

WCRP Academy Consultancy: Climate Training Stocktake Survey Findings report

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TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
SURVEY DATA OVERVIEW	6
Total responses	6
Overview of survey uptake	6
UNDERSTANDING DEMAND AND SUPPLY OF GLOBAL CLIMATE SCIENCE TRAINING OPPORTUNITIES	12
What climate science training opportunities are there across the globe?	12
What shortfalls are there in climate science training opportunities?	15
What is the need for new climate science training opportunities?	19
What can the WCRP Academy offer?	23
UNDERSTANDING DIFFERENCES BETWEEN REGIONS AND GROUPS	26
Do experiences of training and training needs differ by gender?	26
Do experiences of training and training needs differ by region?	29
Global North and Global South	29
WMO Governance Regions	33
Do experiences of training and training needs differ by education level?	39
REFLECTING ON SURVEY UPTAKE AND PATTERNS IN RESPONSE QUALITY	44
RECOMMENDATIONS FOR WCRP ACADEMY	49
Future surveys	49
Academy website and portal	50
ANNEXES:	52
Data Analysis Plan	52
List of survey questions	55
List of all countries in which respondents currently live	58

Executive Summary

Between July to end November 2021 an online survey was circulated by the World Climate Research Programme (WCRP) Academy to its network of climate scientists across the world. The survey was the first climate training stocktake survey by WCRP Academy to understand what climate science training is available, where the gaps are, and hence how WCRP Academy can help address any gaps. In particular, the survey was intended to inform the development of a WCRP Academy web portal for online climate science and related training opportunities. The WCRP Academy intends to run these stocktake surveys annually.

This report summarises the survey data and survey response patterns and makes recommendations to the WCRP Academy for the design of future annual stocktake surveys and for the development of a web portal.

Survey uptake

In total 414 unique survey responses were included in the analysis. These responses showed a good gender balance (54% men, 44% women, 2% other) and a fairly even split between respondents living in the global North (48%) and global South (52%). Respondents were mostly working full time in universities or research institutions, and roughly half (51%) had obtained a PhD as their highest level of education. Respondents had mainly undertaken their highest level of education in English (54%). 71% of respondents had had further training since their highest level of formal education. The majority of respondents (58%) had heard of WCRP before the survey.

Climate science training availability and gaps

Most survey respondents reported that the institution that they are affiliated with provides climate science training or education (73%). The high numbers reporting that the level of this training is at undergraduate (34%) and graduate (47%) levels reflects that most respondents are affiliated to universities.

Analysis of observation, analysis of model results, model evaluation and collecting observations were common climate-process based training available in respondents' countries. This aligned reasonably well to those training areas that respondents felt were most important climate scientists, except for theoretical studies which ranked fairly highly as available in most countries, but fairly low as important or needed. GIS and coding /programming were the most available general training topics. Capacity development/exchange was ranked highly as a general training area needed, but low in terms of training available. It is not clear whether respondents felt that more capacity development is needed in general, or whether training in capacity development is needed (i.e. training in the field of climate education). Climate impacts was the most common contemporary topic for training, followed by climate extremes, adaptation, risk and mitigation. These contemporary topics aligned well with what respondents' felt was important for climate scientists to know.

Indigenous voices and indigenous-led training featured often in open-ended responses or comments but not high on either available training or on importance of training, suggesting that its value is not widely known.

The most reported obstacle to the provision of adequate science training was financial barriers. A lack of local expertise was another important obstacle. Respondents were also asked to identify personal obstacles to accessing training or education. Again, financial barriers were by far the most common obstacle. This was followed by limited knowledge of available options.

The survey asked respondents what additional climate science training or education they would like to undertake now or in the future as an open-ended question. Responses spanned:

- Data analysis skills such as modelling, big data, AI, machine learning, downscaling, ARC GIS and remote sensing, coding and specific tools such as Python, MATLAB, GRADS;
- Knowledge areas such as climate science, climatology, adaptation, mitigation, carbon markets, climate and health, disaster management, climate risks, climate impacts, policies and governance, law;
- Science communication skills including communicating uncertainty, media outreach, data visualization, user-tailored products, interpreting models for stakeholders.

When asked about the main benefits for undertaking this further training or education, by far the most common reason selected was for skills for future research projects (work or study).

Recommendations for WCRP Academy and portal

Short courses were the most selected option for what training the WCRP Academy could provide, followed by webinars by experts and seasonal schools. The most selected option for resources that would be useful on the WCRP Academy web portal was informal training options. This reflects back to respondents' selecting that a lack of knowledge of climate science training options was a personal barrier to accessing additional training and education. Most respondents preferred a combination of face to face and online training. Websites, wikis and web portals were the most selected communication channels used by respondents for information on climate science training and education. The World Climate Science Academy was the most popular suggested name by respondents, followed by The WCRP Academy.

Main differences between gender, region, and education level

Gender differences

There were fewer gender differences than anticipated. More men (54%) than women (45%) have obtained a PhD. Interesting, only those respondents who identified as women reported gender biases as being an important obstacle to access climate science training and education. Double the percentage of women (22.8%) than men (9.9%) said that their preference would be for entirely online training. This may indicate that women appreciate the flexibility of online training more as they balance other responsibilities, or that men have greater access to resources to travel to in person training.

Regional differences

There were large differences in availability and access to climate science education and training across the Global North and Global South. The Global North had almost double the percentage of respondents whose highest level of education was a PhD (64%) compared to the global South (38%). All respondents from the global south reported that they would like access to additional climate science training or education, whereas 26% of Global North respondents said that they did not want access to additional training. Most respondents from the global North (59%) felt that the climate science training and education available in their country was adequate to allow researchers to work effectively on climate change science and associated fields, compared to only 24% in the global South. In the global South, most respondents felt that the climate science training and education available was not adequate (61%).

Education-level differences

There were many differences between those respondents who had not obtained a PhD and those who had. These differences appear to relate to the latter generally being at a more advanced career stage. A much higher percentage of respondents who had not obtained a PhD reported that they would like access to additional climate science training (97%) compared to those who had obtained their PhD (77%). Fewer respondents who had not obtained a PhD were aware of the WCRP. When asked about additional climate

science training or education that respondents would like to undertake, a higher percentage of respondents who had not obtained a PhD wanted further training on data gathering and management; climatology; and climate modeling. Respondents who had obtained a PhD put more emphasis on communication, engagement; policy and law, suggesting that PhD graduates are more concerned with impact and uptake of research than with developing skills for primary research. Informal training was ranked highly by both groups, but was higher for PhD holders. PhD-qualified respondents also more interested in networking. Respondents who had not obtained a PhD were more interested in listing of postgraduate courses. A slightly higher preference for social media amongst respondents who had not obtained a PhD, slightly higher preference for national science society mails and international community mailing lists for PhD graduates – again suggesting more advanced professional networks and affiliations.

Main lessons on survey response quality

From the recorded efforts to promote the survey, the first week following the launch of the survey seems to be where the most promotion activity occurred, including circulating to WMO mailing lists, WCRP social media, and amongst the International Universities Climate Alliance. These promotion activities generated the highest peak in responses - around a quarter of all responses were in the first week of the survey being launched.

Responses to questions tailed off towards end. Some respondents felt survey was too long, though the median time to complete the survey was 21 minutes.

Responses to open-ended questions and to the open-ended explanation when respondents selected “Other” suggest that some questions could be rephrased or simplified for clarity.

Recommendations for WCRP Academy

Survey

Future iterations of the survey may benefit from a narrower focus on climate science, as this is the focus of the WCRP Academy. In other words, the survey may better focus on the needs for climate science training (across multiple levels amongst researchers and practitioners), rather than the training needs of climate scientists (which appears to have been the focus or interpretation of this first survey).

A clearer distinction in the survey between questions for training providers versus training beneficiaries may also help with promoting the survey to different target groups or for different purposes.

Translating the survey into other languages besides English may help generate wider representation of responses and give a broader perspectives of training availability and gaps.

It may be helpful to understand why the survey uptake was so low in China (one response) and so high in Brazil (50 responses, i.e. ±12% of all responses, the highest response from any country).

The wording, ordering and structuring of certain questions, if repeated, could be simplified or explained for clarity and ease of analysis.

Portal

Calling the portal the ‘World Climate Science Academy’ would remove the ambiguity of the acronym WCRP, considering that 42% of respondents had not heard of WCRP before the survey. WCRP Academy may use social media and mailing lists as the primary communication channels.

This portal may start as a website that simply curates and lists known quality formal climate science programmes and upcoming WCRP-affiliated training activities, as the former do not change frequently and the latter is within WCRP's immediate network and hence more accessible, and as there is demand for both these services. Developing and maintaining this website as a first step would give insights into the logistics and hence costs of a larger web portal, and hence inform a business plan for the portal.

In displaying training and formal education options on the website, certain details could be made clear as these appear to be potential barriers or preferences from respondents.

As the biggest demand is for listing more informal training options, yet these are by nature difficult to find information for online, WCRP Academy may build up to a model that captures and curates these efficiently and builds a reputation for displaying up-to-date climate science training options that have been checked for quality.

1. Survey data overview

Total responses

632 survey entries were provided. These survey responses were made between 2021/07/20, 14:53:11 and 2021-12-22, 09:10:39.

10 test entries were removed (entries made prior to 2021/07/20 14:07:00)

182 insufficient entries were removed (of which 106 did not get past checking the consent at the start of the survey and a further 18 did not get past selecting gender; 58 did not answer any questions relating to climate science education)

24 duplicates were removed ('best' response judged, e.g. most complete)

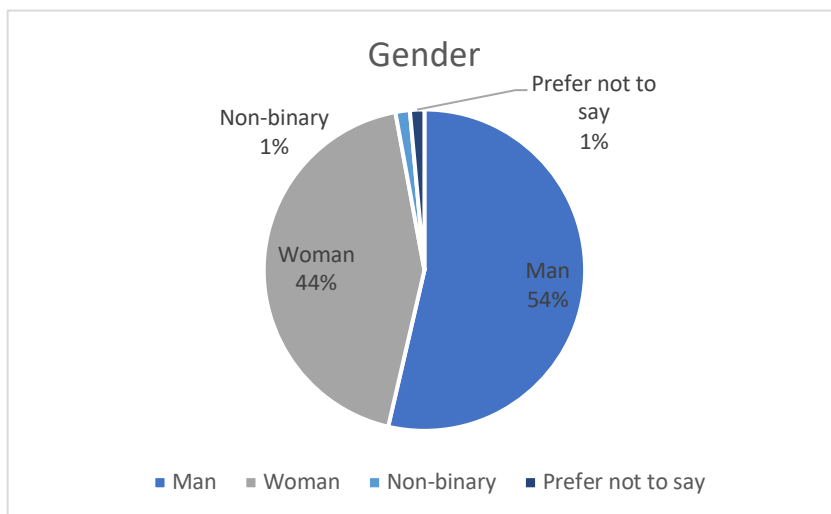
With these entries removed, 414 seemingly unique entries with sufficient data remained for the analysis. The remainder of the report primarily reports on these 414 entries.

Overview of survey uptake

Gender

Men made up the majority of respondents (54%). Women made up 44% of respondents. Non-binary respondents made up 1%, and a further 1% preferred not to give their gender.

Gender	
Man	222
Woman	180
Non-binary	6
Prefer not to say	6



Countries and regions

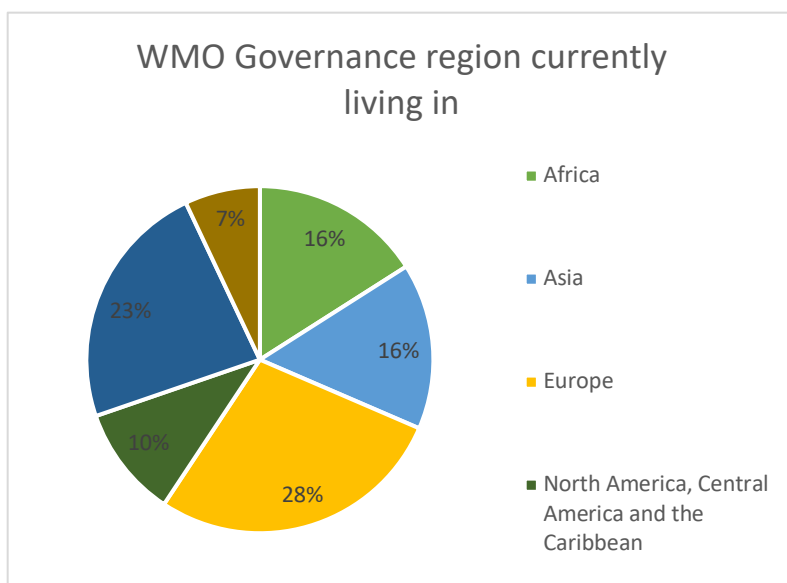
Respondents could indicate the country that they are currently living in, as well as their nationality. Around 89% of respondents are currently living in a country that they hold nationality for.

Brazil had the highest number of respondents. Thereafter, the highest numbers of respondents were from developed countries of USA, UK, Australia and Germany. Surprisingly, the survey only had 1 respondent currently living in China (see full country list in Annex), though at least 4 respondents described themselves as Chinese.

Top 10 countries respondents live in	
Brazil	50
United States	35
United Kingdom	35
Australia	24
Germany	22
India	21
Nigeria	20
Peru	14
Argentina	14
Norway	11

The countries respondents are living in were divided by WMO governance region. The highest proportion of respondents are currently living in Europe (28%), followed by South America (23%). The survey attracted the fewest respondents from the South-West Pacific (7%).

