

Investigating the Carbon footprint of Euro-Par

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Motivation



- All of us experienced the global warming. It is a fact.
- **What** our community should do and, in case, **how**?

Euro-Par 2020 and 2021

- Euro-Par 2020 and 2021 were **virtual**
- **Question:** What were the **savings in CO2 emissions** caused by virtual Euro-Par 2020 and 2021?
- Main factor studied: **Conference travel** (around 85% of the total carbon footprint of conferencing)¹

Euro-Par 2020

26th International European Conference
on Parallel and Distributed Computing

Warsaw, Poland
24-28 August 2020
2020.euro-par.org

A full week of scientific events including workshops, posters and tutorials.



EURO-PAR
CONFERENCE 2021

27th INTERNATIONAL EUROPEAN CONFERENCE ON
PARALLEL AND DISTRIBUTED COMPUTING

KEY DATES:

- 5 February 2021: Abstracts submission
- 12 February 2021: Paper submission deadline
- 12 February 2021: Workshop proposals
- 30 April 2021: Author notification
- 30-31 August 2021: Workshops
- 1-3 September 2021: Main conference

EURO-PAR
CONFERENCE 2020

Conference papers due:
7 February 2020 (abstracts)
14 February 2020 (full papers)

Organizers:
University of Warsaw, AGH

EURO-PAR
CONFERENCE 2021

27th INTERNATIONAL EUROPEAN CONFERENCE ON
PARALLEL AND DISTRIBUTED COMPUTING

10 Aug. – 8 Sep. 2021
<https://2021.euro-par.org>

A full week of scientific events including workshops, posters, and tutorials

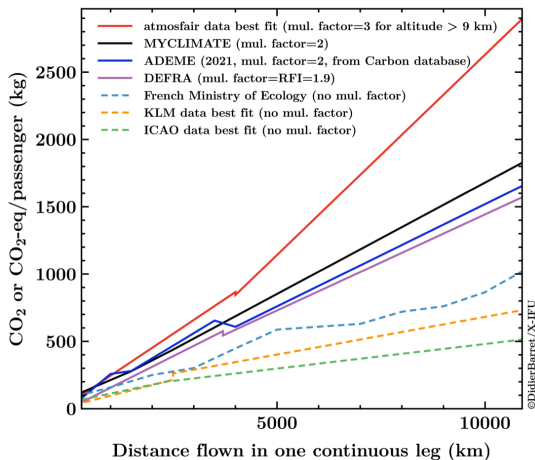
Proceedings in Springer LNCS series
<https://link.springer.com/conference/euro-par>

ORGANIZERS:
TÉCNICO LISBOA, inesc id LISBOA

¹ (Yanqiu Tao et al. "Trend towards virtual and hybrid conferences may be an effective climate change mitigation strategy". In: *Nature communications* 12.1 [2021], pp. 1–14)

Methodology: Travel emissions estimation

- Flight emissions calculator²
- Numerous models fitted with real flight data³
- Approximate travel emissions of Euro-Par 2020 and 2021 as if they were in person

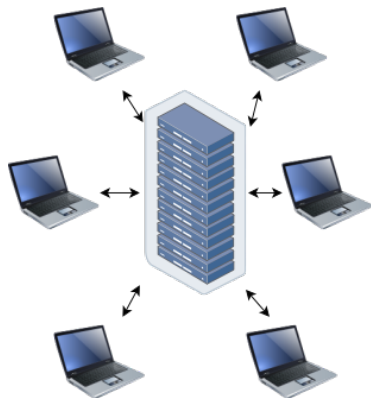


²<https://travel-footprint-calculator.irap.omp.eu/>

³ (Didier Barret. "Estimating, monitoring and minimizing the travel footprint associated with the development of the Athena X-ray Integral Field Unit". In: *Experimental Astronomy* 49.3 [2020], pp. 183–216)

Methodology: Virtual emissions estimation

- Two methods:
 - One method used in an astronomy conference⁴
 - Another method based on the energy cost of video streaming⁵
- Energy consumption from three components: Server, network, and viewing device
- Usage phase only
- Considering the carbon intensity of electricity production



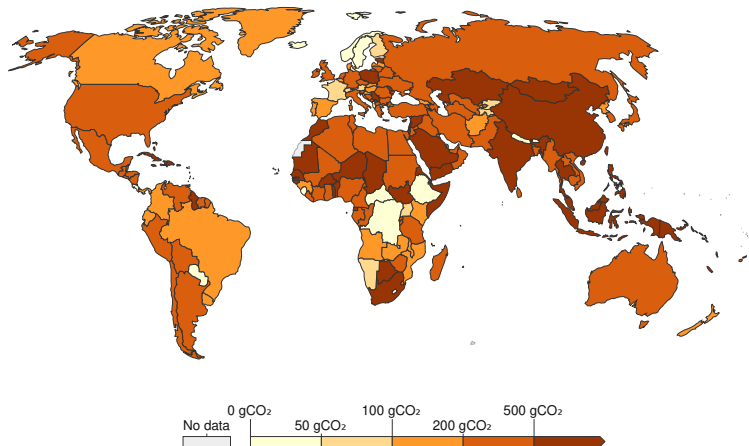
⁴ (Leonard Burtscher et al. "The carbon footprint of large astronomy meetings". In: *Nature Astronomy* 4.9 [2020], pp. 823–825)

