

European Space Weather Week Format Analysis

And call for community input

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1 Executive Summary

Twenty years ago, the Space Weather and Space Climate community had the vision and initiative to start organising the European Space Weather Week, the international conference that strongly contributed to the community's growth and success.

Meanwhile, we are facing a dramatic acceleration of the environmental crisis. To tackle this crisis and align with the goals of the Paris Agreement, the average annual carbon footprint per person should be reduced over fourfold, from ~8 to 2 tonnes of CO₂ equivalent per person per year. This target is crucial for reducing greenhouse gas emissions and mitigating the impacts of climate change.

It has been shown that in-person participation in an international conference has an average carbon footprint of around 1 tonne CO₂ equivalent per participant, thus half the recommended yearly quota. This can amount to a significant proportion of the total carbon emissions of a scientific activity [1].

For this reason, it is now time for our community to once again have vision and be pioneers in finding ways to maintain a vibrant and thriving community while drastically reducing our environmental footprint.

To explore different solutions, the ESWW PC has carried out a survey among its members to identify the goals of organising ESWW and explore the strengths, weaknesses, opportunities and threats of different conference formats.

The goals identified are “environmental sustainability”, “diversity, equity and inclusion”, “community building”, and “knowledge exchange”.

Among the different conference formats investigated, virtual-only conferences are perceived as the most effective in reaching “diversity, equity and inclusion” and

“environmental sustainability”, while annual hybrid conferences are perceived as the most efficient in reaching “community building”, “knowledge exchange”.

There are many caveats in this study. For example, there were only a small number of respondents and all of them were members of the ESWW PC. The results are therefore not representative of what the whole community thinks. Another important caveat is that we restrict our thoughts to the classic conference format instead of being more open to a wider range of solutions such as virtual workshops, multi-site conferences, etc.

Many other prominent organisations such as the IAU and AAS have also begun to reassess the format of future meetings. This is not an isolated initiative but a global trend. It is imperative that we keep pace.

2 Call to the community

The ESWW PC invites the community to share their thoughts on this topic. Together, we hope to find imaginative and visionary solutions to prepare our community to thrive in an environmentally respectful way. If we succeed in this challenge, we hope to lead the path for the scientific community and serve as an example for the general public.

Please send your comments and suggestions to esww-pc@lists.eswan.eu

3 Introduction

Given the severity of the environmental crisis, and the urgency to reduce our environmental footprint,

Given the values of the European Space Weather and Space Climate Association (E-SWAN) and its organ, the European Space Weather Week Program Committee (ESWW PC), to emphasise and support behaviours that respect the natural environment,

Given E-SWAN's and ESWW PC's values to pay particular attention to equity, equality, diversity, and inclusion and to respect all minorities in the core of its activities,

The ESWW PC has analysed the strengths, weaknesses, opportunities and threats of different formats and frequencies for organising the European Space Weather Week (ESWW) and compared the efficiency of each format in reaching ESWW objectives and respecting E-SWAN's and the ESWW PC values. The results of this analysis will help the ESWW PC prepare the call for hosting future post 2028 ESWWs.

4 Background

4.1 Space Weather and international collaboration

International collaboration significantly contributes to scientific development. This is particularly true for the field of space weather and space climate.

The space weather and space climate community is globally concerned with solar activity, the primary driver of space weather. It takes turns monitoring the Sun from various locations around the globe. It is collectively investigating the natural space environment with a worldwide ground-based instrumentation network to capture the regional effects of space weather. It shares the financial burden of onerous space weather observation projects among different nations. The sparse measured in-situ data is shared and utilised across borders. Finally, regulatory aspects related to space weather are approved and implemented on an international level.

In these last 30 years, the international space weather and space climate community has succeeded in creating solid international collaborations. The European Space Weather Week has strongly contributed to this achievement.

4.2 European Space Weather Week (ESWW)

The ESWW originated over two decades ago with the ESA space weather workshops, small meetings gathering a few dozen international space weather actors. The first two ESWWs were held in the ESA ESTEC premises in 2004 and 2005. The ESWW was hosted from 2006 to 2008 in Brussels. From 2009 to 2019, the ESWW was hosted in various Belgian cities (Bruges in 2009 and 2010, Namur in 2011, Brussels in 2012, Antwerp in

2013, Liège in 2014 and 2019, Ostend from 2015 to 2017, and Leuven in 2018). In 2020, ESWW was held virtually due to the Covid-19 pandemic and renamed the European Space Weather Symposium (ESWS). Since then, the ESWW has been held in different European locations (2021 in Glasgow, United Kingdom, 2022 in Zagreb, Croatia, 2023 in Toulouse, France). Upcoming ESWWs are planned to be held in Coimbra, Portugal (2024), Umeå, Sweden (2025), Florence, Italy (2026) and Dublin, Ireland (2027).

From the initial few dozen participants, ESWW has steadily grown over the years to host over 800 participants in 2023.

The ESWW is co-organised by the ESWW PC and a local organising committee (LOC). The program of the ESWW typically includes a combination of plenary sessions and parallel sessions, both being associated with question and answer (Q&A) sessions, topical discussion meetings, poster sessions, a product demonstration fair, a medal awards ceremony, the E-SWAN general assembly, the Space Weather Working Team (SWWT) session, live space weather forecasts, and social events such as the music evening and the conference dinner.

Some years, ESWW is combined with satellite events taking place in the same or neighbouring premises during the days preceding or following the ESWW.