WMO Governance region respondents live in		
Africa	66	16%
Asia	64	16%
Europe	115	28%
North America, Central America and the Caribbean	43	10%
South America	96	23%
South-West Pacific	29	7%



Ethnicity

The survey asked: “Please describe your ethnic/ancestral background (e.g., European, African-American, ...). If you prefer not to say, then you can skip this question. We ask this question because we want to ensure that the Academy is inclusive and that we hear what is needed from many different voices.”

76% of respondents answered this question. As it was an open-ended question, there was a variety in responses. The responses in the table below count when these exact words were used to describe ethnicity.

Ethnicity as described by respondents	
European	106
African	40
Asian	23
India	8
Latin American	6
South Asian	5
White British	5
Black African	4
Chinese	4
Japanese	4
South American	4
White	4
White European	4
British	2
Hispanic	2
Mestizo	2
Yoruba	2

The remainder of responses were more nuanced in wording, for example:

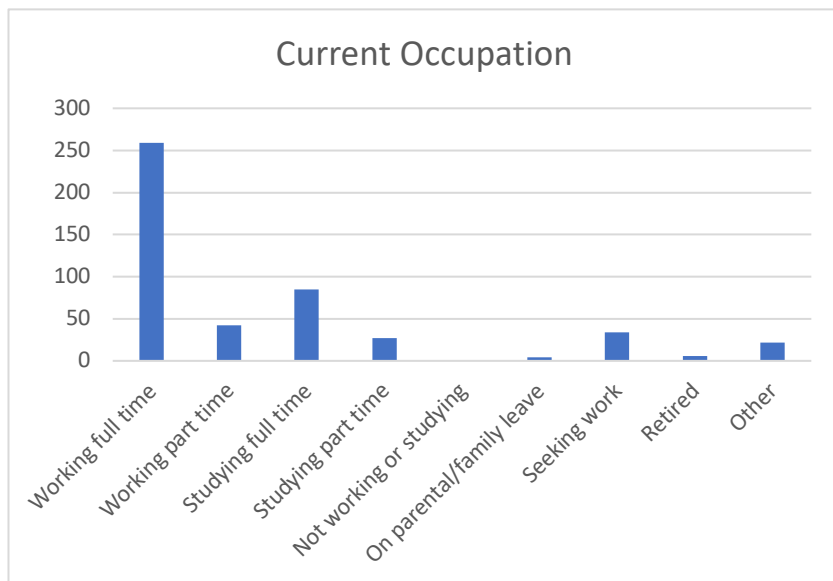
Adopted, Norwegian or Irish possibly
African (Yoruba)
Ancestral background from Syria and Spain
Caucasian, Arabic, and Native-South-American.
Central Asia, Muslim
European and indigenous
European and Jewish
European and native Brazilian
Latino, white
Mediterranean
Mixed (White European and Asian)
Nilo Sahara
Sakha (Native people of Siberia, Republic of Sakha)
Scandinavian/European
South American with ancestor from a mix of Portuguese, Italian, Spanish and native Brazilians
south asian, bengali

It did not feel appropriate to interpret and force responses into categories when there was such a range of interpretation of the question spanning race, religion, ancestry, nationality, and cultural identity.

Current Occupation and Affiliations

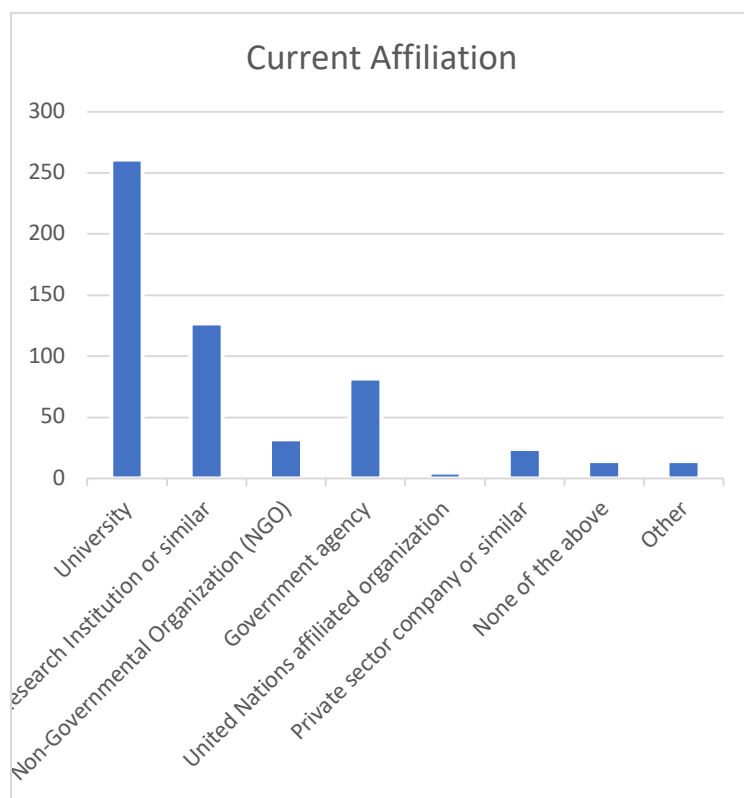
Respondents could select multiple fields for the question “Are you currently...” which listed various occupation options. Most respondents are currently working full time (63%).

Current Occupation*		
Working full time	259	63%
Working part time	42	10%
Studying full time	85	21%
Studying part time	27	7%
Not working or studying	0	0%
On parental/family leave	4	1%
Seeking work	34	8%
Retired	6	1%
Other	22	5%
<i>*Can hold multiple</i>		



Most respondents are currently affiliated to a university (63%), thereafter a research institution or similar (31%). Where respondents selected ‘Other’ (3%) and could self-describe their affiliation, these included intergovernmental organizations, internships, independent consultants, and listing specific organisations.

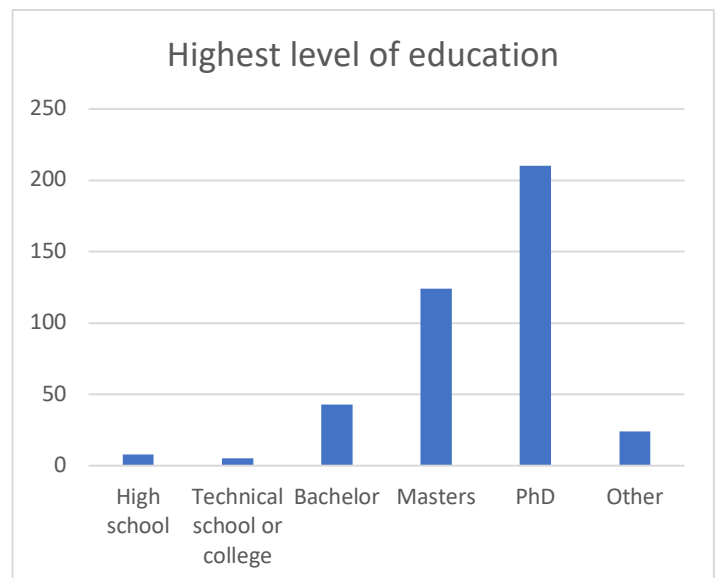
Current affiliation*		
University	261	63%
Research Institution or similar	127	31%
Non-Governmental Organization (NGO)	32	8%
Government agency	82	20%
United Nations affiliated organization	5	1%
Private sector company or similar	24	6%
None of the above	14	3%
Other	14	3%
<i>*Can hold multiple</i>		



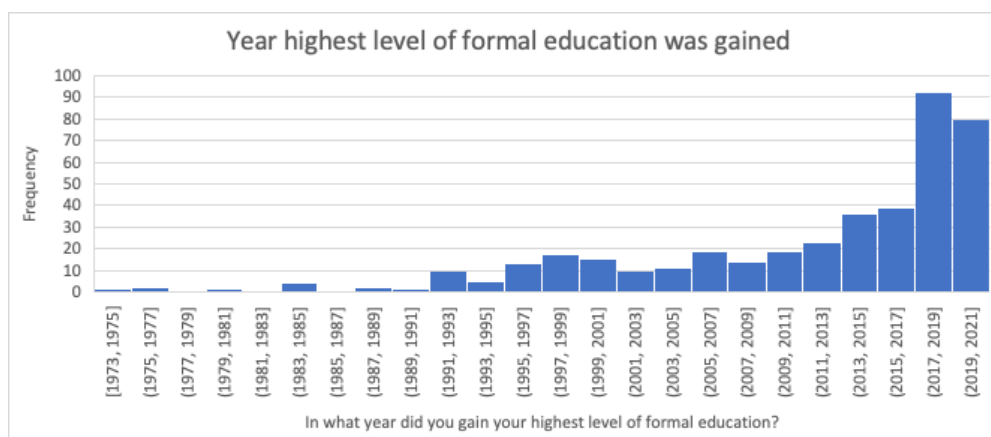
Highest level of Education

Most survey respondents have obtained their PhD (51%), followed by Masters (30%), showing that respondents are generally highly educated. Survey respondents are perhaps primarily advanced stage researchers working in university research institutes.

Highest level of education		
High school	8	2%
Technical school or college	5	1%
Bachelor	43	10%
Masters	124	30%
PhD	210	51%
Other	24	6%



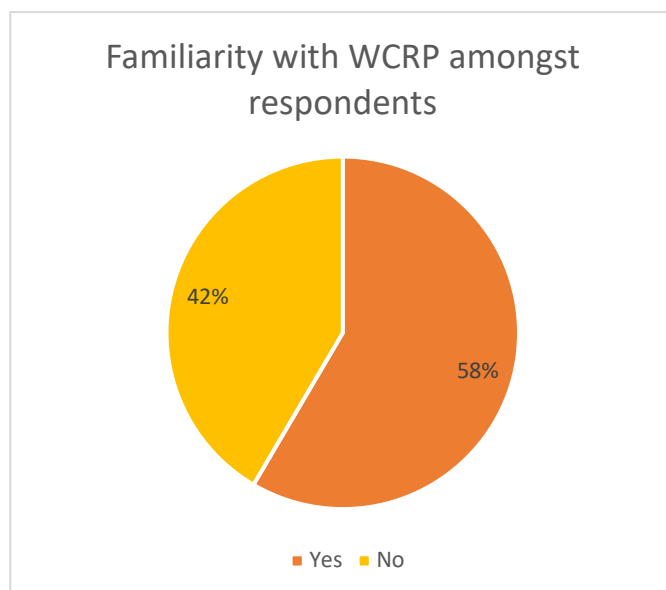
Most respondents had obtained their highest level of education within the past 5 years. The earliest year that a respondent reported obtaining their highest level of education was 1973.



Familiarity with the World Climate Research Programme (WCRP)

The majority of respondents had heard of the WCRP before, though 42% had not heard of the WCRP before suggesting that the survey was taken up more broadly than WCRP's immediate networks.

Familiarity with WCRP	
Yes	190
No	135



2. Understanding Demand and Supply of Global Climate Science Training Opportunities

What climate science training opportunities are there across the globe?

Location and language of highest level of education

Most survey respondents obtained their highest level of formal education in the country that they are currently living in. This is reflected in the top 10 countries where the highest level of education was obtained, which closely resembles the top 10 countries where respondents are living.

English was the most common language that respondents reported their highest level of education being taught in (63.5%), followed by Portuguese (11.1%) and Spanish (8.7%).

Top 10 Countries where highest level of formal education was obtained*		
United States	47	11.4%
Brazil	45	10.9%
United Kingdom	44	10.6%
Germany	27	6.5%
Australia	24	5.8%
India	21	5.1%
Nigeria	17	4.1%
France	15	3.6%
Argentina	14	3.4%
South Africa	14	3.4%
*See annex for full list		
What was the main language that your highest level of formal education was taught in?		
English	263	63.5%
Portuguese	46	11.1%
Spanish	36	8.7%
French	24	5.8%
German	19	4.6%
Italian	5	1.2%
Japanese	4	1.0%
Indonesian	2	.5%
Iranian Persian	2	.5%
Mandarin	2	.5%
Russian	2	.5%
Amharic	1	.2%

Burmese	1	.2%
Hindi	1	.2%
Hungarian	1	.2%
Jin Chinese	1	.2%
Malaysian	1	.2%
Nepali	1	.2%
Turkish	1	.2%
Zulu	1	.2%
Total	41	100.0
	4	

Subsequent training after highest level of education

Since completing their highest level of education, most respondents (70,5%) had further climate science training. Again, most of this further training was taught in English (54,6%), followed by Spanish (5,6%) and Portuguese (4.6%). For many respondents, this further training occurred in the country that they are currently living in.

What was the main language that this training was taught in?		
English	226	54.6
Spanish	23	5.6
Portuguese	19	4.6
French	11	2.7
German	3	.7
Japanese	2	.5
Bengali	1	.2
Eastern Punjabi	1	.2
Greek	1	.2
Iranian Persian	1	.2
Italian	1	.2
Malaysian	1	.2
Nepali	1	.2
Russian	1	.2

Turkish	1	.2
Blank	121	29.2
Total	414	100.0

Have you had any formal or informal climate science training (e.g. short courses, workshops, graduate diploma etc.) since your highest level of formal education?

No	122	29.5%
Yes or maybe	292	70.5%
Total	414	100.0%

Top 10 countries where this additional training mostly occurred*

United States	45	10.9%
United Kingdom	33	8.0%
Brazil	28	6.8%
Australia	15	3.6%
India	14	3.4%
Germany	13	3.1%
France	12	2.9%
South Africa	11	2.7%
Nigeria	10	2.4%
Argentina	8	1.9%
*Full list in annex		

In an open-ended question, respondents could describe the training they had completed since their highest level of education. Responses included workshops, webinars, short courses, online courses and MOOCs, conferences, on the job learning, summer schools, participating in various pieces of work (e.g. contributing to IPCC reports).

