Climate change and research in computer science: what do do?

FSCD General Meeting

12 July 2024

Key numbers

2 tons CO2e $=$ emissions that nature can reabsorb per year

$=$ emissions of a London – New York return flight in one go

$=$ emissions induced by eating a steak every day during one year

+1.45ºC worldwide in 2023 (+2.6ºC in Europe) since preindustrial times

Institutions are acting

- EU declared climate emergency in 2019: reduce emissions of 55% by 2030 compared to 1990, meaning -5% per year in the next 6 years

- countries are acting: in France, the research ministry published a memorandum in June 2023 and asked research institutes to prepare roadmaps for reducing emissions

- institutions are acting: in France, CNRS, Inria, among others, signed in January 2024 an engagement to be *exemplary*

Researchers are acting

- **scientific societies**: SIGPLAN conferences papers are e.g. now published as journal papers and participation moved from mandatory to recommended

- **selection committees**: decisions to evaluate differently applications of persons who decided to publish in journal rather than conferences for environmental reasons (e.g. CNRS in France)

- **labs**: some accept to pay train and extra nights, even when more expensive than plane in total (e.g. some Inria centers) (this is an opportunity to do tourism on the way)

- **individuals**: some decided on their own to limit travel (see e.g. the TCS4F manifesto on a 50% reduction between 2020 and 2030; also, in maths, an engagement to do no more than once per year the equivalent of Paris-San Francisco, was signed in spring 2023 by 640 French researchers)

Possible actions for FSCD (based on experience of other conferences)

Location

- a choice of location limiting travelling distance

- bilocalisation on two different continents

- accept presentation at a geographically closer sister conference, or another year (like some SIGPLAN conferences do)

- move from one-conference per year to two hybrid "cost-less" events per year on different continents (like the ETSI standardization committee do)

Catering

- progressively moving towards vegetarian catering (3-6 times less emissions)

Attendance

- free remote attendance of non-speakers (like this year)

- limited fees for remote speakers (they could pay a special price, contributing to speaker invitations, room renting and publication fees)

- incentive to use train: reduced fees to participants not using planes

- extended stay: incentive to combine with a research visit in the conference surrounding (as ICALP 2022 did)

Complementary informations

Notes about the figures

Different kinds of emissions:

- only CO2: then, for Europe, it is about 6tons/person/year (if my cross-multiplication is correct)

- all greenhouse gaz (GHG) in CO2e: then, for Europe, it is about 11tons/person/year

Two kinds of figures:

- national emissions: what are the emissions produced in the country

- carbon footprint: what are the emissions consumed in the country (e.g. for France, 56% of consumed emissions are imported)

Different kinds of computations for planes:

- only CO2

- with also water vapour (contrails): add 50% of CO2 equivalent GHG effect

For food, there are a lot of variations in computations.

Some selected links

- Impact of climate change (gov. site): https://climatechange.chicago.gov/climate-change-science/future-climate-change

- Impact of climate change (EU site): https://www.eea.europa.eu/en/topics/in-depth/climate-change-impacts-risks-and-adaptation?activeTab=fa515f0c-9ab0-493c-b4cd-58a32dfaae0a

- Projected climate changes in Europe (EU agency site): https://experience.arcgis.com/experience/5f6596

- Emissions per country (2021): https://www.iea.org/regions/europe/emissions

- Emissions in Germany (2023): https://www.umweltbundesamt.de/daten/klima/treibhausgas-emissionen-in-der-europaeischen-union#hauptverursacher

- Distribution of emissions in France (2023): https://www.statistiques.developpement-durable.gouv.fr/len carbone-de-la-france-de-1995-2022

- Footprint in Europe (2018): https://www.insee.fr/en/statistiques/6478761

- Footprint and distribution of emissions in Germany (2024): https://www.umweltbundesamt.de/bild/dur co2-fussabdruck-pro-kopf-in

Some selected links (continued)

- The nine planetary boundaries (gov. site): https://www.statistiques.developpement-durable.gouv.fr/edit numerique/la-france-face-aux-neuf-limites-planetaires/en/4-climate-change

- EU state of urgency: https://www.europarl.europa.eu/factsheets/fr/sheet/72/lutte-contre-le-changement-climatique

- Food emission: https://ourworldindata.org/food-choice-vs-eating-local

- Food emission (research paper): https://www.nature.com/articles/s43016-021-00358-x.epdf