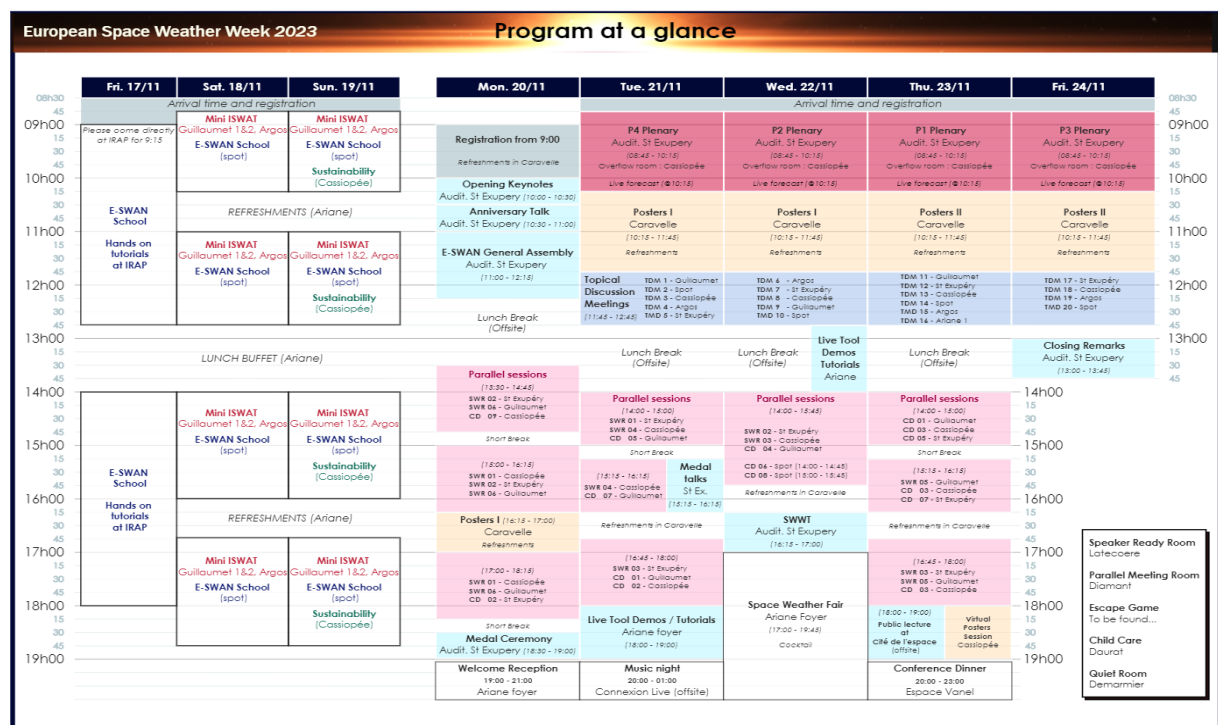


Figure 1: Example of ESWW program from ESWW in Toulouse, France in 2023

Until 2020, the ESWW was an in-person-only conference. In 2020, the European Space Weather Symposium was held entirely online. Since 2021, the ESWW has been held in a hybrid format. The online participation was 70% in 2021 (in a context of travel restrictions imposed during the Covid 19 pandemic), 30% in 2022 and 12.4% in 2023. Virtual

participants can watch all the presentations, participate in the Q&A sessions and topical discussion meetings, and access the posters online. However, they cannot participate in the social events or the fair.

Since 2021, the ESWW PC has set up a diversity, equity, inclusion (DE&I) and sustainability working group. For the DE&I aspects, efforts are made to address any specific needs of the participants, such as providing a small calm/rest room, providing access to the conference venue for those with reduced mobility, and setting up a hybrid format for participants who may not be able to travel. For the ecological sustainability aspects, efforts are made to reduce the ecological footprint of the conference such as by banning single use plastics and program prints, selecting eco-friendly goodies, and providing public transport passes during the conference.

In the coming months, the ESWW PC will issue a call for hosting the ESWW for 2028 and beyond. The aim of this analysis is to help the ESWW PC, and the European space weather and space climate community decide which conference format fits best the community's needs and values.

5 Concerns

The E-SWAN ESWW PC organ is responsible for organising the ESWW. Both E-SWAN and the ESWW PC share values to emphasise and support behaviours that respect the natural environment, to pay particular attention to equity, equality, diversity, and inclusion and to respect all minorities in the core of its activities.

Whilst ESWW is an enjoyable forum for interacting and promoting one's projects and institution or company, there are several environmental, ethical, and health concerns related to the organisation of an international conference [2].

5.1 Environmental concern

The climate and biodiversity crisis are due to human activity. The adverse effects we experience today will only worsen unless deep changes are made in our societies. Many countries have committed to make such changes. For example, the UK has committed to reducing its emissions by 78% by 2035 compared to 1990 levels and to reach net zero by 2050 [3]. France has committed to reducing its emissions by 55% by 2030 compared to 1990 levels [4].

The current average yearly carbon footprint per person in Europe is of the order of 6-12 tonnes of CO₂ equivalent (tCO₂eq) [5]. To avoid a 2°C rise in global temperatures, the average global carbon footprint per year needs to drop to under 2 tCO₂eq per person by 2050. Most European countries have pledged to meet this objective.

The organisation of an international conference has a carbon footprint in the range of 1 tCO₂eq per participant [6], [7], [8], where travel accounts for 80-90% of the conference

emissions, and the venue, hotels, and catering make up the rest. This level of emission represents half of the recommended yearly budget. The carbon footprint of a virtual meeting is up to 94% lower than that of in-person meetings [9], [10].

Environmental concerns are likely to increase in the coming years, resulting in further government legislation to reduce travel while the costs of travel are expected to increase. Aviation in particular is changing the structure of fuel purchase allowances to promote sustainable fuels and the industry anticipates that costs will rise [11]. It is important to anticipate this for the ESWW, which is planned years in advance.

5.2 DE&I concern

Participating in-person at ESWW is a privilege that is unfortunately not accessible to all. Indeed, many potential participants are excluded, due to various reasons, such as financial costs, obtaining visas, caring duties, professional duties, health and disabilities, national regulations [2], [12].

5.3 Health Concerns

In the frame of online participation to conferences, spending too much time in virtual meetings can have several negative effects on health and mental health such as “zoom fatigue” [13], difficulty with time zone differences, lack of focus on the work being presented due to pressure to multi-task when attending remotely and a lack of community building and understanding.

Attending in-person conferences can also be physically demanding, involving challenges such as jet lag, extended travel in confined airplane seats, and the risk of contracting illnesses during transit or within conference venues.

Clearly, both virtual and in-person formats have pros and cons, so it is important to use the best of both. More importantly, several studies have shown how crucial it is to reinvent the way we meet and interact, and to try out new solutions, rather than just replicating in a virtual format what we used to do in the past [2], [14].

