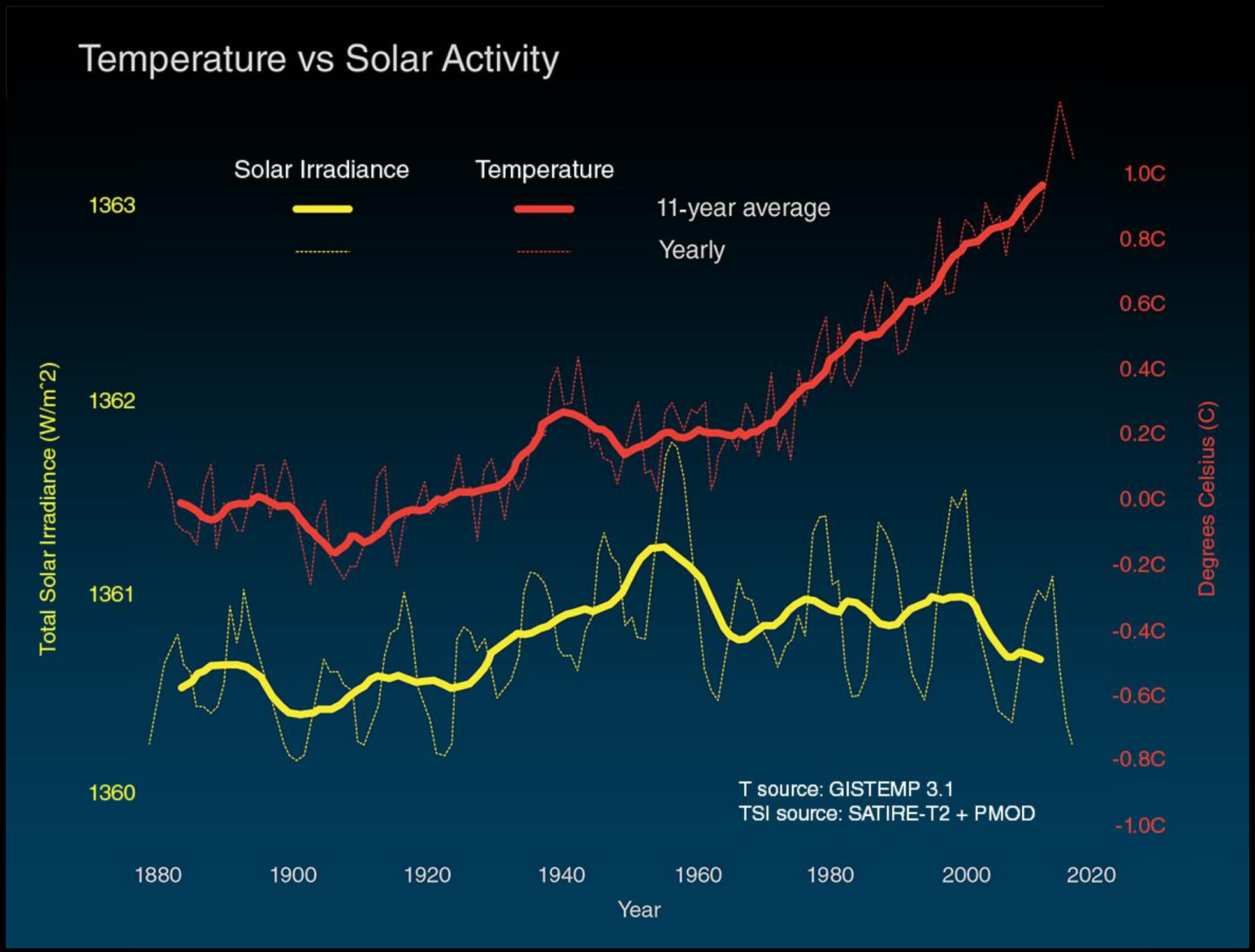
There is no planet B

>4000 exoplanets known to date, but there is no place like Earth.