The topics of additional training were wide-ranging. Topics included: data assimilation, mesoscale meteorology, ecosystem-based adaptation, atmospheric chemistry and physics, Cloud Dynamics, Microphysics and Small-scale simulation, carbon literacy, Climate change negotiation, climate change and climate variability, financing climate change, Model evaluation, Nature based solutions on climate disaster resilience, sea level rise projections, weather forecasting for operational meteorologists, and many more.

Some responses also included PhDs, Masters and BScs, and other degrees, and it was not always clear whether respondents meant that these were still in progress; whether these were not taken for credits; whether these were taken in addition to the highest level of education that they reported in the previous question; or whether the question had not been clearly understood.

Climate science training offered by respondents' institutions

Most survey respondents reported that the institution that they are affiliated with provides climate science training or education (72.7%). The high numbers reporting that the level of this training is at undergraduate (34%) and graduate (47%) reflects that most respondents are affiliated to universities.

Does the institution/ company/ organization that you are affiliated with provide any climate science training or education?		
Yes	301	72.7%
No	65	15.7%
Don't know	33	8.0%
Blank	15	3.6%
Total	414	100%
What level of climate science training or education does the institution/ company/ organization that you are affiliated with provide (Select all that apply)?		
Undergraduate courses	141	34%
Graduate or postgraduate courses	195	47%
Short training courses	147	36%
Informal training	90	22%
Other ¹	22	5%

The training offered in respondents' institutions covered a range of climate science topics. Respondents could enter up to five open-text descriptions of the training their institutions offers. In order of frequency, the most common topics that this training covered included: climate modelling, climatology, fluid dynamics and geophysical fluid dynamics, meteorology, oceanography, climate and atmospheric science, urban climatology, climate variability, climate change adaptation, environmental science, water resources, climate risk and climate data analysis.

Training available in respondents' country

Analysis of observations, analysis of model results other than model evaluation and collecting observations were the top 3 most available climate process-based training in respondents' country or city. However, it is not clear what exactly might be included under 'Analysis of model results other than model evaluation', and in future surveys this response could be expanded further. A couple of respondents in the 'Other' open-text field made the point that with online courses, location does not matter.

Specific climate process-based training (in any field associated with climate) available to climate scientists and key users of technical and scientific climate information in respondents' country or city	
Analysis of observations	231
Analysis of model results other than model evaluation	212
Collecting observations (in-situ, field-studies, remote-sensing, ...)	208
Model evaluation	171
Theoretical studies	162
Verification of forecasts and projections	158

¹ Including online courses / MOOCs, tailor-made courses, professional courses, workshops, student supervision, internships, workshops, high school programs, PhD graduation, and specific technical training.

Model development	142
Construction of observational research data sets	138
Development of systems for providing forecasts and projection	133
Model experimentation	126
Laboratory studies	110
Collection and/or analysis of paleoclimate proxy records	95
Not sure	46
Other	22

Geographic Information Systems (GIS) and Coding/Programming were the most available general training in respondents' country or city. Graphics and data visualization, qualitative methods, and science communication were also listed frequently.

General training available to climate scientists and key users of technical and scientific climate information in the city/country that respondents live	
Geographic Information Systems (GIS)	216
Coding/Programming	195
Graphics and data visualisation	173
Qualitative methods (e.g. qualitative statistics, interviewing methods, etc.)	170
Science Communication (journals, grants, proposals)	163
Capacity development/exchange	144
Media and outreach communication	126
Governance / Policy	116
Indigenous knowledge	79
Not sure	42
Other	11

Climate change impacts, Climates extremes and Climate change adaptation were the top 3 most available training in contemporary topics in respondents' country or city.

Four respondents who selected 'Other' wrote that they do not have training, suggesting this may be a category in itself in future surveys.

Training in contemporary topics available to climate scientists and key users of technical and scientific climate information in the city/country that respondents live in:	
Climate change impacts	225
Climates extremes	187
Climate change adaptation	184
Climate risk	178
Climate change mitigation	168
Air quality	147
Machine learning / Artificial intelligence	121
Urban climatology	109

Detection and attribution	77
Citizen science	64
Geoengineering / Climate intervention	61
Not sure	56
Other	12

What shortfalls are there in climate science training opportunities?

Availability of climate science training and education

Overall, a similar percentage of respondents felt that the climate science training available in their country was adequate (33.3%) as those who felt it wasn't adequate (36.5%).

Is climate science training and education available in respondents' country seen as adequate to allow researchers to work effectively on climate change science and associated fields		
Yes	138	33.3%
No	151	36.5%
Don't know	58	14.0%
Blank	67	16.2%
Total	414	100%

Obstacles to provision of adequate climate science training and education

The most reported obstacle to the provision of adequate science training was financial barriers. A lack of local expertise was another important obstacle.

Discrimination based on gender, ethnic group and ability were reported relatively fewer than other obstacles, though still concerning. Some of the comments from respondents who selected "Other" also pointed to concerning socio-political obstacles, including:

- A lack of Indigenous voices*
- climate leaders are beign killed (sic)*
- Eco-political impediments*
- Low interest to the problem*
- political ideological bias in federal government*

Another respondent in an open-ended response option suggested, "The needed knowledge and skills are too deep, too wide and too fast developing to be taught in standard postgraduate education system in our country," which is indeed a common obstacle for this rapidly developing field.

Important obstacles to the provision of adequate climate science training and education in respondents' country	
Financial barriers	137
A lack of local expertise	95
Limited knowledge of available options	85
Training available but limited to formal studies	85

Technical limitations (computer capacity, etc.)	72
Limited face to face training available	65
Limited online training available	56
Language barriers	50
Limited internet access	46
Training not available formally or informally	32
No physical access to educational facilities (due to distance/transport,...)	24
Limited (or no) help for people with disabilities (physical, behavioural, learning etc.)	21
Ethnic group biases	17
Gender biases	11
Other	19

Personal obstacles to accessing climate science training or education

Respondents were also asked to identify personal obstacles to accessing training or education. Again, financial barriers were by far the most common obstacle. This was followed by limited knowledge of available options. Surprisingly, limited online training being available was the 4th highest obstacles identified, despite (as pointed out in other questions) this type of training not being restricted to country or region. This may suggest that it is more a case of respondents not being aware of online training options either. The high number of respondents reporting that they are not aware of available options suggest the need for WCRP Academy to market training options widely to its network.

A lack of time to access training was frequently reported in the open-ended comments by those who selected 'Other', suggesting this could be a category for this question if asked again in future surveys.

Personal important obstacles to accessing training or education	
Financial barriers	155
Limited knowledge of available options	122
A lack of local expertise	98
Limited online training available	95
Limited face to face training available	81
Training available but limited to formal studies	67
Technical limitations (computer capacity, etc.)	63
Training not available formally or informally	57
Limited internet access	41
Language barriers	41
No physical access to educational facilities (due to distance/transport,...)	29
Limited (or no) help for people with disabilities (physical, behavioural, learning etc.)	14
Ethnic group biases	13
Gender biases	7
Other	27*
<i>*Of which 14 related to time/lack of time</i>	

Awareness of limited access to climate science training and education in other countries

For the most part, respondents did not know of other countries where access to climate science training and education is limited (47,8%). Where respondents did report of limited access, their explanations mainly focused on the geographic region, particularly in Africa and the global south, or listing specific countries (notably Benin, Pakistan and Nigeria). Some explanations justified the reason for limited access which included computational, internet and other e-infrastructure limitations; and the lack of expertise or capacity.

Are you aware of other countries (not where you currently live, study or work) where access to climate science training and education is limited?		
Yes - please briefly explain*	93	22.5%
No	52	12.6%
Don't know	198	47.8%
Blank	71	17.1%
Total	414	100%

* Explanations given were open-ended:	
17	Specified Africa, African countries, west Africa, East Africa, Southern Africa
17	Specified LMICs, developing countries, global south
6	Specified Latin America, south America, Central America
29	Listed specific countries. Benin, Pakistan and Nigeria each listed multiple times, otherwise a range of LMICs
15	Gave reasons rather than areas. Reasons across all open-ended responses mainly focused on computational, internet and other e-infrastructure limitations; and the lack of expertise or capacity.

What is the need for new climate science training opportunities?

Important climate process-based training areas

Analysis of model results other than model evaluation was selected most frequently as an important climate process-based training area that climate scientists need to address current climate science challenges and emerging challenges. Again, it is not clear what exactly might be included under 'Analysis of model results other than model evaluation', and in future surveys this response could be expanded further.

Many of the open-ended responses given by those who selected 'Other' suggest that respondents struggled to determine what constituted a 'climate process-based training area'. For example, 7 of these comments related to communication and public engagement, and others pointed to inter-sectional links such as 'climate change and health' or 'climate change and agriculture'.

Important climate process-based training areas (in any field associated with climate) that climate scientists need to address current climate science challenges and emerging challenges	
Analysis of model results other than model evaluation	116
Analysis of observations	90
Verification of forecasts and projections	87
Collecting observations (in-situ, field-studies, remote-sensing, ...)	84
Development of systems for providing forecasts and projection	80
Model development	79
Model evaluation	71
Construction of observational research data sets	68
Model experimentation	40
Theoretical studies	31
Laboratory studies	27
Collection and/or analysis of paleoclimate proxy records	26
Not sure	3
Other	27

Important general training areas

Coding/ Programming, closely followed by Science Communication (journals, grants, proposals) and Capacity Development/ exchange were selected as the most important general training areas that climate scientists need to address current climate science challenges and emerging challenges. It is not clear whether respondents felt that more capacity development is needed in general, or whether training in capacity development is needed (i.e. training in the field of climate education). Indigenous knowledge was selected the least out of the options given, though it is important to note that this is based on respondents' opinion and may indicate a lack of awareness of the value of indigenous knowledge in addressing climate challenges.

Important general training areas that climate scientists need to address current climate science challenges and emerging challenges	
Coding/Programming	118
Science Communication (journals, grants, proposals)	115
Capacity development/exchange	111

Media and outreach communication	88
Governance / Policy	86
Graphics and data visualisation	85
Qualitative methods (e.g. qualitative statistics, interviewing methods, etc.)	82
Geographic Information Systems (GIS)	73
Indigenous knowledge	44
Not sure	2
Other	8

Important contemporary training topics

Climate change impacts, climate risk, climate adaptation, climate extremes, and climate change mitigation were selected as important contemporary training topics that climate scientists need to address current climate science challenges and emerging challenges. Indeed, combined with climate science, these categories broadly cover the field of climate change.

Important contemporary training topics that climate scientists need to address current climate science challenges and emerging challenges	
Climate change impacts	136
Climate risk	129
Climate change adaptation	128
Climate extremes	126
Climate change mitigation	106
Machine learning/Artificial Intelligence	69
Detection and attribution	67
Urban climatology	40
Citizen science	31
Air quality	30
Geoengineering	19
Not sure	3
Other	6

Additional climate science training or education that respondents want to undertake

The survey asked respondents what additional climate science training or education they would like to undertake now or in the future as an open-ended question. Responses spanned:

- Data analysis skills such as modelling, big data, AI, machine learning, downscaling, ARC GIS and remote sensing, coding and specific tools such as Python, MATLAB, GRADS;
- Knowledge areas such as climate science, climatology, adaptation, mitigation, carbon markets, climate and health, disaster management, climate risks, climate impacts, policies and governance, law;
- Science communication skills including communicating uncertainty, media outreach, data visualization, user-tailored products, interpreting models for stakeholders.

Coding or categorising these open-ended responses was difficult as respondents gave very varying levels of detail. For example, a respondent may simply say “climate modelling” or “machine learning”. On the other

hand, they may give a very detailed response such as “In-depth interdisciplinary training in Systems Science in combination with meteorologic phenomena like convective precipitation” or “Expand the comprehension of biological and ecological consequences and how to predict climate changes consequences using models, remote sensors and learning machining.” Hence, a response may be reflected across multiple categories in the table below. For example, “Modelling climate impacts in agriculture and effective policy responses” would be categorized in Climate modelling; Impact; and Policy.

It is also worth noting that these categories do not show the level of training expected, which spanned from “Intro to climatology” to very specific applications such as “Climate science training linked to landslides” or “Field-based Glacier Monitoring”.

Training providers should be aware that there is a broad appetite for further climate science training that spans many themes and levels.

Additional climate science training or education respondents want to undertake (categorised)	
Climate modelling, forecasting, downscaling, model evaluation	95
Impacts, sectors (ecosystems, health, agriculture, cities, rural, water)	39
Communication, engagement, data visualisation, writing	33
Advanced programming, machine learning, big data, AI	32
Climatology, climate science, climate dynamics, ocean dynamics, climate forcings	29
Data gathering, management, data science, coding, data evaluation	27
Adaptation and resilience	27
Mitigation	21
Risk assessment, risk analysis, risk management	19
Policy and law	19
Statistics	16
Observations	10
Attribution	10
GIS, remote sensing	10
Introduction, basics, overview of climate change	9
Sociology, psychology, behaviour change, education	6
Climate services	5
Research methods, research design	5
Paleoclimate	4
Citizen science	2
Climate finance	2
Advocacy	1
Indigenous-led training	1

The range of responses suggest that respondents may have used a much broader understanding of ‘climate science’ than the survey intended. It would perhaps be better to view the survey responses as the training needs of climate scientists rather than the needs for climate science training. If WCRP Academy wishes to focus specifically on climate science training, future iterations of the survey could narrow this focus.

When asked about the main benefits for undertaking this further training or education, by far the most common reason selected was for skills for future research projects (work or study), perhaps reflecting again that the survey was primarily answered by senior researchers working in universities.