6 Methodology

The ESWW PC has so far investigated four different possible future ESWW format options:

- **Annually hybrid (HH):** ESWW is held every year in hybrid format
- **Biennially hybrid (H-):** ESWW is held every other year in hybrid format
- **Alternating biennially hybrid-virtual (HV):** on H years, ESWW is held in hybrid format, on V years, ESWW is held fully online.
- **Annually virtual (VV):** ESWW is held every year entirely online.

In all options, the hybrid (H) concept refers to the ESWW conference format used from 2021 to 2023 (see also Section ESWW). The virtual (V) option is a fully online conference. This format has only been attempted in this context in 2020 with the European Space Weather Symposium in 2020 which consisted of five 4-hour sessions.

6.1 ESWW format SWOT Analysis

The ESWW PC, in collaboration with the E-SWAN Sustainability working group, analysed the strengths, weaknesses, opportunities and threats (also known as SWOT analysis) for the four investigated ESWW conference formats (HH, H-, HV, VV).

6.2 Objectives and Elements

The ESWW PC consulted its bylaws, its statements, E-SWAN's statutes, and past ESWW programs to describe the different objectives of ESWW. The objectives identified for future ESWWs are:

- Community building
- Knowledge exchange
- Diversity, equity, and inclusion (DE&I)
- Environmental sustainability

Key factors to be taken into consideration are labelled as elements, and these were included under a single objective. For each objective, these elements are:

6.2.1.1 *Community building*

- **Informal networking:** Provide opportunities for informal networking by allocating time and space to coffee breaks, lunch breaks, social evenings,
- **Product demonstration/Fair:** Provide opportunities for the fair, product demonstration, interaction with end users.
- **Support Early Career Researchers (ECR):** Help ECR to develop their network and exchange ideas on their research
- **Satellite meetings:** Provide opportunities for satellite meetings, workshops, or schools, ...

- **Promotion:** Give visibility to the LOC, sponsors, companies, and business collaborations

6.2.1.2 *Knowledge exchange*

- **Parallel sessions:** the parallel sessions are typically held 3-4 in parallel, lasting between 60 and 90 minutes and covering topics proposed either by the ESWW PC (Space Weather Research sessions) or by the community (100% Community-Driven sessions).
- **Poster presentations:** poster presentation sessions typically last 70 minutes and are usually combined with the refreshment break.
- **Topical Discussion meetings:** open discussion on a specific topic of general interest, lasting approximately 60 minutes and usually held three to five in parallel.
- **Question & Answer sessions:** each session convener is asked to accommodate a Q&A session directly after each presentation or at the end of the session.
- **Plenary sessions:** plenary sessions typically last 90 minutes and cover topics relevant to all ESWW participants

6.2.1.3 *DE&I*

The ESWW DE&I and environmental sustainability statement states that ESWW is devoted to universal values of diversity, equity, and inclusion (DE&I).

The key elements related to this objective are:

- **Diversity:** refers to who is represented
- **Equity:** refers to fairness and justice
- **Inclusion:** refers to the degree to which diverse individuals are able to participate fully.
- **Cost reduction:** the effort to keep the registration fee low. The registration fee for ESWW is typically in the range of 300€-500€, which is lower than other major space weather and space climate related international conferences.

6.2.1.4 *Environmental sustainability*

The ESWW DE&I and sustainability statement states that the ESWW PC and LOC are committed to sustainable development, and strive to promote practices to reduce their environmental impact.

The E-SWAN's statutes, article 3.5, states that E-SWAN will strive to undertake all of its activities to be compatible with the principles of a sustainable society.

6.3 ESWW PC survey

Respondents were asked to participate in a survey to evaluate their perceptions of the importance of each element in reaching the specific goal and the efficiency of different conference formats in achieving these goals. The individual survey table is presented in Figure 2.

	Element weight	Conference format score			
		HH	H-	HV	VV
Community building					
Informal networking					
Product demonstration/Fair					
Support Early Career Researchers					
Satellite meetings					
Promotion					
Knowledge exchange					
Parallel sessions					
Poster presentation					
Topical Discussion meetings					
Q&A sessions					
Plenary sessions					
DE&I					
Equity					
Diversity					
Inclusion					
Budget reduction					
Environmental Sustainability					

Figure 2: ESWW PC individual survey template

6.3.1.1 ESWW objectives key element weighing

For each of the objectives, the survey respondent was asked to consider the different elements under this objective and quantify the relative importance of each element for this specific objective.

6.3.1.2 ESWW conference format efficiency scoring

Respondents were asked to score the effectiveness of each element for each of the proposed conference formats. The scoring ranged from 1 (very inefficient) to 5 (very efficient).

6.3.1.3 Result compilation

The assessments provided by each respondent for the importance of each element related to an objective were averaged across all respondents to determine the final weight per element.

The summary table illustrating the individual weights, and the averaged overall weight is shown in Figure 3.

		Participants individual weights										Average objective weight	Average element weight
Community building													
Informal networking	Element weight	46%	33%	24%	33%	26%	24%	33%	40%	22%	33%		32%
Product demonstration/Fair		23%	27%	8%	27%	16%	20%	13%	10%	22%	20%		19%
Support Early Career Researchers		15%	20%	24%	20%	26%	24%	27%	35%	22%	27%		24%
Satellite meetings		8%	13%	20%	13%	16%	20%	13%	5%	17%	13%		14%
Promotion		8%	7%	24%	7%	16%	12%	13%	10%	17%	7%		12%
Sub-Total:		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%
Knowledge exchange													
Parallel sessions	Element weight	23%	27%	20%	20%	26%	20%	33%	40%	21%	13%		24%
Poster presentation		23%	13%	20%	20%	16%	20%	13%	10%	16%	20%		17%
Topical Discussion meetings		23%	27%	24%	20%	16%	20%	13%	35%	21%	27%		23%
Q&A sessions		15%	13%	24%	20%	16%	20%	13%	5%	21%	13%		16%
Plenary sessions		15%	20%	12%	20%	26%	20%	27%	10%	21%	27%		20%
Sub-Total:		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%
DE&I													
Equity	Element weight	29%	30%	25%	31%	27%	27%	27%	25%	31%	27%		28%
Diversity		29%	30%	25%	31%	27%	23%	27%	25%	23%	27%		27%
Inclusion		29%	30%	25%	31%	27%	27%	36%	25%	31%	36%		30%
Budget reduction		14%	10%	25%	8%	20%	23%	9%	25%	15%	9%		16%
Sub-Total:		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%
Environmental Sustainability													
	Element weight	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%		100%

Figure 3: Individual and overall weighting

The score attributed to each conference format for each element was averaged across all respondents. A score for each objective was obtained for each conference format by computing a weighted sum of the elements using the key element final weights.

