Assessing the Carbon Footprint

of the 15th International Coral Reef Symposium 2022

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Introduction

The International Coral Reef Symposium is the leading conference on coral reef science, conservation and management, bringing together scientists, researchers, policy makers and many more, from all over the world. Its history goes back more than 50 years.
The 15th ICRS will take place from July 3rd to 8th 2022 in Bremen, Germany, and will be the first in-person ICRS ever to happen in Europe. Climate change is a critical global stressor, particularly for coral reefs, due to rising levels of greenhouse gas emissions in the atmosphere. Coral reefs act as early warning systems for climate change consequences, and they are warning loud! Thus, coral reef-related events particularly need to consider and assess their carbon footprint.
After the 14th ICRS virtual event being successfully implemented as a carbon neutral event, the set target for the 15th ICRS was to be organized as sustainable and climate friendly as possible. In order to reach that goal, green strategies consisting of two steps were applied: 1. To avoid and minimize local CO_2 emissions and waste wherever possible and 2. To offset all unavoidable CO_2 emissions, particularly caused by the travel of the participants, through investment in climate protection projects as a compensation measure.

Material & Methods

In order to assess the extent of CO_2 emissions for this year's in-person event, a calculation following the Greenhouse Gas Protocol (GHG Protocol) was carried out. To assess various forms of emissions the GHG Protocol distinguishes between 3 scopes. Scope 1 includes direct greenhouse emissions from sources that are controlled by the facility or organization, e.g. by burning fossil fuels. Scope 2 emissions are indirect energy-related emissions and include any purchased energy that is not produced within the facility. All other indirect emissions are categorized as scope 3 emission, among others this includes travel, catering and waste.

For the calculation of this year's carbon footprint the following emission sources were relevant:

Scope 1 - none
Scope 2 - electricity, heating and cooling within the conference halls (MESSE BREMEN and Congress Centrum Bremen), online attendees
Scope 3 - Travel, Public transport, Catering, Accommodations, Waste, Additional items (t-shirts, conference passes, lanyards)

The calculation was carried out for 1052 in-person attendees including volunteers, members of the organization team and press plus 272 online attendees.

Research was undertaken to identify CO_2 emission factors which were generated by all listed scope categories. As some of the categories differ in their CO_2 emission factors between countries (e.g. hotel accommodation), the pursued strategy was to specifically identify emission factors, that were most applicable to Germany. Key words for the research included "CO_2 emissions", "carbon dioxide emissions", "emission factor", specified for the individual categories. In some cases, the determined factors have been converted into consistent units e.g. miles into kilometres. A complete list of emission factors and references can be found attached to this technical report.

Emissions for travel to and from Bremen were calculated with the mean distance of all attendees' country of residence[1]. It was assumed that distances over 500 km were travelled by airplane and distances under 500 km were travelled in equal parts by train or car. Total emissions caused by travel of participants were established through multiplication with suitable emission factors[2,3,4].
CO_2 calculations for public transport[5] included a two-way journey between the airport and central station for all attendees arriving by airplane. It was presumed that 25 % of attendees, as well as the organization team, use public transport twice a day between their accommodation and the conference location. This assumption was made based on the fact that the majority of attendees resided in hotels within walking distance of the conference location.
Emission calculations caused by food and drinks considered a total of 6 meals, 2 Ice-Breaker drinks and 10 Coffees per attendee for the entire duration of the conference. Emission factors used for calculation were determined for certain ingredients individually [6,7]. Furthermore, the daily consumption of 1.5 l of drinking water per attendee was estimated with a particular emission factor[8].
For the calculation of CO_2 emissions from hotel accommodation, it was assumed that all in-person attendees from outside of Bremen had five overnight stays in an average star category of three. The emission factor was specific for an overnight stay in a three star category hotel accommodation in Germany[9].
Energy consumption for all occupied conference halls were calculated for the total span of the conference, based on known consumption data provided by MESSE BREMEN and Congress Centrum Bremen. Since all energy in those locations is provided either by Norwegian Hydropower stations or solar panels, an emission factor specific for those energy sources were chosen[10]. Estimations were made for the amount of water consumption from sanitary use, including sewage[11,12]. For water provision[13,14] and processing of the sewage[15] the emission factors were based on the arising electricity consumption.
CO_2 emissions generated by online attendees were calculated with the emission factor of 10 kg of CO_2 per attendee[16].
For waste, an amount of 0.15 kg per meal, added up by one napkin per person per meal and coffee break was estimated. An average emission factor for general household waste in Germany was used for calculation[17].
The calculation for CO_2 emissions from additional items encompasses the production of 527 t-shirts and 1000 conference passes and lanyards. For all additional items the most fitting emission factors for the type of item were used[18,19,20,21].