⁵ (IEA. *The carbon footprint of streaming video: fact-checking the headlines*. 2020. URL: <https://www.iea.org/commentaries/the-carbon-footprint-of-streaming-video-fact-checking-the-headlines> [visited on 01/17/2022])

Carbon intensity of electricity generation

Carbon intensity of electricity, 2021

Carbon intensity measures the amount of greenhouse gases emitted per unit of electricity produced. Here it is measured in grams of CO₂ per kilowatt-hour of electricity.



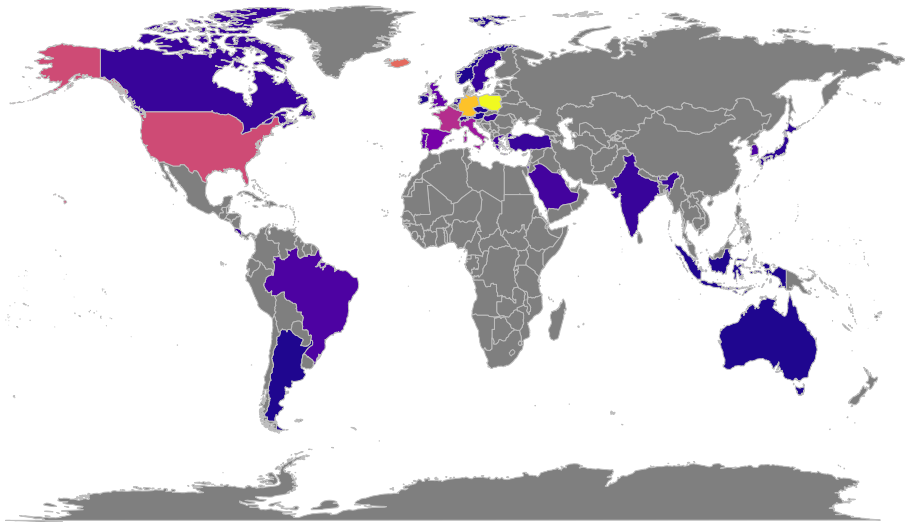
Source: Ember Climate (from various sources including the European Environment Agency and EIA)