7 Results

7.1 SWOT analysis results

Members of the ESWW PC and members of the E-SWAN Sustainability working group prepared the following SWOT analysis. Several references were consulted to compile this list ([2], [9], [12], [15]).

7.1.1.1 Annually hybrid format (HH)

Annually Hybrid (HH)	Strengths	7.1.1.1.1.1 For the in-person component:		
		HH.S1	Enhanced Experience	Physical presence enhances the overall experience and retention of information.
		HH.S2	Spontaneity	In-person events allow for spontaneous impromptu discussions and collaborative experiences.
		HH.S3	Product Demonstration	Service providers can provide a higher level of examples and demonstrations in-person than they can virtually.
		HH.S4	LOC/Business LOC Visibility	Provides visibility to the organiser, sponsors and participants of the fair.
		HH.S5	Satellite events	Provides opportunity for satellite events which can contribute to reduced travel when compared to dedicated workshops.
		HH.S6	Community building	Favours a well-connected SWSC community.
		HH.S7	Team building	Being together abroad has a team-building effect, this is particularly important for young people to build up their professional network.
		HH.S8	Benefit in kind	Travelling for work: can be perceived as a type of professional benefit in kind
		7.1.1.1.1.2 For the hybrid aspect:		
		HH.S9	Flexibility	It's the least imposing option, people can choose
		7.1.1.1.1.3 For the virtual aspect:		
		HH.S10	Inclusivity	Virtual meetings are more inclusive for those who cannot join in-person due to budget restrictions.
		HH.S11	Openness	As this format does not require participants to free themselves for a whole week, this format may allow new types of participants, such as experts from other but related fields or high calibre speakers who may normally have too full of a schedule to travel.
		HH.S12	Accessibility	Attendees can join from anywhere in the world.
		HH.S13	Asynchrony	Recordings allow attendees to view content at their convenience.
		HH.S14	Archiving	All material is online and archivable
HH.S15	Diversity	Potential to attract a diverse audience. Virtual meetings are more accessible for physically challenged scientists, single parents, visa-requiring scientists, people who lack time to travel		
HH.S16	Attendance statistics collection	Online attendance can be monitored enabling to improve the program based on attendance of each session		
HH.S10	Session switching	online participants can more easily switch from one session to another		

Annually Hybrid (HH)	Weaknesses	<i>For the hybrid component:</i>		
		HH.W1	Experience Disparities	There is a divide between the in-person and virtual experience. The virtual aspect of a hybrid meeting is often the 'poor cousin'.
		HH.W2	Complexity	Requires careful planning to ensure a seamless experience for both virtual and in-person participants.
		HH.W3	Resource Intensive	Demands more resources to manage two types of experiences simultaneously.
		HH.W4	Technology	Needs a robust technical setup to accommodate both live and virtual audiences.
		HH.W5	Extra-cost	The digitisation of audio and video implies higher cost for both organisers and attendees.
		<i>For the in-person component:</i>		
		HH.W6	Limited accessibility	Geographic and financial barriers can limit attendance, preventing some participants from enjoying the enhanced in-person experience.
		HH.W7	Exclusivity	People who cannot travel for any reason are excluded from enjoying the enhanced in-person experience.
		HH.W8	Limited Scalability	The number of attendees at in-person conferences may be limited by the capacity of the venue.
		HH.W9	Environmental Impact	Large environmental impact mainly due to travel, venue, and accommodation.
		HH.W10	Disruption from Travel	Travelling for conferences can disrupt regular work schedules.
		HH.W11	Schedule conflicts	Not possible to attend all parallel sessions.
		HH.W12	Cost	Higher cost for the organisers (premises rental, catering, social events...) and for the participants (travel, lodging, ...).
		<i>For the yearly aspects (versus biennial):</i>		
	HH.W13	Time consumption	Requires a considerable amount of time and energy for all those organising or contributing to the meeting. This time is taken from their other research work.	
	<i>For the Virtual component:</i>			
	HH.W14	Poor networking	There are few initiatives to have people 'meet' virtually.	
	HH.W15	Time zone issues	Difficult to attend in real time sessions that are at inconvenient times in the home time zone.	
	Opportunities	<i>For the virtual aspect:</i>		
HH.O1		Online experience improvement	Improve the online experience to reduce the divide between virtual and in-person participants.	
Threats	<i>For the in-person component:</i>			
	HH.T1	Health Risks	Large gatherings pose a risk for disease transmission.	
	HH.T2	Economic Fluctuations	Sensitive to economic downturns affecting travel and budgets.	
	HH.T3	Regulation	Subject to local and international regulations that may impose restrictions.	
	HH.T4	Attendance reduction	More and more people may choose or be imposed by regulation not to attend in-person to reduce their travels and environmental impact	
	HH.T5	Criticism	That ESWW Scientists are producing a 'carbon plume' congregating for their conference, while Climate Scientists have published sound peer-reviewed rationale that this behaviour is environmentally harmful.	