Results

The results of the calculations showed that the total amount of CO_2 emissions produced by the 15th ICRS including a 10 % safety margin were approximately: **1491 t**

Table 1.
Total CO_2 emissions (t) for seven main categories.

Category	tCO_2
Travel of participants	1135.9
Catering	94.2
Hotels	79.3
Energy	39.5
Additional items	4.9
Public transport	0.9
Waste	0.3
total	1355
+ 10% SAFETY MARGIN	**1491**

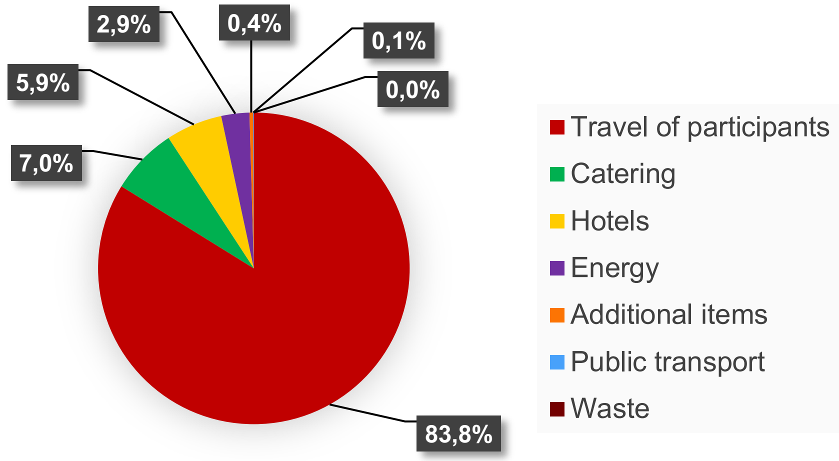

Figure 1: Proportion of CO_2 emissions by key categories to the overall carbon footprint of the 15th ICRS in Bremen, Germany.

As shown in Table 1 and Figure 1, the highest percentage of CO_2 release was caused by travel of participants. With 83.3 % that category displays a distinct majority off all CO_2 emissions.

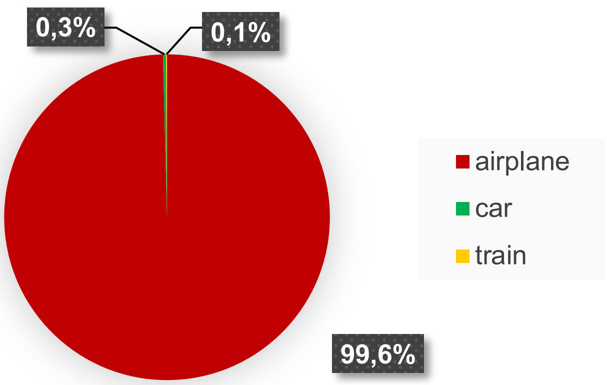

Figure 2: Proportions of unavoidable CO_2 emissions from travel of participants, contributed by three subcategories.

Within that category, the main emission source was airplane travel to and from Bremen, which is shown in figure 2. It makes up 99.6 % of all travel of participants, whereas travel by train and car combined contribute with only 0.4 %.

Local emissions sources on the other hand totalled at 16.2 % of all CO_2 emissions. Proportions of local emission sources can be seen in Figure 3. The main emission source within local emissions was found to be Catering with 42.8 % equalling 7.0 % of total CO_2 emissions.