OurWorldInData.org/energy • CC BY

Participation - Euro-Par 2020

221 participants

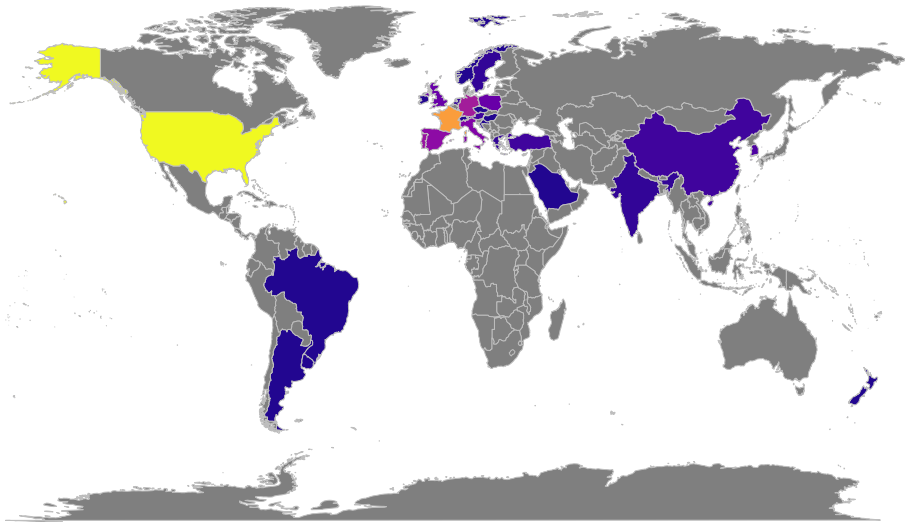
Number of Participants



Participation - Euro-Par 2021

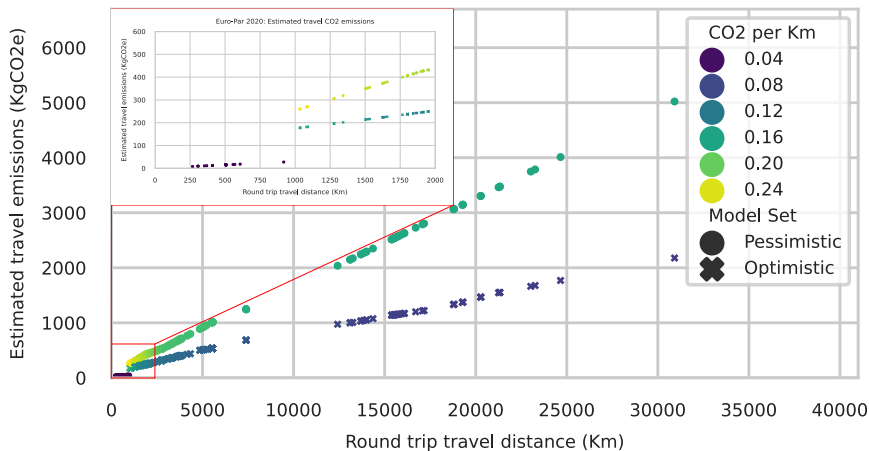
137 participants

Number of Participants

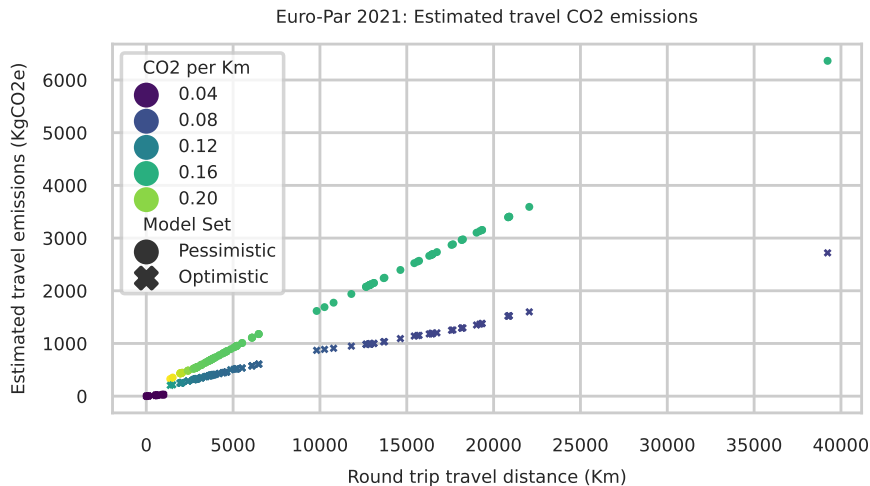


Results - Flying Euro-Par 2020

Euro-Par 2020: Estimated travel CO2 emissions



Results - Flying Euro-Par 2021



Results – In-person *versus* virtual

In-person:

Year	Model Set	Estimated Emissions (kgCO ₂ eq)	Equivalent Emissions (U.S. homes' energy use for one year ⁶)	Equivalent to Carbon Sequestered by (m^2 of U.S. forests in one year ⁷)
2021	Pessimistic	173252.45	21.8	$8.30 \cdot 10^5$
2021	Optimistic	84616.6	10.7	$4.05 \cdot 10^5$
2020	Pessimistic	214128.06	27	$1.02 \cdot 10^6$
2020	Optimistic	106453.20	13.4	$5.10 \cdot 10^5$

Virtual:

Year	Method	Emissions (kgCO ₂ eq)				Equivalent to Carbon Sequestered by (m^2 of U.S. forests in one year)
		Laptop	Network	Server	Total	
2021	Extended IEA	9.26	6.48	1.74	17.50	84.98
2020	Extended IEA	9.07	9.19	3.591	21.86	105.21
2021	Extended Burtscher <i>et al.</i>	12.63	11.27	3.73	27.64	133.54
2020	Extended Burtscher <i>et al.</i>	12.37	15.99	12.16	40.53	194.24

⁶US Environmental Protection Agency. *Greenhouse Gas Equivalencies Calculator*. 2022. URL: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator> (visited on 07/18/2022).

⁷Agency, *Greenhouse Gas Equivalencies Calculator*.

Concluding remarks

- As, expected, it is clear that the impact of physical meetings is much higher than virtual ones, in the order of **tens of thousands lower**
- The global impact of a usual Euro-Par is significant (Per capita annual CO₂ budget to reach the Paris Agreement: 1.5tCO₂e⁸)

⁸Source: https://www.atmosfair.de/en/green_travel/annual_climate_budget/

Changing our practice (moving to virtual): Pros and Cons

Pros:

- They are good for the climate
- They allow more participants

Cons:

- Humans need human interactions!
- Hard to replace face-to-face meetings by virtual ones
- Diversity and team building effects
- Restricts the exchanges to the conference topic

Open the discussion



Some ways to react. . .

- By constraints
 - Multiple (local) hubs – One per continent
 - Always take the train for less than 1000/1500 Km distances or less than one day
 - Reduce in-person events: one over three years
 - Reduce the number of events per year
- By incentive mechanisms
 - Communicate on the impact
 - Choose the venues with small carbon footprint
 - Gain efficiency in staying longer. Half fees if the participant provides proof of extended (professional) stays
 - Ask for carbon footprint estimation for the new bids

Should we rely only on individual behavior/opinions on the matter?