7.1.1.2 Biennially hybrid (H-)

Biennially hybrid (H-)	Strengths	H-.S1	HH strength	
		H-.S2	Environmental impact reduction	Divides by 2 the impact on the environment.
		H-.S3	Quality over quantity	With more time between each meeting, presenters would have more time to conduct in-depth research, leading to more significant findings and higher quality presentations.
		H-.S4	Financial Burden Reduction	For organisers and participants. The money saved can be used for other activities.
		H-.S5	Fairness	Shares the burden of reducing carbon footprint among all the participants not just remote or eco-conscious ones, or ones who have strict emission reduction constraint in their institute.
		H-.S6	Increased participation	A biennial schedule could potentially allow more scientists to participate giving more time to prepare and submit abstracts. Scientists may also place more importance on preparing abstracts as they would know that if they missed the event they would need to wait for another 2 years before the next opportunity to participate. In a yearly format, some participants come every year, others skip some years, the biennial format ensures that those that skip a year don't miss each other and meet the same year.
	Weaknesses	H-.W1	HH weaknesses	All HH weaknesses, some at a lesser level
		H-.W2	Early career researchers	Young scientists have less opportunity to network and present their research.
		H-.W3	Community Building	Reduced community building compared to an annual conference.
	Opportunities	H-.O1	More preparation time	More time for conference planning, establishing sessions and conveners and then a longer period for abstract submission.
		H-.O2	Time and money saving	This option reduces the administrative workload for organising such a meeting by half. All this time and money can then benefit from doing more science.
		H-.O3	Increased participation	Some institutions are reducing the number of meetings people can attend. Having biennial meetings may then increase participation.
		H-.O4	Improved benefit processing	More time for lessons learned to be processed and adopted
	Threats	H-.T1	List of HH threats	All HH format threats albeit reduced by a factor of two due to the biennial frequency.
		H-.T2	ESWW PC Momentum reduction	Risk of reducing the momentum, efficiency, and team spirit of the ESWW PC as well as participants for who it is an annual meeting.
		H-.T3	Participation may drop	If an event is not every year, it could slip out of people's calendar, and people might lose interest and start turning to other conferences that take place annually,
H-.T4		Replacements	The years people do not meet at ESWW they might start organising separate consortia meetings, project meetings, discussion meetings which would increase CO ₂ emission.	

7.1.1.3 Biennially alternating hybrid/virtual (HV)

Biennially alternating hybrid/virtual (HV)	Strengths	HV.S1	VV strengths for V years		
		HV.S2	HH strengths for H years		
	Weaknesses	HV.W1	VV weaknesses for V years		
		HV.W2	HH weaknesses for H years		
		HV.W3	Unclear benefits for V years	V years require commitment and effort by the LOC without a clear indication of important benefits.	
	Opportunities	For the V years			
		HV.O1	Innovation	Opportunities to learn to network and collaborate in a carbon neutral world.	
		HV.O2	Future conference	Opportunity to invent new ways of organising conferences (e.g. multi-site). By having a dedicated Virtual conference prior to a Hybrid conference, the onus placed on the virtual could support a truly hybrid meeting the following year.	
		HV.O3	Preparedness	Potentially get ahead of Government or other authority legislation intended to reduce travel carbon emissions by implementing a compatible policy earlier.	
		HV.O4	Improved poster experience	Online offers the possibility for keyword search, interaction, hyperlinks and animations.	
		HV.O5	Improved Q&A experience	Online chat has the advantage of written record of the conversation, might facilitate participation of shyer participants, and allow the possibility for asynchronous discussions.	
		HV.O6	Biennial cycle	The V year can facilitate more collaborative work which can then be presented in the 'H' meeting the year after. Projects can have a 1-2-year target.	
		HV.O7	Style/scope adaptation to the format	Hybrid imposes a large meeting with many sessions, whereas Virtual could allow for targeted workshops (1 day at most) distributed in time. We should try to avoid reproducing in virtual what we do in hybrid.	
		HV.O8	Opportunity for Focus workshops	Alternating H and V meetings allows to have in the latter short but focused workshops that bring together more specialists than at the ESWW.	
	Threats	HV.T1	VV threats for V years		
HV.T2		HH threats for H years			
HV.T3		Lack of LOC candidates	Risk of LOCs not applying for the organisation of V years due to the high effort and perceived low benefit.		

7.1.1.4 Annually virtual format (VV)

Annually virtual format (VV)	Strengths	VV.S1	HH virtual component strengths	All the strengths of the virtual component of the hybrid format, to a higher level, as there is no divide between in-person and virtual participants
		VV.S2	Environmental Sustainability	Reduction of carbon footprint by limiting the need for travel, accommodation, printed material.
		VV.S3	Cost-Effective	Reduced costs related to travel, accommodation, venue hire and catering.
		VV.S4	Scalability	Can easily adapt to the number of participants
		VV.S5	Fairness	Shares the burden of reducing carbon footprint among all the participants not just remote or eco-conscious, or ones who have strict emission reduction constraint in their institute
		VV.S6	Equal voice	Equal voice given to all participants
	Weaknesses	VV.W1	Limited Networking	Limited opportunities for spontaneous conversations and connections.
		VV.W2	Reduced Engagement	More challenging to maintain attendee attention and interaction. Employers and colleagues often do not acknowledge someone is unavailable when they are attending a conference online.
		VV.W3	Technical Issues	Dependence on technology can lead to potential disruptions.
		VV.W4	Time zones	Difficulties for participants from very different time zones to participate to real-time events
		VV.W5	Unpopular	According to ESWW2023 poll
		VV.W6	Fatigue	Attendee fatigue from excessive screen time and changes of a day routine because of the time zones differences (e.g., US or New Zealander participants attending ESWW on CET time). Spending several days in a row with Zoom is an unpleasant experience.
		VV.W7	Early career scientists	Risks to prevent young scientists from networking, meeting their peers (and potential future employers) in-person.
		VV.W8	No in-person meeting	People cannot meet if they really need to.
		VV.W9	No Fair/Product Demonstration	Impossible to set up a fair at the virtual meeting; difficult to have product demonstration
		VV.W10	Technical material	While everyone has a computer, not everyone has technical material and space to properly follow/listen/present an online conference.
	Opportunities	VV.O1	Innovation	Opportunities to learn to network and collaborate in a virtual world.
		VV.O2	Future conference	Opportunity to invent new ways of organising conferences (e.g. multi-site).
VV.O3		Preparedness	Potentially get ahead of Government or other authority legislation intended to reduce travel carbon emissions by implementing a compatible policy earlier.	
VV.O4		Improved poster experience	Online offers the possibility for keyword search, interaction, hyperlinks and animations.	
VV.O5		Improved Q&A experience	Online chat has the advantage of a written record of the conversation and might facilitate participation of shyer participants and allow the possibility for asynchronous discussions.	
VV.O6		LOC accessibility	Opens the possibility to teams unable to host an in-person event to apply as LOC for a virtual event.	