While the response options given in the survey focused on personal work or advancement, many of those who selected 'Other' (13 of the 21) and provided open-ended responses gave reasons that were more altruistic. These responses focused on broader societal / environmental impact such as helping the planet, limiting the colonization of climate science, contributing as a citizen, for the benefit of society, and for more impactful research in the future, amongst others.

Main benefits of undertaking this training or education	
Skills for future research projects (work or study)	257
Skills for my current work or study	231
Improve future prospects for long term employment (e.g., academia, government or industry)	170
Improve future study prospects (e.g., attaining a PhD scholarship)	125
Improve future prospects for attaining a postdoctoral or short term contract (e.g., research assistant) position	109
Improve prospects for promotion in my current work	81
Don't know	1
Other (<i>of which 13 related to wanting broader societal / environmental impact</i>)	21

Preferred mode of delivery for training

Most respondents (51,4%) would prefer a combination of online and face-to-face training for short courses, workshops, and professional development. In the comments left by those who selected 'Other', a few respondents pointed out that it depends on the type of training, topic, context or cost.

For your current career level and time commitments, do you prefer face-to-face training or online training for short courses, workshops, and professional development?		
A combination of online and face to face training	213	51.4%
Entirely face to face training	45	10.9%
Entirely online training	63	15.2%
Other (please specify)	9	2.2%
Blank	84	20.3%
Total	414	100%

What can the WCRP Academy offer?

Training that the WCRP Academy could provide

Short courses were the most selected option for what training the WCRP Academy could provide, followed by webinars by experts and seasonal schools. These were followed by online lectures, blended options, MOOCs and online internships.

Training that WCRP Academy could provide (Respondents could choose multiple):	
Short courses	267
Webinars by experts	214
Seasonal schools (e.g., summer schools, winter schools)	213
Online lectures	197
Blended/hybrid learning options that encompass practical/hands-on learning (e.g., workshops on practical skills such as using sensors, fieldwork methods, etc.)	195
Longer online courses such as Massive Open Online CourseS (MOOCs)	127
Online models of practicums and internships	116
Other	8

Resources that would be useful on the WCRP Academy web portal

The most selected option for resources that would be useful on the WCRP Academy web portal was informal training options. This reflects how limited knowledge of available options was a common personal barrier to accessing training and education – many people want to know what training is available to them. Networking, internships, and targeted training were also all selected more than formal/accredited postgraduate or undergraduate training. This could reflect how most respondents are affiliated to universities and aware of formal programmes which are generally findable through a variety of online platforms. On the other hand, informal training is not as easy to find online, perhaps because it tends to be short-term, ad hoc and/or project-based.

Resources that would be useful on the WCRP Academy web portal	
Informal training options (e.g., short courses, seasonal schools, workshops)	236
Networking opportunities	185
Internship opportunities	178
Targeted training to increase local capacity/expertise (e.g. train the trainer initiatives, lifelong learning opportunities)	174
Listing of formal postgraduate training (accredited and recognised)	162
Mentoring opportunities	155
Positions vacant	154
Listing of formal undergraduate training (accredited and recognised)	93
Don't know	31
Other	4

Communication channels for information on climate science training

Websites, wikis and web portals were the most selected communication channels used by respondents for information on climate science training and education, followed by newsletters, and thereafter by journals and mailing lists equally.

Communication channels used by respondents for information on climate science training and education	
Websites, wikis and web portals	202
International climate science community mailing lists (newsletters, alerts etc)	199
Journals and other publications	169
Mailing lists or notifications that I subscribe to myself (e.g, LinkedIn, UNCC)	169
My institution sends information to me by email	162
Social media channels (e.g., Facebook, Twitter)	158
National science society emails	90
Personal connections	10

Suggested names for the WCRP Academy

This question had a low response rate, perhaps because it was one of the last questions in the survey. Of those who did respond, World Climate Science Academy was the popular suggested name, followed by The WCRP Academy. Other names put forward by respondents included The WCRP Climate Science School and World climate change knowledge and training hub.

Suggested name would for the branding and marketing of the WCRP Academy to an international audience, given the goal is to inform on climate science training		
World Climate Science Academy	51	12.3%
The WCRP Academy	34	8.2%
The Climate Science Academy	29	7.0%
Climate Training Hub	23	5.6%
Climate Knowledge Hub	18	4.3%
The Climate Academy	15	3.6%
World Climate Scientists Academy	13	3.1%
The Climate Scientists' Academy	4	1.0%
Other (please specify)	2	.5%
Blank	225	54.3%
Total	414	100%

Lists of training programmes, providers, and portals

Survey respondents provided links to the training that their institution provides and for their favourite web portals for accessing climate training. Some sites (19) listed by participants could not be accessed. In total 178 unique sites were given, of which 37 were listed by multiple survey responses. These were captured

together in a separate database after being checked and categorized according to the type of programme, target participant, focus or theme, country and language.

In line with findings across the survey, most training sites listed were for training programmes in English. Roughly half were online, a third in the global north and the remainder in the global south. A third of the training sites listed were for academic courses or programmes (i.e. Masters, BSc or PhD programmes).

3. Understanding differences between regions and groups

Do experiences of training and training needs differ by gender?

Highest level of formal education by gender

A higher percentage of men (54,5%) than women (45%) reported that their highest level of formal education was a PhD.

Highest level of formal education by gender								
	Man		Woman		Non-binary		Prefer not to say	
High school	4	1.8%	4	2.2%				
Technical school or college	3	1.4%	2	1.1%				
Bachelor	22	9.9%	21	11.7%				
Master	63	28.4%	57	31.7%	2	33.3%	2	33.3%
PhD	121	54.5%	81	45.0%	4	66.7%	4	66.7%
Other	9	4.1%	15	8.3%				

Access to additional climate science training by gender

Gender did not appear to make a discernable difference to whether respondents wanted access to additional climate science training. A roughly even percentage of men (73%) as women (71,1%) wanted access to additional climate science training or education.

Would you like to access additional climate science training or education?								
	Man		Woman		Prefer not to say		Non-binary	
Blank	33	14.9%	37	20.6%	2	33.3%	1	16.7%
No	27	12.2%	15	8.3%	1	16.7%		
Yes or maybe	162	73%	128	71.1%	3	50%	5	83.3%
Total	222	100%	180	100%	6	100%	6	100%

Financial barriers followed by limited knowledge of available options were the biggest obstacles to accessing additional training or education across men and women. Interesting, only those respondents who identified as women reported gender biases as being an important obstacle to access.

Important obstacles to accessing additional training or education (respondents could select 5)					
	Man	Woman	Non-Binary	Prefer not to say	Total
Financial barriers	95	59	1	0	155
Limited knowledge of available options	64	53	3	2	122
A lack of local expertise	60	38	0	0	98
Limited online training available	56	37	2	0	95
Limited face to face training available	51	26	2	2	81
Training available but limited to formal studies	31	35	1	0	67

Technical limitations (computer capacity, etc.)	47	16	0	0	63
Training not available formally or informally	27	30	0	0	57
Limited internet access	29	12	0	0	41
Language barriers	20	21	0	0	41
No physical access to educational facilities (due to distance/transport,...)	18	11	0	0	29
Limited (or no) help for people with disabilities (physical, behavioural, learning etc.)	4	9	0	1	14
Ethnic group biases	6	7	0	0	13
Gender biases	0	7	0	0	7
Other	10	16	0	1	27

Needs and preferences for climate science training by gender

Across all genders, there was a preference for a combination of online and face to face training. Double the percentage of women (22.8%) than men (9.9%) said that their preference would be for entirely online training. This may indicate that women appreciate the flexibility of online training more as they balance other responsibilities, or that men have greater access to resources to travel to in person training.

Preference for face-to-face training or online training for short courses, workshops, and professional development by gender								
	Man		Woman		Prefer not to say		Non-binary	
Blank	39	18%	43	24%	1	17%	1	17%
A combination of online and face to face training	122	55%	84	47%	4	67%	3	50%
Entirely face to face training	35	16%	8	4%			2	33%
Entirely online training	22	10%	41	23%				
Other	4	2%	4	2%	1	17%		
Total	222		180		6		6	

Men's top communication channel for information on climate science training was Websites, wikis and web portals; whereas women's top channel was International climate science community mailing lists (newsletters, alerts etc).

Communication channels used to inform about climate science training and education by gender				
	Man	Woman	Non-Binary	Prefer not to say
Websites, wikis and web portals	124	74	2	2
International climate science community mailing lists (newsletters, alerts etc)	114	82	1	2
Journals and other publications	92	73	2	2
Mailing lists or notifications that I subscribe to myself (e.g, LinkedIn, UNCC)	88	76	2	3
Social media channels (e.g., Facebook, Twitter)	86	65	4	3
My institution sends information to me by email	80	75	3	4

National science society emails	53	34	1	2
Other	4	4	0	2

Short courses were rated highly across gender groups as suggestions for training that WCRP Academy could offer. Seasonal schools were the second choice for men; whereas webinars by experts were the second choice for women; this is perhaps a reflection of greater preference for online training amongst women (see above).

Suggestions for training that WCRP Academy could provide by gender				
	Man	Woman	Non-Binary	Prefer not to say
Short courses	145	115	3	4
Seasonal schools (e.g., summer schools, winter schools)	122	86	3	2
Webinars by experts	113	96	3	2
Online lectures	109	83	4	1
Blended/hybrid learning options that encompass practical/hands-on learning (e.g., workshops on practical skills such as using sensors, fieldwork methods, etc.)	107	84	4	0
Longer online courses such as Massive Open Online CourseS (MOOCS)	71	54	2	0
Online models of practicums and internships	71	42	1	2
Other	3	4	0	1

In terms of useful resources that the WCRP Academy web portal could provide, informal training options were rated highly amongst all gender categories. Networking opportunities and internship opportunities ranked higher amongst men than women.

Useful resources for the WCRP Academy web portal by gender				
	Man	Woman	Non-Binary	Prefer not to say
Informal training options (e.g., short courses, seasonal schools, workshops)	128	101	3	4
Networking opportunities	109	70	3	3
Internship opportunities	102	70	2	4
Targeted training to increase local capacity/expertise (e.g. train the trainer initiatives, lifelong learning opportunities)	85	84	3	2
Listing of formal postgraduate training (accredited and recognised)	84	72	3	3
Positions vacant	80	69	3	2
Mentoring opportunities	77	71	4	3
Listing of formal undergraduate training (accredited and recognised)	47	42	2	2
Don't know	22	8	1	0
Other	2	1	0	1

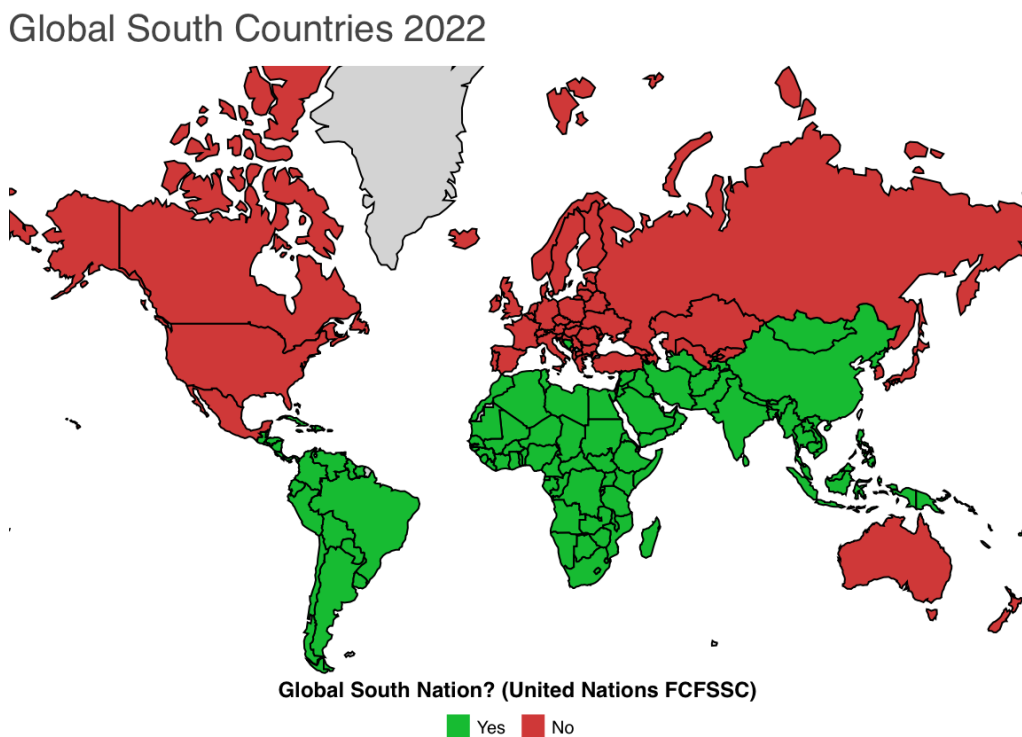
Do experiences of training and training needs differ by region?

Global North and Global South

To understand differences by region, respondents were split into Global North or Global South depending on the country that they currently reside in. Global South countries are mostly Low and Lower Middle-Income countries (LMICs) with exception to a few countries (e.g., Uruguay is in the global South but is not an LMIC). There were 15 respondents from across 9 countries have this discrepancy between global South and LMIC; they were included in the analysis as Global South.

Although very similar, the analysis compared Global South and North (as opposed to LMIC and non-LMIC) to align with preferred discourse amongst the Global South, and for complementarity with another WCRP Academy consultancy focused on the Global South.

The analysis below uses classifications for Global South/North from the United Nations' Finance Center for South-South Cooperation, accessed through <https://worldpopulationreview.com/country-rankings/global-south-countries> (courtesy image below).