This was followed by accommodation of participants from outside Bremen with 36.6 % of local emissions. The main category of energy, comprising electricity, heating, cooling, water usage, sewage as well as emissions caused by the online platform, contributed 17.9 % to all local emissions. Altogether emissions arising from additional items, public transport and generated waste during the conference, sum up to a total of 2.7 % of all local CO_2 emissions.

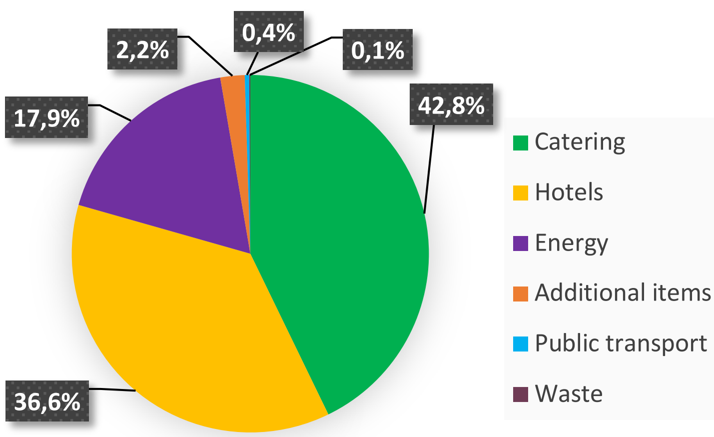

Figure 3: Proportions of local CO_2 emissions, contributed by six main categories.

Discussion

The calculation of the carbon footprint of the 15th ICRS showed that 83.8 %, therefore a vast majority of all emissions was caused by unavoidable travel of in person attendees. The number of international attendees travelling far routes, coupled with generally high aviation emission factors, resulted in airplane travel having by far the highest impact on the carbon footprint. In comparison to that, all local emissions combined, contributed a rather small proportion of 16.2 % to all emissions.

This was achieved by following the previously mentioned Green Strategy of avoiding and minimizing local emission wherever possible. While emissions stemming from international travel were inevitable for an in-person conference, bringing together coral reef experts from all over the world, emissions from all other categories were reduced to a minimum. This was attained through a variety of measures. A conference location was chosen, in which all energy needs were exclusively covered by renewable energies. Additionally, the conference catering was focused on sustainable, regional and mostly vegetarian food. The amount of waste produced was reduced by avoiding the use of disposable materials e.g. through reusable dishes and cutlery for lunch, dinner and coffee breaks. In order to reduce local emissions caused by transportation within Bremen, all registered attendees were given the opportunity to use public transport free of charge for the entire conference duration. Additionally, the conference took place in the city centre within a short walking distance from the central railway station as well as many accommodations and restaurants. Furthermore, a t-shirt brand was chosen that designed the whole production and shipment process as eco-friendly and sustainable as possible e.g. by using 100 % organic cotton.

Based on the aforementioned calculations all unavoidable emissions were compensated by investing into climate protection projects. Therefore, the target to implement the 15th ICRS as a CO_2 neutral event was successfully reached. This achievement is based on the green strategies that were applied: 1. Minimization and avoidance of emissions wherever possible and 2. Compensating all inevitable emissions through investment into climate protection programmes.

The portfolio of remediation projects was selected because of their broad geographical coverage, their linkage to coral reefs and UN Sustainable Development Goals, and their high certification standard. Four of those projects promote the generation of green electricity in the Dominican Republic, Mauritius, Aruba and India. The fifth project focuses on the protection of mangroves and coastal swamp forests in Borneo, Indonesia.

Conclusion

The 15th ICRS in 2022 was successfully implemented as a carbon neutral event through the balancing of any generated CO_2 emissions by funding of climate protection projects as compensation. Applied green strategies help to minimize CO_2 emissions and offer possibilities of climate neutrality for future conferences.

Acknowledgment

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6. Emission factors for food products per kg food:

Rice/potatoes	Average: 2.455 kg
Vegetables	0.98 kg
Cheese/eggs	Average: 14.274 kg
Milk	3.15 kg
Coffee/tea	28.53 kg
Wine	1.79 kg

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8. Emission factor for 1.5 l glass water bottles (323 g/bottle)
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11. Estimated water consumption per toilet flush within range of the reference (6 l)
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