Threats	VV.T1	Expense	Potential for escalation of costs by virtual environment providers.
	VV.T2	Lack of LOC volunteers	May be difficult find a LOC- some groups may perceive that organising a virtual event does not provide enough visibility
	VV.T3	Drop of sponsors	Both in numbers and in money
	VV.T4	Drop of participants	Some people may simply not attend anymore and chose another conference instead (especially if they have to pay to attend online)
	VV.T5	Increase of participants fee	Potential Increase of the online participation fee (which is now partially covered by sponsors for the physical organisation of the conference).

7.2 Weight results

Ten members of the ESWW PC participated in the scoring survey.

The resulting weights and scores are presented in the following section. In the graphics, the dots represent the individual weight proposed by each participant, and the bars represent the average over all respondents.

Note: where fewer dots are visible, this is due to multiple respondents proposing identical weightings.

7.2.1.1 DE&I concern

The relative weightings of the DE&I key elements are:

DE&I key element	Weight
Equity	28%
Diversity	26%
Inclusion	30%
Budget reduction	16%

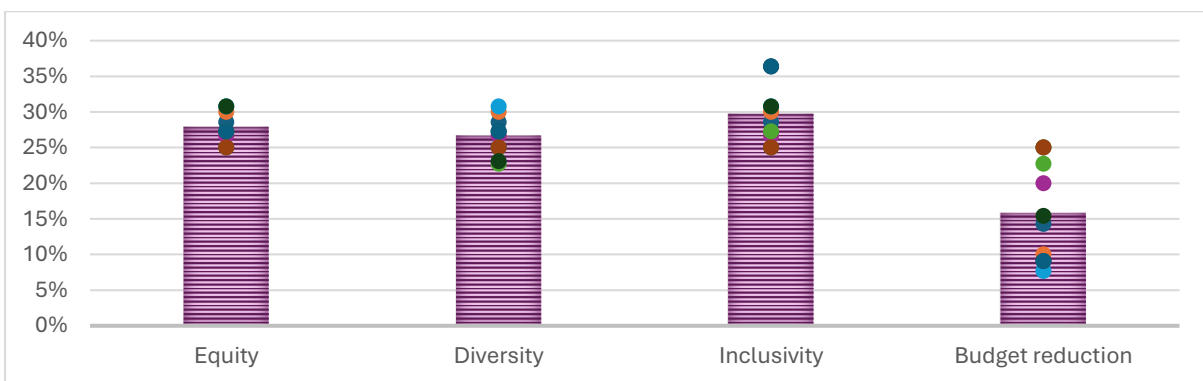


Figure 4: Relative importance of the four DE&I elements

7.2.1.2 Community building

The relative weightings obtained for each of the community building key elements are:

Community building key element	Weight
Informal networking	32%
Product demonstration/Fair	18%
Support Early Career Researchers	24%
Satellite meetings	14%
Promotion/Sponsors	12%

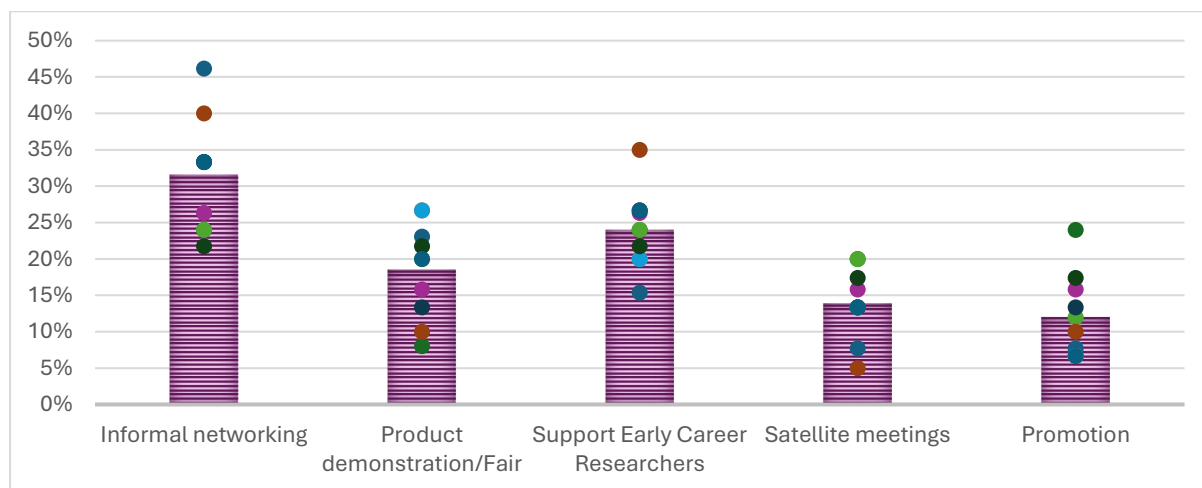


Figure 5: Relative importance of the five community building elements

7.2.1.3 Knowledge exchange

The relative weightings obtained for each of the knowledge exchange key elements are:

Knowledge exchange key element	Weight
Parallel sessions	24%
Poster presentation	17%
Topical Discussion meeting	23%
Q&A sessions	16%
Plenary sessions	20%