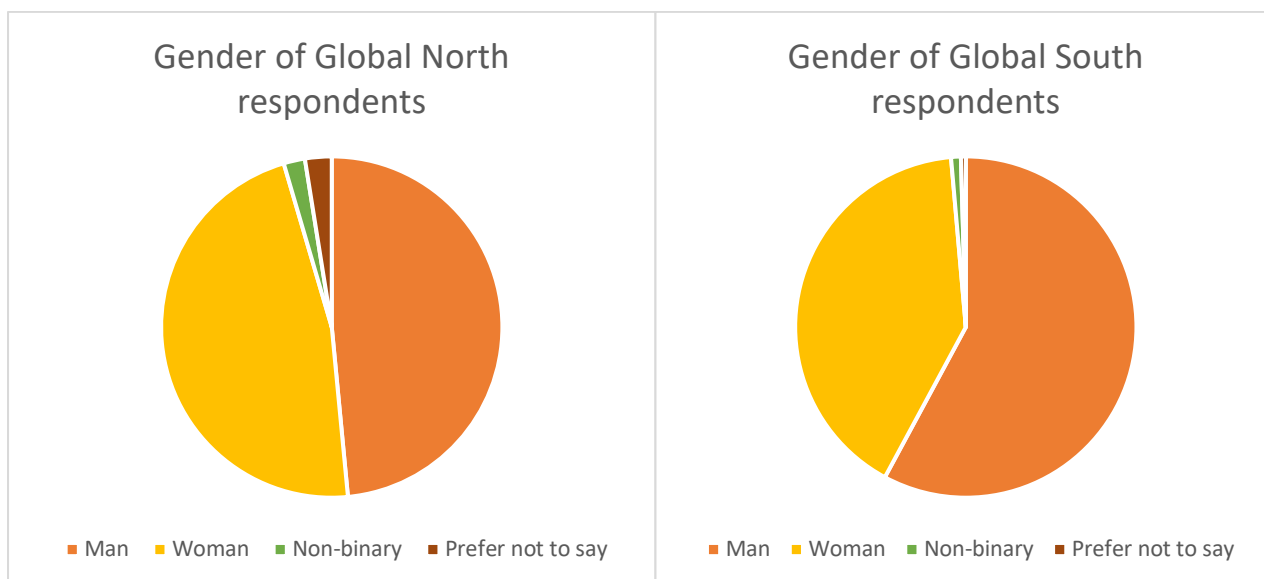
The survey had a fairly even spread of respondents from the global North (46,8%) as the global South (52,1%).

Survey respondents		
Global North	198	(47,8%)
Global South	216	(52,1%)
Total	414	

Gender of respondents in the global North and South

The gender balance of respondents in the global south was less than in the global north. In the global south, 57,9% of respondents are men compared to 40,7% who are women. In the global north, the balance is 48,5% to 47% respectively.

Gender	Global South	Global North
Man	125 (57,9%)	96 (48.5%)
Woman	88 (40,7%)	93 (47%)
Non-binary	2 (0,9%)	4 (2%)
Prefer not to say	1 (0.5%)	5 (2,5%)



Top 5 Countries of Global South Respondents

Brazil	50
India	21
Nigeria	20
Peru	14
Argentina	14

These top five countries account for 55% of Global South survey respondents.

Top 5 Countries of Global North Respondents

United States	35
United Kingdom	35
Australia	24
Germany	22
Norway	11

These top five countries account for 65% of Global North survey respondents.

Highest level of education

Respondents in the Global North were more highly educated than those in the global South. The Global North had almost double the percentage of respondents whose highest level of education was a PhD (64,1%) compared to the global South (38,4%).

Highest level of formal education				
		Global South		Global North
High School	4	(1,9%)	4	(2%)
Technical school or college	5	(2,3%)	0	0
Bachelor	35	(16,2%)	8	(4%)
Masters	71	(32,9%)	53	(26,8%)
PhD	83	(38,4%)	127	(64,1%)
Other	18	(8,3%)	6	(3%)

Obstacles to the provision of adequate climate science training in the global north and global south

Across the Global North and Global South, financial barriers are the main reported obstacle to climate science training, followed by a lack of local expertise.

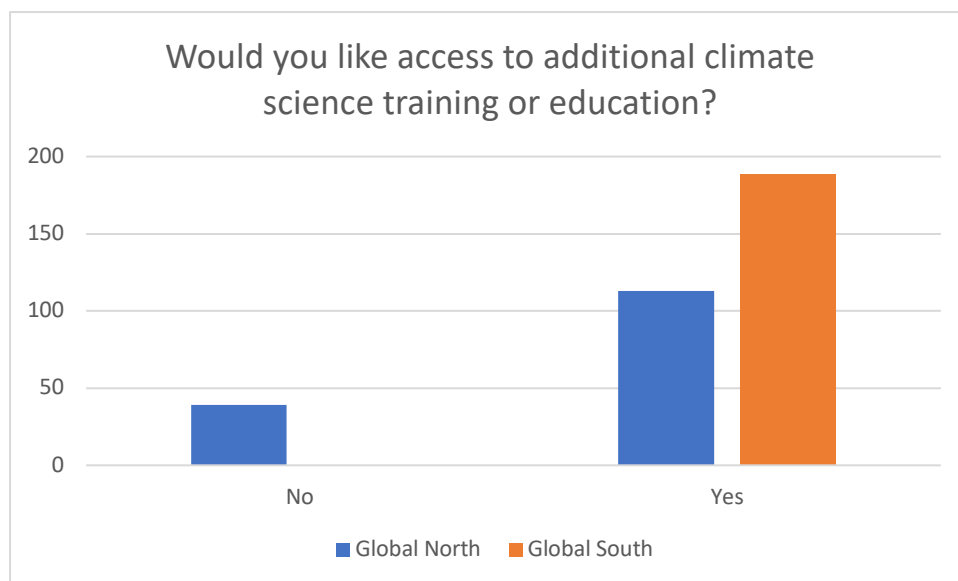
Obstacles to the provision of adequate climate science training and education in your country (respondents could choose multiple)		
	South	North
Financial barriers	112	137
A lack of local expertise	74	95
Technical limitations (computer capacity, etc.)	60	72
Training available but limited to formal studies	58	85
Limited knowledge of available options	54	85
Limited face to face training available	47	65
Limited internet access	41	46
Limited online training available	39	56
Language barriers	35	50
Training not available formally or informally	21	32
Limited (or no) help for people with disabilities (physical, behavioural, learning etc.)	17	21
No physical access to educational facilities (due to distance/transport,...)	15	24
Ethnic group biases	12	17
Gender biases	7	11
Other	6	19

Access to additional climate science training

All respondents from the global south reported that they would like access to additional climate science training or education, whereas 25,7% of Global North respondents said that they did not want access to additional training.

Respondents wanting access to additional climate science training or education by region

	No	Yes
North	39 (25,7%)	113 (74,3%)
South	0	189 (100%)

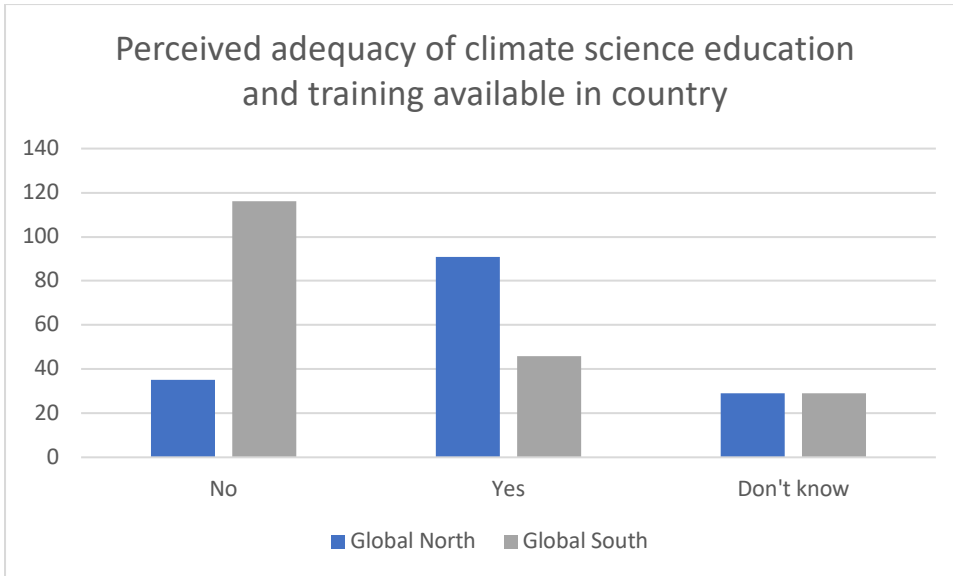


Perception on whether climate science training and education is adequate in respondents' country

Most respondents from the global North (58,7%) felt that the climate science training and education available in their country was adequate to allow researchers to work effectively on climate change science and associated fields, compared to only 24,1% in the global south. In the global south, most respondents felt that the climate science training and education available was not adequate (60,7%).

Respondents' opinion on whether the climate science training and education available in their country is adequate to allow researchers to work effectively on climate change science and associated fields

	No	Yes	Don't know
North	35 (22,6%)	91 (58,7%)	29 (18,7%)
South	116 (60,7%)	46 (24,1%)	29 (15,2%)



WMO Governance Regions

As the World Meteorological Organization (WMO) is an important partner for the WCRP, and as the WMO Global Campus will be an important resource for the WCRP Academy, the survey data was also analyzed according to WMO Governance Regions.

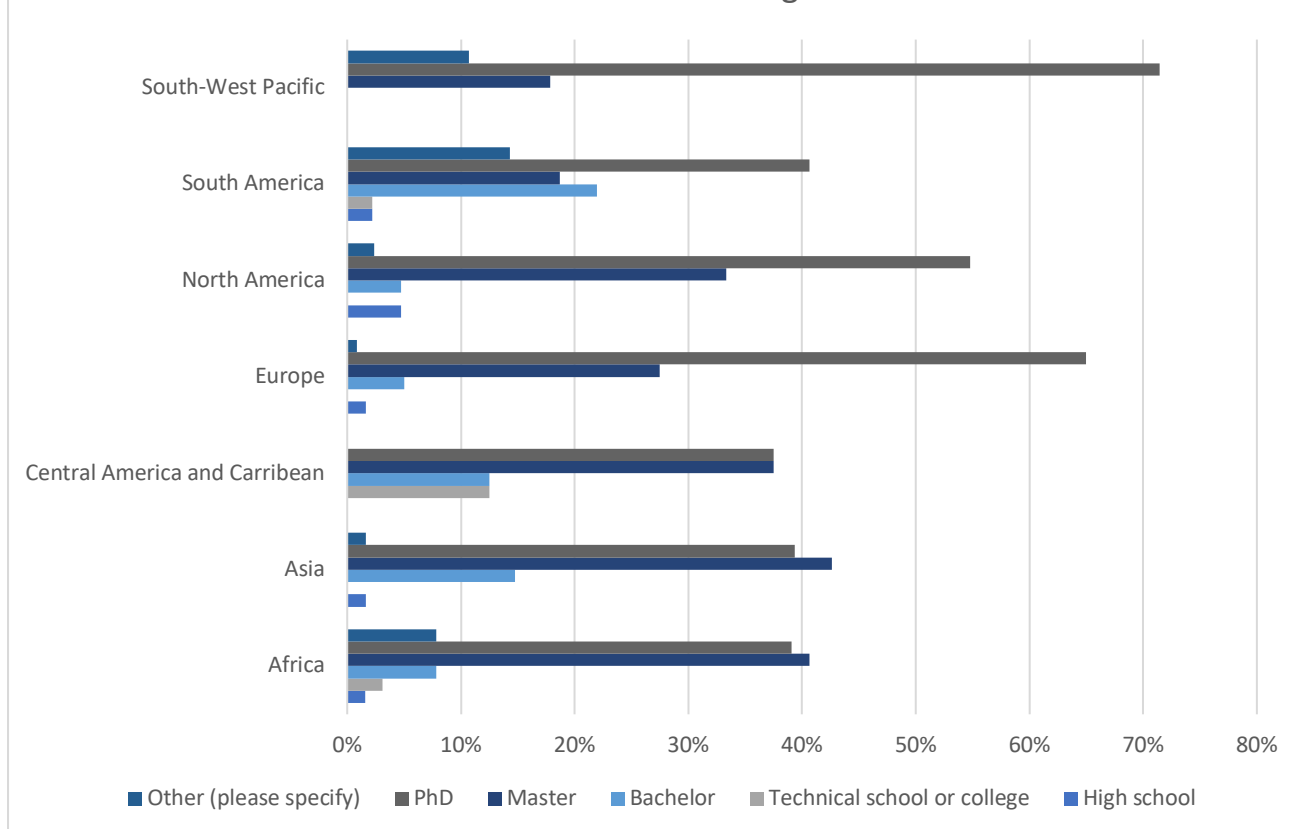
It is worth noting that WMO Governance regions contain a mix of respondents from the Global North and South (or LMIC and non-LMIC) countries:

- Africa: all Global South
- Asia: mixed; mainly Global South, with 10 out of 61 respondents from the Global North
- Central America and Caribbean: all Global South
- Europe: all Global North though Turkey (2 respondents) and Serbia (1 respondent) are LMIC
- North America: all Global North
- South America: all Global South, though a few are non-LMIC (Chile (5), Uruguay (1))
- South-West Pacific: all Global North except 1 respondent from Suriname

Highest Level of formal education by WMO Governance Region

Respondents from South-West Pacific, South America, North America and Europe all have high levels of PhD graduates. Respondents from Central America and Caribbean had an even amount of PhD and Masters as the highest level of formal education. Respondents from Asia and Africa had fewer PhDs as the highest level of formal education compared to the other regions.