ESO / M. Kornmesser

Facts & Methods

climate communication from the "neutral" ground



NASA/JPL-Caltech

„Spaceship“ Earth

"Earthrise", Apollo 8

NASA/Bill Anders

Perspective

"Pale Blue Dot", Voyager 1

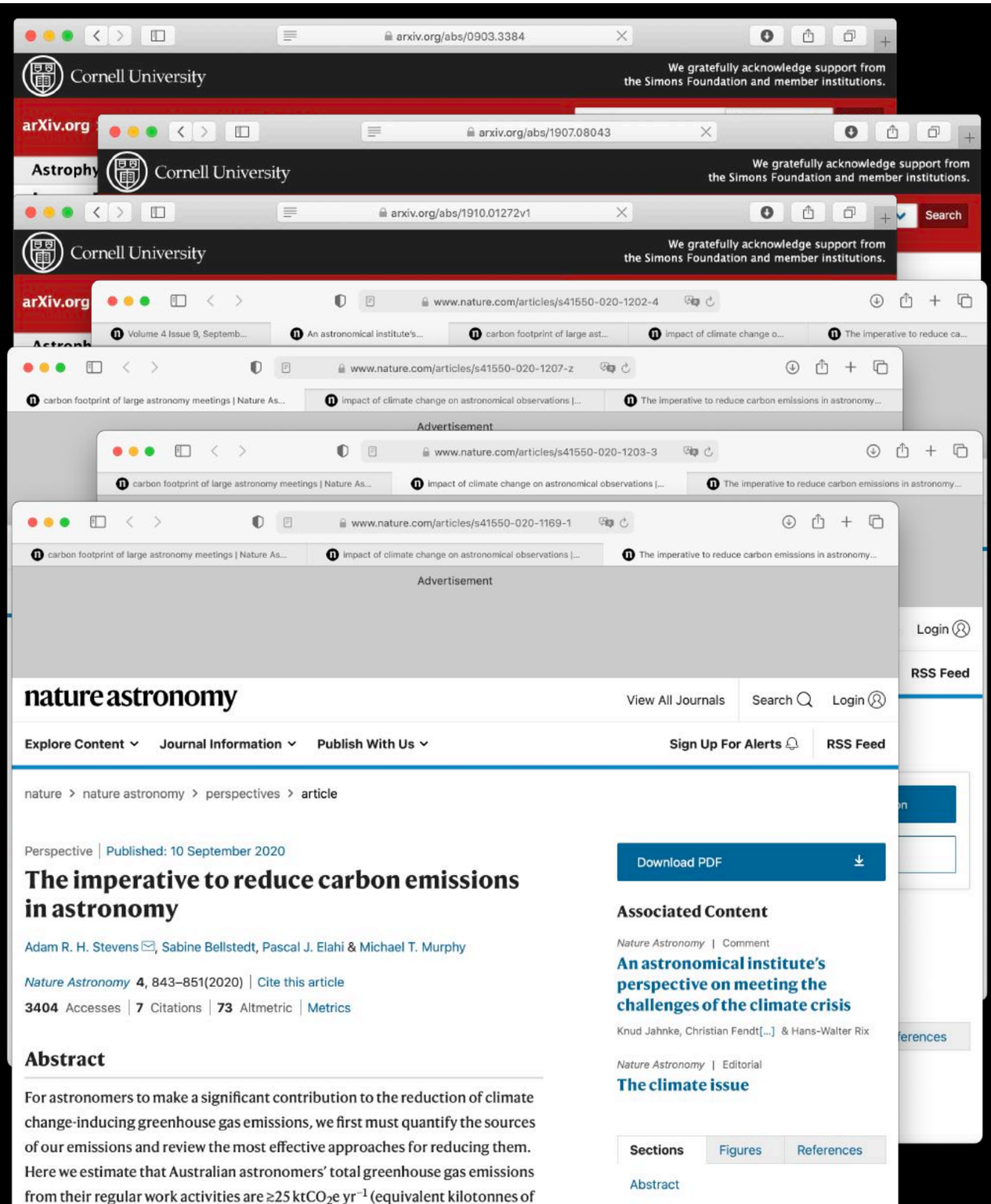
NASA

Who are we trying to reach?

Similar distribution internationally, see *International Public Opinion on Climate Change*
(Leiserowitz et al., 2021, Yale Program on Climate Change Communication)

ASTRONOMERS FOR PLANET EARTH

- **https://astronomersforplanet.earth**
  - Mailing list
  - Slack space
  - Google drive
  - Regular video meetings
- See also ileo.de/climate-crisis for more resources
- Get in touch: @LeoBurtscher (Twitter) or burtscher@strw.leidenuniv.nl



Summary

- The current climate crisis is real, it’s us, and it’s bad, but we can still fix it.

- Astronomy is an energy-intensive business. We can and must reduce emissions for the sake of our own discipline and to act as role models.

- We are the group that understands most keenly that „there is no planet B“. We should act accordingly, and communicate this message.

NASA/Bill Anders