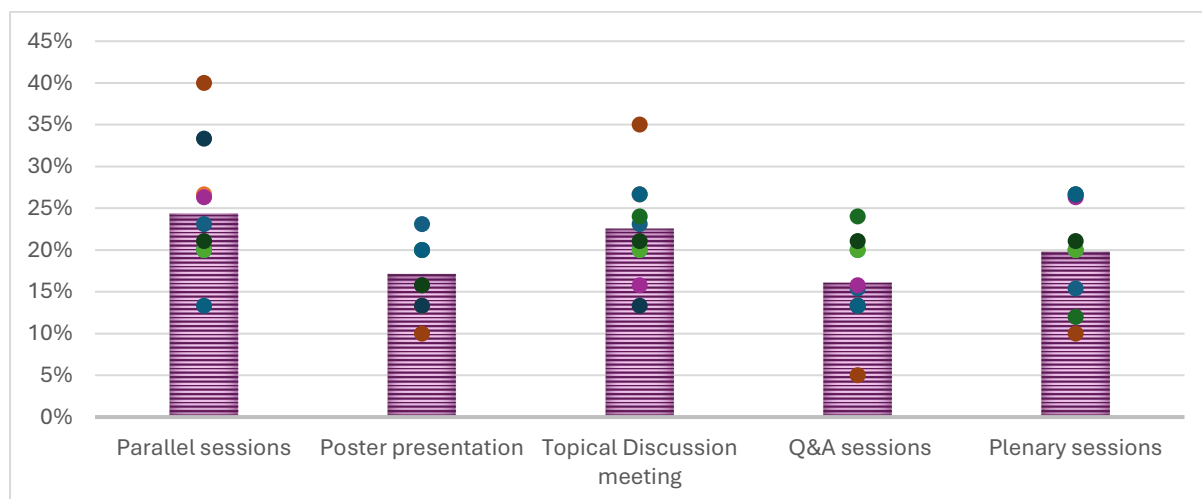


Figure 6: Relative importance of the five knowledge exchange elements

7.3 Scoring results

Each element of each objective is scored with a rating from 1 (very inefficient in reaching this objective) to 5 (very efficient in reaching this objective). The final weightings of each element (obtained by averaging the weightings assigned by each participant, as described above) are used to compute a weighted average total for each objective.

7.3.1.1 Environmental Sustainability

Environmental Sustainability	HH	H-	HV	VV
	1.9	3.4	3.0	4.5

According to the averaged respondents' perception, environmental sustainability is best achieved in the annually virtual format (VV), and the poorest is the hybrid format (HH). Interestingly the HH format obtains a score of 1.9 and not lower. This may be linked to the possibility to attend online but would require a good hybrid conference.

7.3.1.2 DE&I

DE&I	Weight	HH	H-	HV	VV
Equity	28%	3.0	2.8	3.4	3.7
Diversity	26%	3.2	3.0	3.9	3.8
Inclusion	30%	3.6	3.0	3.6	3.4
Budget reduction	16%	2.4	3.5	3.1	4.2
Weighted average		1.8	3.0	3.5	3.7

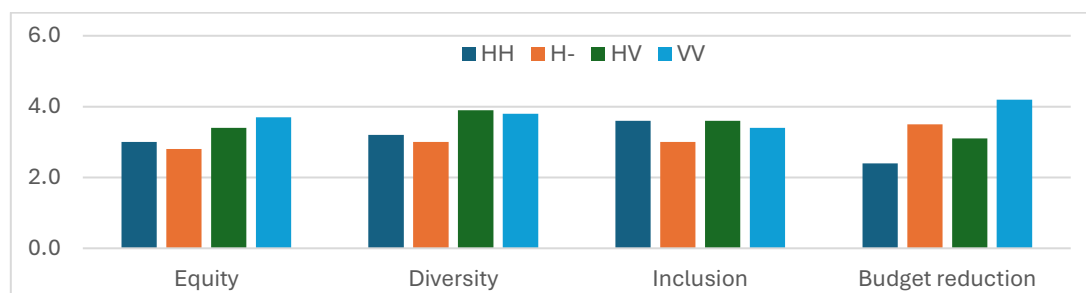


Figure 7: Score for reaching DE&I goals per conference format

According to the averaged respondents' perception, DE&I is best achieved in the annually virtual format (VV), mainly thanks to budget reduction. The hybrid format (HH) obtains the lowest scores, despite the provision for both online and in-person elements. The largest distribution is seen for the budget reduction, where respondents think these will be better constrained with a Virtual-only conference. The Inclusion element gives the same score for HH and HV, which is higher than that for VV, and H- is the lowest (most likely due to missed opportunities for presentation in years where there is no conference, which may be most keenly felt by young scientists completing their research in those years).

7.3.1.3 Community building

Community building	Weight	HH	H-	HV	VV
Informal networking	32%	5.0	2.8	3.0	0.6
Product demonstration/Fair	18%	4.8	2.9	2.8	1.2
Support Early Career Researchers	24%	4.6	2.7	3.2	1.4
Satellite meetings	14%	4.6	2.9	3.2	1.4
Promotion	12%	4.4	2.8	3.1	1.0
Weighted average		4.7	2.8	3.1	1.1

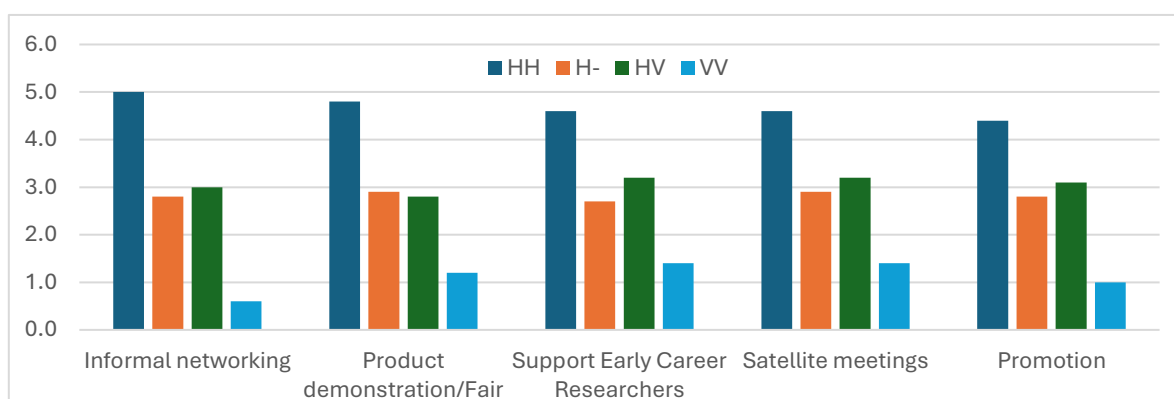


Figure 8: Score for reaching community building goals per conference format

The HH format received the highest overall score, followed by HV, then H-, and finally VV. The highest contrast of all elements is seen for Informal Networking, whereas a narrower distribution is seen for the Support of Early Career Researchers and Satellite meetings.

Respondents considered on average that hosting a virtual event every other year (HV) instead of hosting no event at all every other year (H-) reduced the Product demonstration/Fair score. This is probably linked to the relative impact of the fair in Virtual years in relation to the effort.