Percentages of respondents' highest level of education across WMO Governance Regions



Respondents' highest level of education across regions

	Africa		Asia		Central America & Caribbean		Europe		North America		South America		South-West Pacific	
High school	1	2%	1	2%	0	0%	2	2%	2	5%	2	2%	0	0%
Technical school or college	2	3%	0	0%	1	13%	0	0%	0	0%	2	2%	0	0%
Bachelor	5	8%	9	15%	1	13%	6	5%	2	5%	20	22%	0	0%
Master	26	41%	26	43%	3	38%	33	28%	14	33%	17	19%	5	18%
PhD	25	39%	24	39%	3	38%	78	65%	23	55%	37	41%	20	71%
Other	5	8%	1	2%	0	0%	1	1%	1	2%	13	14%	3	11%

Climate science training available in respondents' countries

In terms of specific climate process-based training available in respondents' country, there were a few regional differences. For example, training on model development is more widely available in Europe than in Africa, Asia or South America.

Specific climate process-based training (in any field associated with climate) available to climate scientists and key users of technical and scientific climate information in respondents' country							
	Africa	Asia	Central America & Caribbean	Europe	North America	South America	South-West Pacific
Analysis of observations	40	37	3	64	18	55	14
Analysis of model results other than model evaluation	35	34	1	67	19	42	14
Model evaluation	26	22	1	55	22	31	14
Construction of observational research data sets	24	17	2	40	17	26	12
Model development	15	17	0	55	21	22	12
Collecting observations (in-situ, field-studies, remote-sensing, ...)	36	34	4	60	19	44	11
Development of systems for providing forecasts and projection	20	19	1	48	16	18	11
Theoretical studies	29	20	1	55	14	33	10
Verification of forecasts and projections	28	23	2	47	17	31	10
Model experimentation	14	18	0	45	15	24	10
Collection and/or analysis of paleoclimate proxy records	12	12	0	35	9	19	8
Laboratory studies	10	14	1	39	12	28	6
Not sure	4	1	2	17	4	12	6
Other	2	7	0	5	3	4	1

In terms of general training available in respondents' country, there were a few regional differences. For example, GIS was the most widely available training in Africa and South America, whereas Coding/Programming was the most available training in Europe and North America.

General training available to climate scientists and key users of technical and scientific climate information in respondents' country							
	Africa	Asia	Central America & Caribbean	Europe	North America	South America	South-West Pacific
Geographic Information Systems (GIS)	38	34	34	63	20	44	13
Graphics and data visualisation	25	20	20	58	18	35	12
Coding/Programming	24	22	22	72	23	35	16
Capacity development/exchange	30	21	21	39	11	29	11
Qualitative methods (e.g. qualitative statistics, interviewing methods, etc.)	29	28	28	52	18	28	11
Science Communication (journals, grants, proposals)	18	27	27	55	20	27	14
Governance / Policy	20	16	16	36	16	20	6

Media and outreach communication	16	13	13	49	15	17	16
Indigenous knowledge	20	11	11	14	11	16	6
Not sure	6	5	5	9	6	14	2
Other	2	3	3	4	0	1	1

In terms of training in contemporary topics available in respondents' country, training on climate change impacts was one of the most widely available training options across regions. Training on machine learning and AI was more readily available in Europe than in Africa or Asia.

Training in contemporary topics available to climate scientists and key users of technical and scientific climate information in respondents' country

	Africa	Asia	Central America & Caribbean	Europe	North America	South America	South-West Pacific
Climate change impacts	44	38	3	65	18	48	9
Climate extremes	36	33	0	54	17	36	11
Climate change adaptation	42	29	5	53	17	31	7
Climate risk	34	34	3	53	14	29	11
Climate change mitigation	36	22	4	50	19	29	8
Machine learning / Artificial intelligence	11	11	1	49	16	25	8
Air quality	19	25	3	42	19	32	7
Detection and attribution	8	12	0	32	10	6	9
Urban climatology	18	18	0	30	10	26	7
Geoengineering / Climate intervention	7	10	0	23	10	9	2
Citizen science	5	9	1	21	15	7	6
Not sure	7	3	1	16	6	16	7
Other	2	5	0	3	0	1	1

Obstacles to the provision of climate science training in respondents' countries

Financial barriers were listed highly across regions as an obstacle to the provision of climate science training in respondents' country, though its emphasis was more pronounced in Africa, Asia and South America. Technical limitations (computer capacity etc.) and internet were listed more frequently as an obstacle in Africa compares to the other regions.

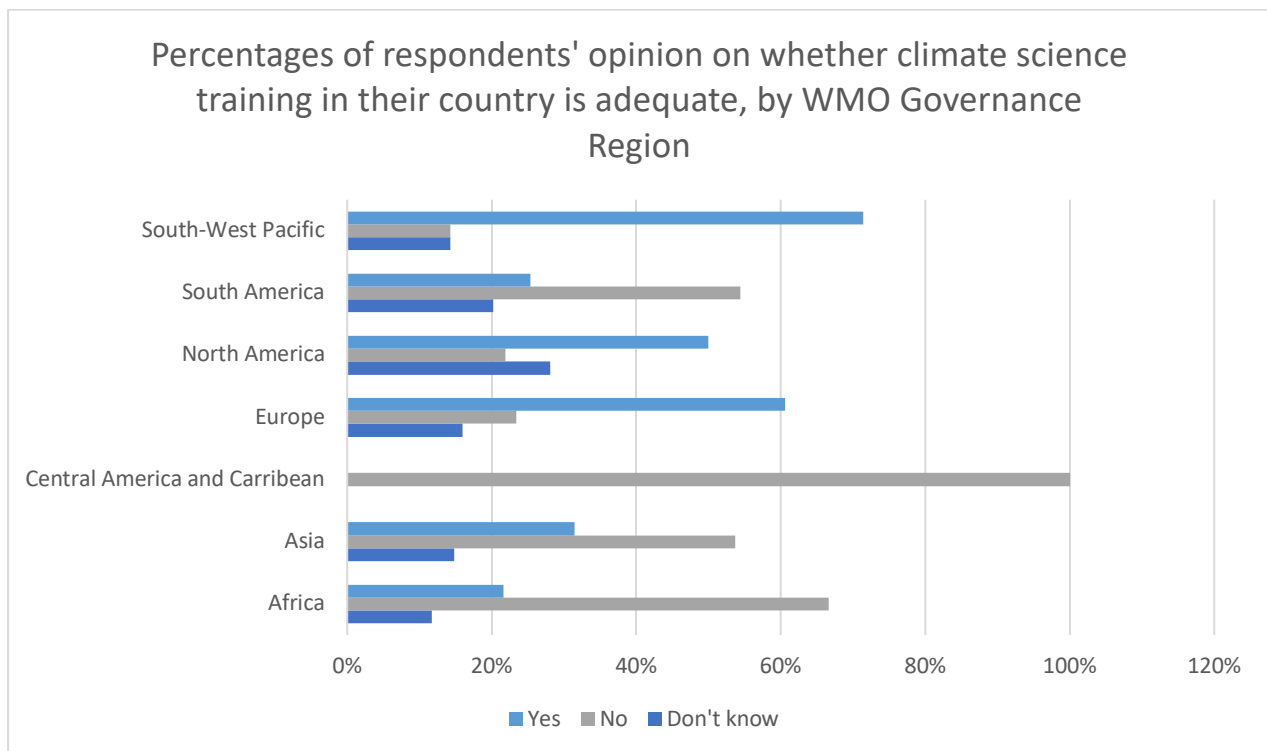
Obstacles to the provision of adequate climate science training and education in respondents' country

	Africa	Asia	Central America & Caribbean	Europe	North America	South America	South-West Pacific
Financial barriers	43	20	7	13	7	45	2
Technical limitations (computer capacity, etc.)	28	10	4	7	5	17	1
Limited internet access	26	7	1	3	2	7	0
A lack of local expertise	25	22	4	12	4	24	4

Limited face to face training available	25	11	3	12	4	9	1
Limited knowledge of available options	16	16	3	17	11	21	1
Training available but limited to formal studies	12	15	3	19	6	29	1
Training not available formally or informally	9	8	1	5	4	3	2
Limited online training available	8	14	2	11	4	16	1
Language barriers	7	10	2	11	1	19	0
Limited (or no) help for people with disabilities (physical, behavioural, learning etc.)	6	4	2	2	2	5	0
Ethnic group biases	5	6	0	2	2	2	0
No physical access to educational facilities (due to distance/transport,...)	3	4	1	5	3	7	1
Gender biases	3	4	0	3	0	1	0
Other	0	4	0	7	3	4	1

Adequacy of climate training in respondents' countries

A higher percentage of respondents from South-West Pacific, North America and Europe felt that climate science training in their country was adequate. A higher percentage of respondents from South America, Centra America and Caribbean, Asia and Africa felt that climate science training in their country was *not* adequate.



		Africa		Asia		Central America & Caribbean		Europe		North America		South America		South-West Pacific
Don't know	7	12%	8	15%	0	0%	15	16%	9	28%	16	20%	3	14%
No	40	67%	29	54%	7	100%	22	23%	7	22%	43	54%	3	14%
Yes	13	22%	17	31%	0	0%	57	61%	16	50%	20	25%	15	71%

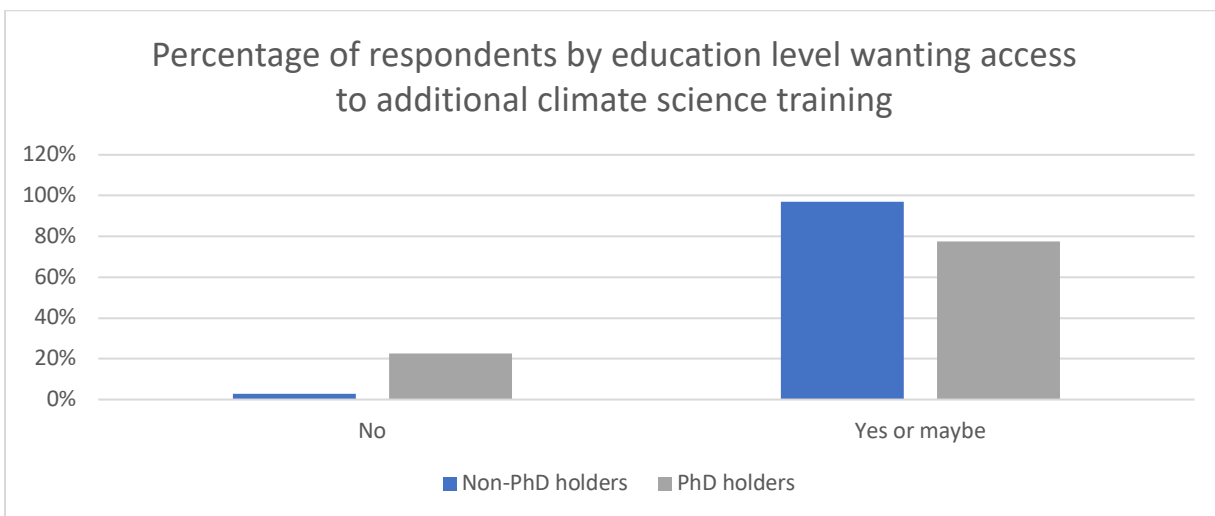
Do experiences of training and training needs differ by education level?

As roughly half of respondents had obtained their PhD (51%), it was suggested that the analysis looked at differences between those who had obtained their PhD or not.

The WCRP Academy does not intend to focus on a particular career stage as a target audience, preferring to acknowledge that climate science training is needed at multiple levels across the career stage particularly as the field develops and changes rapidly. However, these differences in between PhD-qualified and pre-PhD qualified respondents suggest differences in need and approaches that the WCRP Academy can be aware of in its marketing and promotions.

A much higher percentage of respondents who had not obtained a PhD reported that they would like access to additional climate science training (97%) compared to those who had obtained their PhD (77%).

Would you like to access additional climate science training or education?				
	Pre-PhD qualified		PhD-qualified	
No	5	3%	38	23%
Yes or maybe	167	97%	130	77%
	172	100%	168	100%



Additional training

When asked about additional climate science training or education that respondents would like to undertake, a higher percentage of respondents who had not obtained a PhD wanted further training on data gathering and management; climatology; and climate modeling. Respondents who had obtained a PhD put more emphasis on communication, engagement; policy and law, suggesting that PhD graduates are more concerned with impact and uptake of research than with developing skills for primary research.

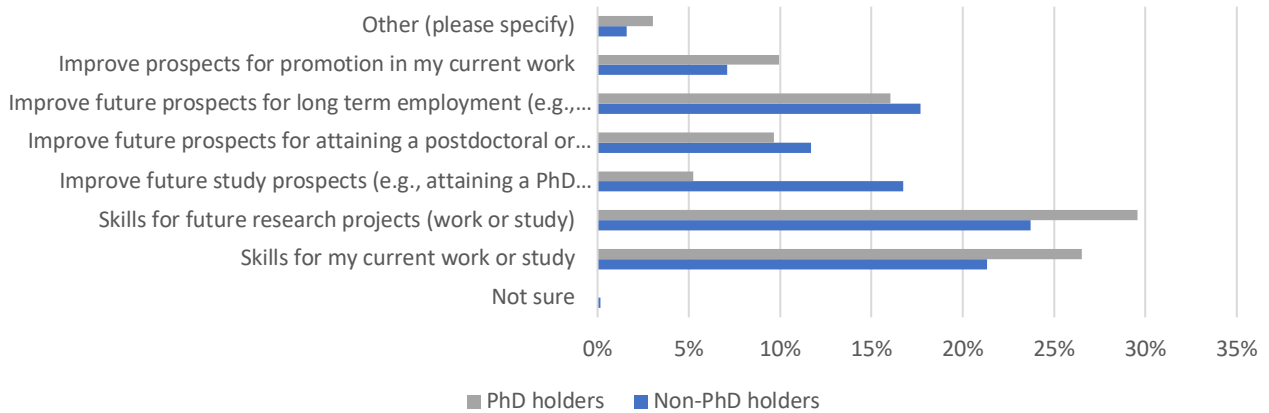
There were no notable differences in personal obstacles to obtaining additional training between PhD holders and those who hadn't obtained a PhD.