- Vegan meals: https://www.theguardian.com/environment/2023/jul/20/vegan-diet-cuts-environmental-damage-climate-heating-emissions-study

- European meal analysis: https://www.sciencedirect.com/science/article/pii/S2211912418300361?via

- Research ministry roadmp in France: https://www.enseignementsup-recherche.gouv.fr/sites/default/file 06/plan-climat-biodiversit-et-transition-cologique-de-l-enseignement-sup-rieur-et-de-la-recherche-2022-28244.pdf

- Report on ICALP 2022: https://icalp2022.irif.fr/?page_id=1092

More detailed informations

Basic facts

- increasingly alarming alerts from our climatology colleagues since 1992

- global warming ($+1.45^{\circ}$ worldwide in 2023, $+2.6^{\circ}$C in Europe, compared to mid-19th century) induces extreme climate events and invalidates current models (tipping points: collapse of permafrost, collapse of ice sheets, collapse of ocean currents, ...)

- worldwide emissions of CO2e are still not decreasing (current trajectory is towards $+3^{\circ}$C, that is suspectingly about $+4^{\circ}$C in Europe and even higher in North Europe)

- projections for Europe are: more drought, more forest fires, more storms, more floods

- only about 2 tons CO2e/person are renewable per year

- Carbon footprint: European consumers emit between 8 and 11 tons CO2e/person/year, 4 to 5.5 more than renewable (depending on sources)

- a return flight Paris-Tallinn emits 0.6 tons/person in one go, New York-Tallin 2 tons in one go, Tokyo-Tallinn 2 tons in one go

- in Europe, a study on meals gave in 2018: 56% of emissions come from meat, 27% from dairy products (1 steak every day = 2 tons CO2e in one year)

- in computer science labs, planes are in general the first source of emissions (40-60%), then purchases and daily use of car for working, as well as heating

The institutional actions

- EU declared in November 2019 the state of CLIMATE EMERGENCY

- EU decided in 2021 to reduce emissions by 55% by 2030 compared to 1990 (i.e. 6 years from now on), and reach renewability in 2050

- already -32.5% done in EU in 2022 (meaning we need roughly -5% per year in the next 6 years)

- countries are acting: in France, the research ministry published a memorandum in June 2023 and asked research institutes to make roadmaps for reducing emissions

- institutions are acting: in France, CNRS, Inria, among others, signed in January 2024 an engagement to be *exemplary*

- in France, CNRS set up the "Labo 1.5" research group

Excerpt of the current situation at the research level (with examples in France)

- some scientific societies changed their rules to address the global warning:

  e.g. SIGPLAN conferences papers are now published as journal papers and participation moved from mandatory to recommended

- some selection committees evaluate differently applications of persons who decided to publish in journal rather than conferences for environmental reasons (e.g. CNRS in France)

- some evaluation institutions require the labs they evaluate to have an environmental internal regulation (e.g. HCERES in France)

- some labs accept to pay train and extra nights, even when more expensive than plane in total (e.g. some Inria centers) (this is an opportunity to do tourism on the way)

- some labs order only vegetarian food for professional meals (e.g. the PPS group at IRIF in Paris)

- some groups engage themselves (see e.g. the TCS4F manifesto on a 50% reduction between 2020 and 2030; also, in maths, an engagement to do no more than once per year the equivalent of Paris-San Francisco, was signed in spring 2023 by 640 French researchers)

Excerpt of the current situation with conferences

- climate change awareness of organisers increases regularly

- hybrid conference: the case of ICALP organised in full hybrid mode in 2022 in Paris

  - incentive for seizing the opportunity of travelling to extend stay with a research visit
  - more vegetarian food than usual

- many conferences propose remote attendance of non-speakers (e.g. FSCD this year)

- to control the budget, separate catering from speaker invitations + room renting + publication fees

- reachability of location (e.g. TYPES rejected this year a location estimated too far)

- bilocalised events (e.g. Highlights in 2022)

- differed presentations

  - some blocks of conferences propose to present papers to a different conference requiring less travels (e.g. PLDI)
  - the idea to present the paper another year when the conference is on a closer location was discussed on the ACM climate google group

Initiatives taken at the individual level

- publish to journals rather than conferences when the objective is only publication (vs the objective is to meet people)

- use train when on the same continent and seize this opportunity to do tourism on the way

- reduce meat consumption, and reduce in particular red meat (more and more flexitarians, vegetarians and vegans)