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The carbon footprint of NL astronomy in 2019

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The carbon footprint of NL astronomy in 2019

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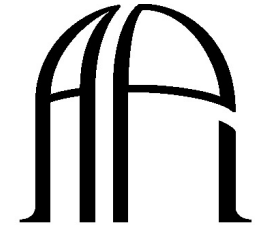
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ANTON PANNEKOEK
INSTITUUT

SRON



**university of
groningen**

ASTRON

Netherlands Institute for Radio Astronomy



**Radboud
University
Nijmegen**

Netherlands Institute for Space Research

Netherlands Organisation for Scientific Research (NWO)

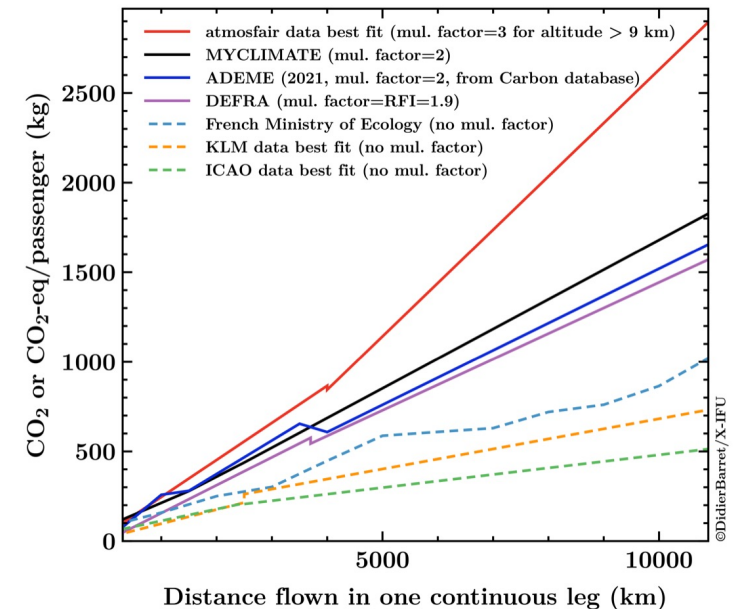
Toward climate-neutral science: Where & how much?

- Goal: increase awareness and acceptance for sustainable development
- On-line EAS 3000x less CO₂ than live .. but requires to re-think networking
- Today: Quantify CO₂ emission per source & institute
- Next step: Make recommendations to NL Astronomy Council

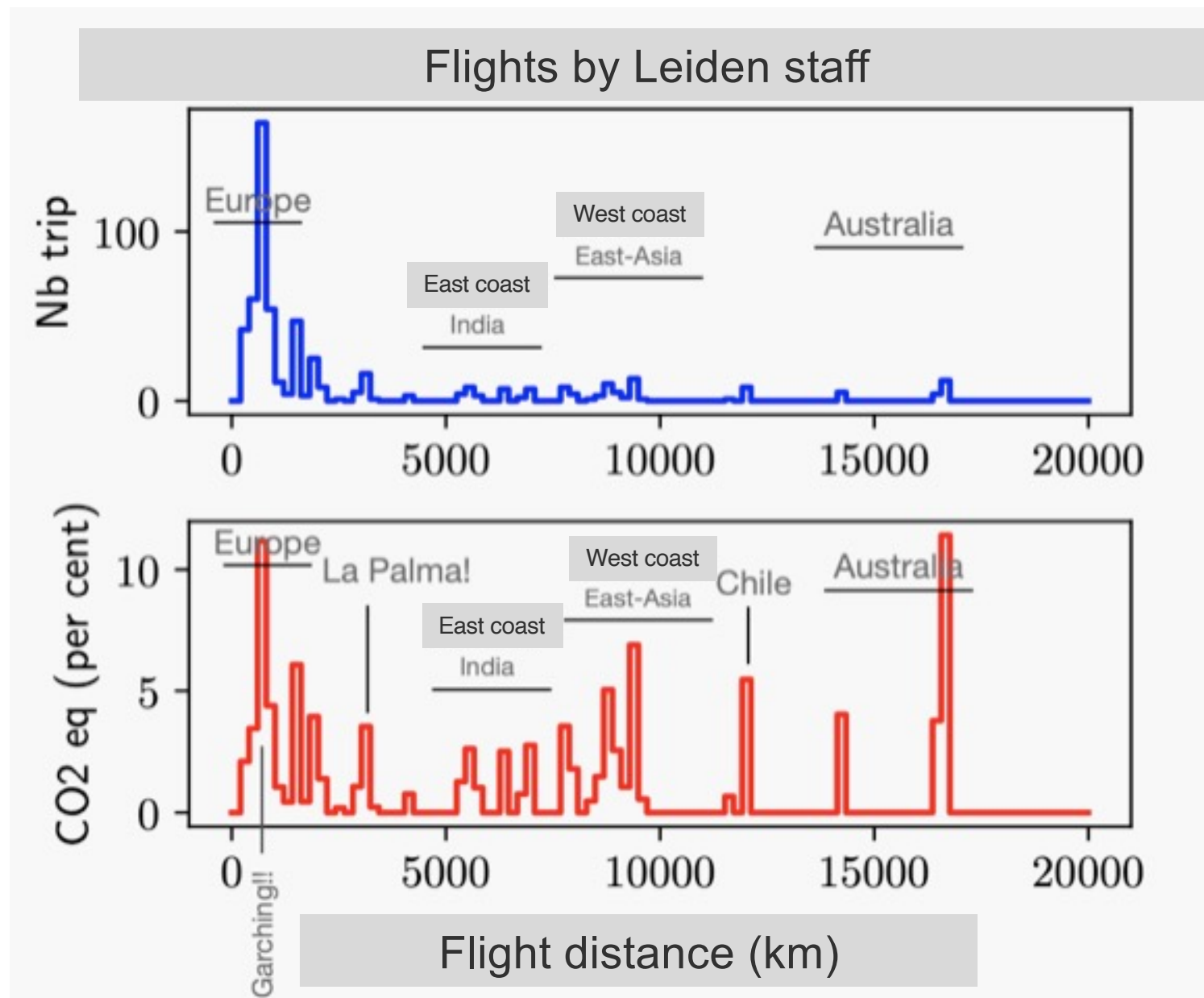


Approach

- Air travel: Barret (2020) model (*effective* emission)
 - accounts for stopovers, radiative forcing, ...
- Other business travel (train) assumed to be CO₂-neutral
- Heating & electricity: from housing & facility managers
 - power: green / grey / mixed multiplier
 - shared heating: scaled by floor area
- Commuting: from (anonymized) reimbursement data
- Not included: Education, observatories, missions
- (Super)computing: only international facilities
 - SURF uses 100% green power
 - Local ('tier-2') facilities to be added
- Survey of NWO institutes by Arcadis consultancy: Other sources relatively small (consumables, food, office equipment)



Example results: Long-haul flights cause most emission



Emerging trends / Preliminary conclusions

- Preliminary total: 4582 t(e)CO₂ i.e. 4.4 p.p.
- 46% air travel, 31% electricity, 17% heating/cooling, 4% commuting, 2% (super)computing
- Emission top-4 same as in Arcadis survey of NWO institutes
- SRON & Groningen dominated by power consumption
 - power-intensive laboratory equipment
- Leiden, Nijmegen, Amsterdam, ASTRON dominated by (long-haul) flights
 - instrumentation projects
- For further progress institutes must allocate time & money