Additional climate science training or education respondents would like to undertake				
	Pre-PhD		PhD	
Observations	6	4%	4	3%
Climate modelling, forecasting, downscaling, model evaluation	58	34%	37	29%
Mitigation	12	7%	9	7%
Data gathering, management, data science, coding, data evaluation	19	11%	8	6%
Risk assessment, management	13	8%	6	5%
Impacts, sectors (ecosystems, health, agriculture, cities, rural, water)	24	14%	15	12%
Adaptation and resilience	12	7%	15	12%
Climatology, climate science, climate dynamics, ocean dynamics, climate forcings	20	12%	9	7%
Attribution	7	4%	3	2%
Communication, engagement, data visualisation	11	6%	22	17%
Citizen science	2	1%	0	0%
Statistics	9	5%	7	6%
Intro/basics of CC	6	4%	3	2%
Policy and law	9	5%	10	8%
Advanced programming, machine learning	19	11%	13	10%
Climate finance	1	1%	1	1%
GIS, remote sensing	7	4%	3	2%
Paleoclimate	3	2%	1	1%
Climate services	3	2%	2	2%
Sociology, psychology, behaviour change, education	3	2%	3	2%
Research	3	2%	2	2%
Advocacy	1	1%	0	0%
Indigenous	1	1%	0	0%

Unsurprisingly, a higher percentage of those who did not have a PhD were motivated by improving their future study prospects for attaining a PhD and scholarships. PhD graduates put more emphasis on skills for their current work or future research prospects.

Main benefits of undertaking this training or education				
	Pre-PhD		PhD	
Skills for my current work or study	135	21%	96	27%
Skills for future research projects (work or study)	150	24%	107	30%
Improve future study prospects (e.g., attaining a PhD scholarship)	106	17%	19	5%
Improve future prospects for attaining a postdoctoral or short term contract (e.g., research assistant) position	74	12%	35	10%
Improve future prospects for long term employment (e.g., academia, government or industry)	112	18%	58	16%
Improve prospects for promotion in my current work	45	7%	36	10%
Other	10	2%	11	3%
Not sure	1	0%	0	0%
	633		362	

Percentage of respondents by education level reasons for wanting further training

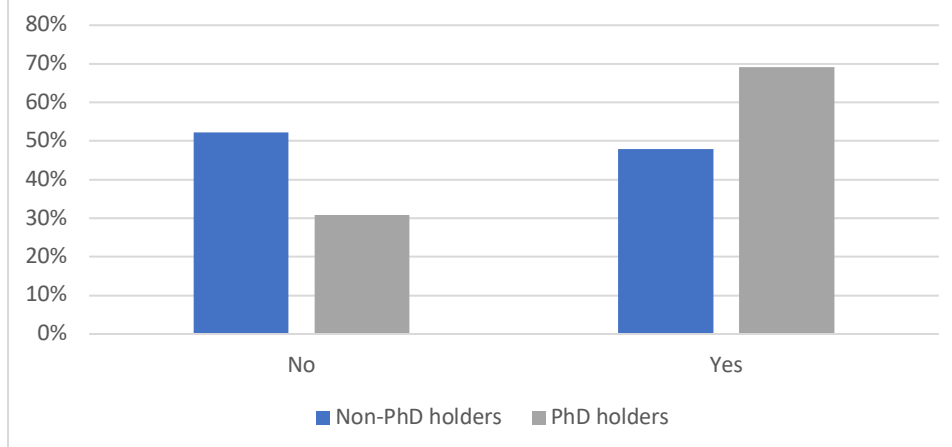


What WCRP Academy can offer

Respondents who had obtained their PhD were more aware of WCRP prior to receiving the survey, perhaps indicating their more advanced careers, networks and affiliations.

Are you familiar with the World Climate Research Programme (WCRP)?				
		Pre-PhD		PhD
No	85	52%	50	31%
Yes	78	48%	112	69%
	163	100%	162	100%

Percentage of respondents by education level who are familiar with WCRP



Pre-PhD respondents more interested in online models of practicums and internships. PhD graduates more interested in webinars by experts. But no major differences

Suggestions as to what training WCRP Academy could provide				
	Pre-PhD		PhD	
Short courses	143	20%	124	20%
Blended/hybrid learning options that encompass practical/hands-on learning (e.g., workshops on practical skills such as using sensors, fieldwork methods, etc.)	112	15%	83	14%
Seasonal schools (e.g., summer schools, winter schools)	108	15%	105	17%
Webinars by experts	105	14%	109	18%
Online lectures	101	14%	96	16%
Longer online courses such as Massive Open Online CourseS (MOOCS)	79	11%	48	8%
Online models of practicums and internships	79	11%	37	6%
Other	4	1%	4	1%

Informal training was ranked highly by both groups, but was higher for PhD holders. PhD-qualified respondents also more interested in networking. Respondents who had not obtained a PhD were more interested in listing of postgraduate courses.

Resources useful to have in the WCRP Academy web portal				
	Pre-PhD		PhD	
Informal training options (e.g., short courses, seasonal schools, workshops)	118	15%	118	19%
Internship opportunities	106	14%	72	12%
Listing of formal postgraduate training (accredited and recognised)	102	13%	60	10%
Targeted training to increase local capacity/expertise (e.g. train the trainer initiatives, lifelong learning opportunities)	99	13%	75	12%
Networking opportunities	95	12%	90	15%
Mentoring opportunities	94	12%	61	10%
Positions vacant	85	11%	69	11%
Listing of formal undergraduate training (accredited and recognised)	51	7%	42	7%
Don't know	15	2%	16	3%
Other	1	0%	3	0%

Preferred communication channels

Slightly higher preference for social media amongst pre-PhD holders, slightly higher preference for national science society mails and international community mailing lists for PhD holders – suggesting more advanced professional networks/affiliations.

Communication channels used to inform respondents about climate science training and education				
	Pre-PhD		PhD	
Websites, wikis and web portals	103	17%	99	17%
Mailing lists or notifications that I subscribe to myself (e.g, LinkedIn, UNCC)	97	16%	72	13%
International climate science community mailing lists (newsletters, alerts etc)	92	16%	107	19%
Social media channels (e.g., Facebook, Twitter)	91	15%	67	12%
My institution sends information to me by email	87	15%	75	13%
Journals and other publications	85	14%	84	15%
National science society emails	35	6%	55	10%
Other	2	0%	8	1%

4. Reflecting on survey uptake and patterns in response quality

General demographics of survey respondents

- The survey achieved a good gender balance of respondents.
- A different survey tool or approach may be needed for China (only 1 response).
- Future surveys may reach greater demographics if translated. The survey only being in English may have contributed to the predominantly advanced career stage of respondents if it was only accessible to English-speakers in countries without English as first language. For example, some open-ended responses were given in Spanish indicating preference to use first language.
- The survey was primarily responded to by advanced career stage researchers from universities / training providers. For the next survey, need a different way to attract early career responses / training seekers, most appeared to be advanced stage.

Average and median times to complete the survey

The average response time was 1 hour 36 minutes, with a range from 2 minutes (respondent did not complete) to 4 days 6 hours, which could account for the long average.

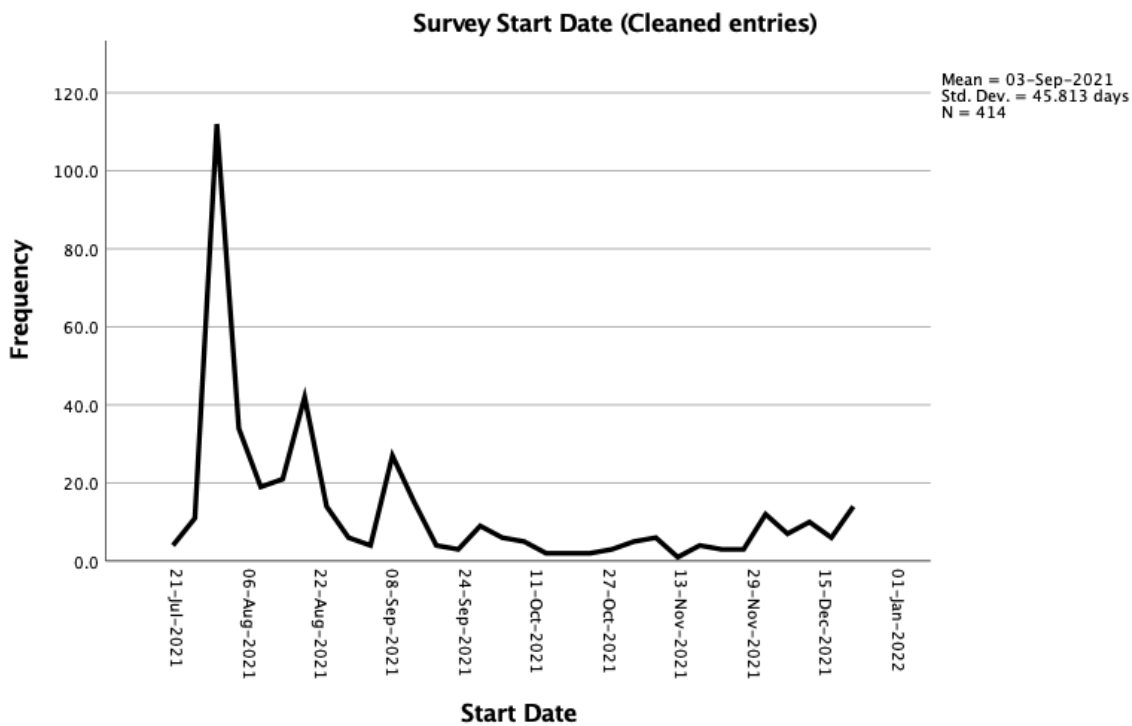
The median response time was 21 minutes, 37 seconds which seems more realistic indication of the time it takes to complete the survey.

What questions appear to have been answered poorly?

- Open-ended responses did not always address question
- 'Other' responses that could have fitted into given category / fixed response option suggests that the question or the responses were not read clearly or not understood
- There was some duplication in responses for nationality and ethnicity
- Some questions contain too many things, needing to be teased out, e.g. "Please briefly describe the training. If you received training in multiple countries, please list those countries."
- Responses dipped towards the end of the survey, e.g. Suggested names for WCRP Academy received a very low response

Patterns for survey completion

The graph below shows when the survey was responded to, with most responses coming in three waves: in late July, mid-August and mid-September. The graph reflects the 414 responses included in the analysis. The pattern for all 632 data entries follows a similar pattern of peaks of high activity.



Around a quarter of all responses were in the first week of the survey being launched.

Busiest days of survey responses		
Date	Responses	Week day
2021/07/27	10	Tues
2021/07/28	52	Wed
2021/07/29	23	Thur
2021/07/30	26	Fri
2021/08/02	15	Mon
2021/08/06	9	Fri
2021/08/09	8	Mon
2021/08/16	8	Mon
2021/08/17	16	Tues
2021/08/18	12	Wed
2021/09/08	19	Wed
2021/09/14	8	Tues
2021/11/30	9	Tues
2021/12/20	11	Mon

These peaks of survey responses were compared against these promotional activities:

- 26th July: Initial survey launch and promotion.
- WCRP social media 27/07
- International Universities Climate Alliance emailed on 28/07
- Request to take the survey was sent to WMO mailing lists 30/07/21
- 6th September: Second promotion of survey
- South America Climate Research Forum 8-9 September
- 1st November: Third and final promotion

- 14th WMO Symposium on Education and Training. 22-25 November 2021
- 26th November: Survey close

From the recorded efforts to promote the survey, the first week following the launch of the survey seems to be where the most promotion activity occurred, including circulating to WMO mailing lists, WCRP social media, and amongst the International Universities Climate Alliance.

The second promotion of the survey on 6 September generated a much smaller response, a couple of days later. The third promotion of the survey had little effect.

Of the 50 responses from Brazil, only 3 were received during 8-9 Sept at the South America Climate Research Forum; otherwise Brazilian responses followed general trend (highest number on 29 and 30 July).

These trends raise questions:

- Were there any promotion activity around 16 – 18 August, end November, 20 December?
- Is there any other reason to account for the relatively high number of responses from Brazil?

How respondents came to know about the WCRP

Most respondents reported that they have heard about the WCRP, but don't know much about it. This was closely followed by respondents having attended a WCRP-sponsored event.

There was no response option for not having heard about WCRP before this survey and so it is difficult to say how useful the survey was for making WCRP known.

How do you know the World Climate Research Programme (Select all that apply)?	
I have heard about WCRP, but don't know too much about it	87
I have attended a meeting/conference/workshop/summer school sponsored by WCRP	76
I am or have been involved in a WCRP project, Grand Challenge, Lighthouse Activity, Council, Working Group or similar	30
I am or have been a member of a scientific steering group (or equivalent) or one of the WCRP Core Projects.	14
I am or have been affiliated with a WCRP partner organisation	14
I have been funded by WCRP	10
I am or have been affiliated with one of the WCRP co-sponsors (World Meteorological Organization, International Science Council, Intergovernmental Oceanographic Commission of UNESCO)	8
I am or have been a member of the WCRP Joint Scientific Committee	6
Other	17

How was the survey rated?