7.3.1.4 Knowledge exchange

Knowledge exchange	Weight	HH	H-	HV	VV
Parallel sessions	24%	4.7	3.7	3.8	3.0
Poster presentation	17%	4.8	3.5	3.3	1.8
Topical discussion meetings	23%	4.8	3.6	3.4	2.4
Q&A sessions	16%	4.8	3.6	3.4	2.9
Plenary sessions	20%	4.8	3.7	3.9	3.2
Weighted average		4.8	3.6	3.6	2.7

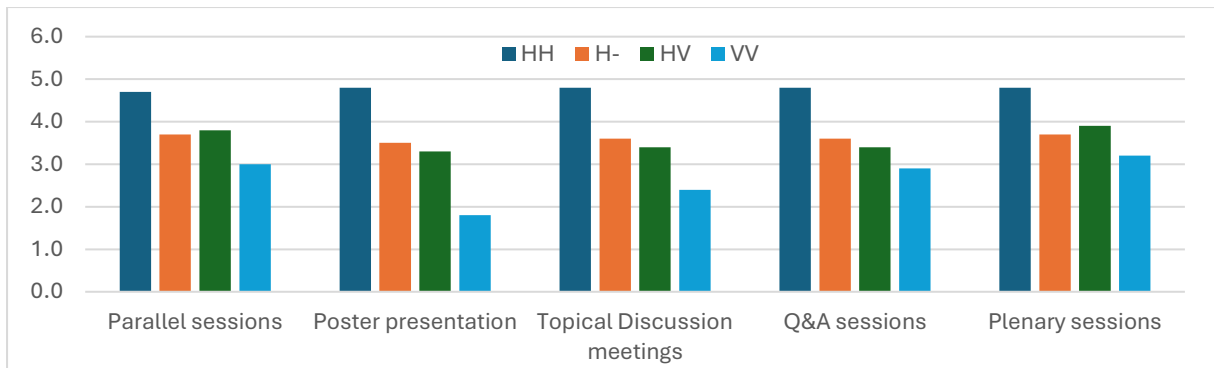


Figure 9: Score for reaching knowledge exchange goals per conference format

Under this objective, the distribution of results is narrower than for Community Building. The smallest contrast is seen for the sessions, implying that respondents think these can be organised online but with diminished impact compared to in-person. The largest contrast is seen in the Poster Presentation element, where respondents view Virtual events relatively poorly. In total, the respondents considered that hosting a virtual event every other year (HV) added no benefit to hosting no event every other year (H-). Respondents considered, on average, that HV reduced the efficiency of Poster presentation, topical discussion meetings, and Q&A sessions compared to H-. This, again, is probably linked to the relative impact of these items in Virtual years in relation to the effort.

7.3.1.5 Summary

In summary each objective, obtained the following scores for each format:

	HH	H-	HV	VV
Community building	4.7	2.8	3.1	1.1
Knowledge exchange	4.8	3.6	3.6	2.7
DE&I	1.8	3.0	3.5	3.7
Environmental Sustainability	1.9	3.4	3.0	4.5

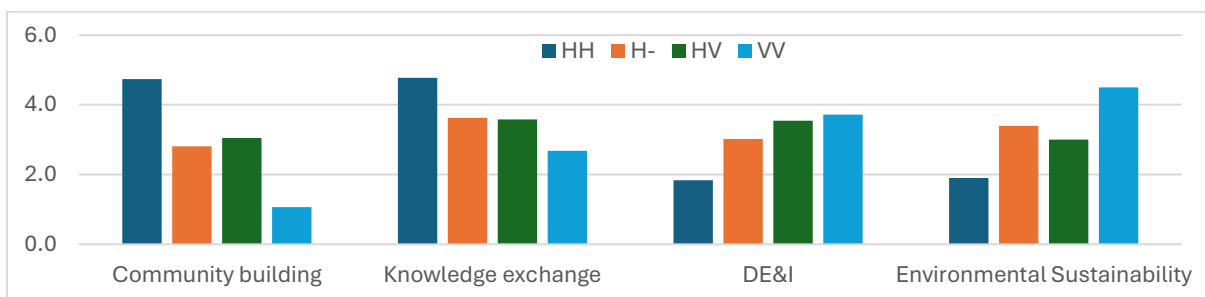


Figure 10: Overall score for ESWW objectives per conference format

Among the different conference formats investigated, virtual-only conferences are perceived as the most effective in reaching “diversity, equity and inclusion” and “environmental sustainability”, while annual hybrid conferences are perceived as the most efficient in reaching “community building” and “knowledge exchange”.

7.4 Caveats

Subjectivity in objective matters: respondents were asked to evaluate how efficiently a format reaches the goal of keeping registration fee low or reducing environmental impact. These items are not subjective and could be measured objectively. In the case of costs, a dedicated investigation into appropriate platforms and labour hours to implement online components correctly would be required.

Bias: There were only a small number of respondents (ten), and all of them are ESWW participants and members of the ESWW PC. We did not collect the voice of those who do not attend ESWW. The results are not representative of what the entire community thinks.

Known hybrid format used as standard: The elements listed to reach specific goals are based on the current hybrid ESWW program. If the conference went virtual, there could be other ways to reach the goals. The weights and scores are provided based on what is known from the hybrid/in-person format and might differ for other formats. It is clear that in the context of hybrid conferences, the virtual component is often poorly perceived.

No virtual-only precedent: To date, only in-person and hybrid ESWW conferences have been organised. The only exception was the online ESWS of 2020, which was organised by the LOC of the delayed ESWW2021 conference. It is not known how appealing it would be for prospective LOCs to arrange a virtual conference. The potential of virtual events, in e.g. building community, through leveraging new communication technologies, has never been explored.

8 Conclusions

In summary, the perception of the respondents is that, though the virtual format is the most ecologically sustainable and DE&I respectful, it is not very efficient for community building and knowledge exchange. The SWOT analysis highlights several strengths and opportunities related to the biennially hybrid option, such as more time for conference preparation, for doing science and processing lessons learned, and for organising small targeted virtual workshops.

There are many caveats in this study. One important caveat is the lack of a virtual-only event precedent. It is hard to imagine what a virtual event could be. We limit our thoughts to the conventional in-person meeting format.

Finally, there were only ten respondents, all ESWW participants and ESWW PC members. The results are not representative of what the entire community thinks. We therefore call on the community to share their thoughts on this topic.

Please send your comments to esww-pc@lists.eswan.eu

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