Respondents rated the survey highly, with most giving it a 5 star (35.5%) or 4 star (30.4%) rating.

<p>Rating of survey (1 star means 'bad' and 5 stars means 'excellent')</p>

1	2	.5%
2	2	.5%
3	34	8.2%
4	126	30.4%
5	147	35.5%
Total	311	75.1

Comments by respondents

The final open-ended survey question, “Is there anything else you wish to comment on regarding the education and training of climate scientists?” generated a range of responses.

Most of those who commented emphasized points that they had raised in the survey about priority needs, or pointed out the training needs of other groups not targeted by the survey (e.g. the general population and government). Many of these spoke directly to where respondents felt the WCRP Academy should be focusing efforts.

Some interesting comments here included:

“‘Climate scientist’ is a term that encompasses researchers of many backgrounds, fields and skill-sets. To create a portal for everyone would require understanding of common needs (I suppose the survey helps with that...). Any training resource should focus on our technical ability as scientists. Our role is to be rigorous in our research and careful in our interpretations and communications. I worry that some groups/researchers are so eager to show a particular headline-grabbing result (“the world is burning”), that they will cherry-pick and exaggerate results. The peer-review process is supposed to counter this problem, but it is not perfect and should not be the sole weapon against bad science. Resources on “bad science and scientists”, and how they affect climate research, would be interesting! One thing that isn’t discussed often is ethical use of climate research. Scientists expand knowledge, find links, and create methods and tools. We also can provide examples of what to do with our output. For example, my work on ocean temperature forecasting will hopefully (one day...) lead to reliable early warnings of marine heat waves for aquaculture farms. At the same time, data is becoming free and easy to access for public and private use. We assume this will be used for good (e.g., an aquaculture farm checking for heatwaves during harvest). Are we being naïve here? What if the open data we produce is used for “bad”? Should we be thinking about potential nefarious uses of climate science? Anyway, if data is open access, is it even the fault of the scientists how it is used? These questions and more should be tackled... “

“Climate scientists have a huge variety of undergraduate training, which is a strength but also a challenge. As a UK trained and based scientist I feel there are gaps in my knowledge vs Americans with a more ‘grad school’ type experience and more formal training. It’s intimidating and challenging to prioritise filling knowledge gaps, e.g. learning new python packages, learning new statistical techniques. The web feels full of misinformation. I would love to see high profile, peer-reviewed community resources drawn together by experts on e.g. best practice for analysis of extremes, differences between reanalysis datasets, appropriate statistical testing for different circumstances, methods in machine learning and the available code packages to support this. As it is I tend to end up googling lecture notes from other universities and piecing together new information that way! Platforms like Coursera could be used to inspire/support some material - the data science courses there have been really valuable to me.”

“It would be great if training could be given in different languages as well as creating multilingual resources”

“More training especially to indigenous communities are important especially to my Country and other parts of the world”

“Not just a list of courses at universities, which are expensive and often impossible to take if not a student there. Instead, this should be an offering of actual short courses paid for by WCRP and free or low cost (<\$50) for participants. Even in the US, we have \$0 professional development funds from our universities, so anything has to come out of our own pocket.”

“Regarding the education and training, I would find such a resource most useful if it could be on varying levels of complexity per concept/subject/topic (basic, intermediary, advanced), I think the option of choosing a level to learn something at would help with "self-tailoring" training to suit everyone's needs. I am an ecologist by training and would like to train towards an advanced understanding of Climate Modelling, but not necessarily be an expert on other topics, just know the basics where necessary.”

Many respondents emphasized differences in developing/lower- and middle income countries, the high cost of training and further education, and the need for scholarships, funding to travel to and attend training and/or the need for free training, for example:

“It is really hard and usually impossible that students and young scientists from my country to get access to international conferences or training courses due to financial limitations. Just to give an example, the registration fees for EGU or AGU Fall meeting cost what a young scientist receive as monthly income in my country (Argentina). The funding provided by national agencies are not enough to cover any international trip.”

A few respondents showed general appreciation for the WCRP’s initiative and the survey, and looked forward to receiving feedback or survey results. A couple of respondents criticized the survey:

“Your survey is very very long.”

“The survey will be hard to analyse since it is not clear if the focus is on potential learners or potential teachers.”

5. Recommendations for WCRP Academy

Future surveys

Focus on climate science training and education

Future iterations of the survey may benefit from a narrower focus on climate science, as this is the focus of the WCRP Academy. If using the WCRP Academy definition of climate science, it may help to limit the focus of survey as such. The range of responses suggested that respondents may have used a much broader understanding of 'climate science' than the survey intended. In other words, the survey may better focus on the needs for climate science training (across multiple levels amongst researchers and practitioners), rather than the training needs of climate scientists (which appears to have been the focus or interpretation of this first survey).

Distinguish target audience: providers or participants

The survey included questions on both the provision of climate training and the needs for climate training. This was noted in one participant comment: *"The survey will be hard to analyse since it is not clear if the focus is on potential learners or potential teachers."*

Amongst the WCRP Academy team, there appeared to be some confusion as to who the survey primarily targeted. A clearer distinction in the survey between questions for training providers versus training beneficiaries may also help with promoting the survey to the target beneficiaries.

A survey focused on training providers may help to understand supply of training and information that the WCRP Academy portal may include. A survey focused on participants may help inform where there is greatest demand and hence opportunity for impact, in terms of what the portal may contain and what training could be developed by training providers.

Translation

Translating the survey into other languages besides English may help generate wider representation of responses and give a broader perspectives of training availability and gaps.

Understand outliers in country responses

It may be helpful to understand why the survey uptake was so low in China (one response) and so high in Brazil (50 responses, i.e. $\pm 12\%$ of all responses, the highest response from any country).

Caution on use of survey findings

Analyses of future surveys must be cautious of over-generalising across groups or even about drawing conclusions on the needs of global climate scientists, as the survey is not a representative sample (and possibly never can be) of 'global climate scientists'.

Re-ordering, restructuring and rewording questions for clarity and ease of analysis

As responses petered out towards the end of the survey, future versions of the survey may want to be re-ordered so that the most important questions that get to the heart of the survey are asked at the start of the survey.

Multiple choice questions (i.e. where respondents can only select one option) are easier to analyse than checkboxes (i.e. where respondents can select more than one option) as single-answers makes it easier to provide percentages of responses. For example, if one respondent selects five checkbox options and another respondent selects one checkbox option, it becomes difficult to weigh these responses.

Open-ended responses are difficult to analyse as they first need to be coded, and as they contain widely different levels of detail. However, having a few open-ended questions are useful for gauging how the survey is being understood and how questions may be adjusted in future iterations.

The wording of certain questions, if repeated, could be simplified or explained for clarity. For example,

- “Ethnicity” was interpreted widely by respondents to span race, religion, ancestry, nationality, and cultural identity. In future, ethnicity may be defined more clearly to make analysis of this question easier.
- Some questions contained more than one question which then needed to be teased out in analysis, e.g. “Please briefly describe the training. If you received training in multiple countries, please list those countries.”
- It is not clear what exactly might be included under ‘Analysis of model results other than model evaluation’, and in future surveys this response could be expanded further.
- Capacity development/exchange was ranked highly as general training area needed, but low in terms of training available. It is not clear whether respondents felt that more capacity development is needed in general, or whether training in capacity development is needed (i.e. training in the field of climate education).
- Many of the open-ended responses given by those who selected ‘Other’ suggest that respondents struggled to determine what constituted a ‘climate process-based training area’. For example, 7 of these comments related to communication and public engagement, and others pointed to inter-sectional links such as ‘climate change and health’ or ‘climate change and agriculture’.

Other questions, if repeated, could benefit from expanding in the response options. For example,

- When asked about motivation for further training, the response options given in the survey focused on personal work or advancement, yet many of those who selected ‘Other’ (13 of the 21) and provided open-ended responses gave reasons that were more altruistic. These responses focused on broader societal / environmental impact such as helping the planet, limiting the colonization of climate science, contributing as a citizen, for the benefit of society, and for more impactful research in the future, amongst others.
- Time was a common personal barrier for further training amongst those who selected “Other” and provided an open-ended explanation.

Academy website and portal

Calling the portal the ‘World Climate Science Academy’ would remove the ambiguity of the acronym WCRP, considering that 42% of respondents had not heard of WCRP before the survey. WCRP Academy may use social media and mailing lists as the primary communication channels.

This portal may start as a website that simply curates and lists known quality formal climate science programmes and upcoming WCRP-affiliated training activities, as the former do not change frequently and the latter is within WCRP’s immediate network and hence more accessible, and as there is demand for both these services. Developing and maintaining this website as a first step would give insights into the logistics and hence costs of a larger web portal, and hence inform a business plan for the portal.

In displaying training and formal education options on the website, these details could be made clear as these appear to be potential barriers or preferences from respondents:

- Cost and scholarship opportunities
- Online or availability of travel funds if in-person
- Clear learning outcomes
- Clear level / expected prior learning

As the biggest demand is for listing more informal training options, yet these are by nature difficult to find information for online, WCRP Academy may build up to a model that captures and curates these efficiently. For example, by developing criteria for inclusion on the portal and circulating requests to various climate science training providers for short courses, informal training, and online training. New listings of upcoming training could be entered into a form on the portal and received listings may then be vetted either directly by WCRP staff or by consultants using the criteria developed. These criteria may include the availability of travel funds or reduced fees for those from the global South; and a clear indication of learning outcomes, training level, and background training required. In this way, the World Climate Science Academy may build a reputation for displaying up-to-date climate science training options that have been checked for quality.

The portal may also over time build up a repository of recordings of online training or webinars by experts that have been vetted by WCRP staff or consultants using criteria for quality.

Over time, the portal may seek to include a balance of:

- A range of levels as there is demand for climate science training from beginner to expert levels
- Online, face to face and blended listings
- Lists of formal qualifications as well as informal training options
- Webinars by expert speakers
- Recommended resources by experts

The WCRP Academy could be a value-addition to its network of training providers by growing a database of training attendees, promoting events to a wider global mailing list and social media followers, by storing and displaying event recordings, and by building a database of past training offered.

Annexes:

Data Analysis Plan

Between July to end November 2021 an online survey was circulated to climate scientists across the world by the World Climate Research Programme (WCRP) Academy. The resulting dataset includes 632 entries (including duplicated, blank entries and tests) which must be cleaned and analysed to help the WCRP Academy understand and respond to global climate science training needs.

This document outlines guiding research questions and methodology for analysing the dataset.

Research Questions

1. Understanding Demand and Supply of Global Climate Science Training Opportunities:

- 1.1. What climate science training opportunities are there across the globe?
 - a. Where are there the most/least climate science training opportunities?
 - b. What languages are climate science training opportunities offered in?
 - c. What training is offered by different types of employers?
 - d. What topics are most covered in climate science training?
- 1.2. What shortfalls are there in climate science training opportunities?
 - a. Is the training available seen as adequate?
 - b. What general barriers are there to accessing climate science training?
 - c. What personal barriers to respondents face in accessing climate science training?
- 1.3. What need is there for new climate science training opportunities?
 - a. What climate-science training areas are considered most valuable at present?
 - b. What topics do respondents need further climate science training in?
 - c. What formats (e.g. online, practical, etc.) are preferred for climate science training?
- 1.4. Do experiences of training and training needs differ by:
 - a. Gender
 - b. Region currently living in
 - a. WCRP governance areas
 - b. LMICs
- 1.5. What can the WCRP Academy offer?
 - a. Links to specific training for WCRP Academy Marketplace
 - b. Suggestions for training offered by WCRP
 - c. Suggestions for resources on the web portal
 - d. Suggestions for name of web portal

2. Reflecting on survey uptake:

- 2.1. Which is a more relevant response: country currently living in, or nationality?
- 2.2. Who answered the survey? And hence, who did not answer the survey?
 - a. Regional and country gaps
 - b. Ethnic backgrounds
 - c. Occupational status
 - d. Highest degree
 - e. Gender

- f. Sector
- g. Year of highest degree as proxy indicator for age
- 2.3. What questions appear to have been answered poorly?
 - a. Point of highest drop-out of survey
 - b. Most skipped question/s
 - c. Most 'jumbled' answer/s
 - d. Repetitive questions / answers
- 2.4. Identify patterns for survey completion, linked to the promotion of the survey
- 2.5. How did respondents come to know about the WCRP Academy?
- 2.6. How was the survey rated?
 - a. Comments by participants in final open-ended questions

3. Other useful information

- 3.1. Email addresses of all respondents
- 3.2. Email addresses of respondents wishing to be contacted further by WCRP Academy
- 3.3. Weblinks to useful training and portals
- 3.4. Email addresses of climate science training opportunities

These research questions are matched against survey responses in the Annex at the end of this document.

Methods

Cleaning and categorising the data

The survey results will first be cleaned. Though 632 survey entries were provided in the dataset, test entries (entries made prior to 2021/07/20 14:07:00), insufficient entries (where the respondent did not proceed far enough to answer useful questions), and duplicates must be removed (most recent or complete duplicate entry kept).

Thereafter an initial screening of open-ended questions will be made to see if responses can be categorized and analysed, or if these responses are only useful for further descriptive information. This applies to questions such as, "Please briefly describe the training. If you received training in multiple countries, please list those countries."

Analysing the data

The cleaned and categorized dataset will be analyzed using Excel and SPSS. Responses for this full dataset will be summarized. Thereafter, statistical significance will be checked for research question 1.4. (whether key responses differ by demographic groups) i.e., selected good quality and relevant survey responses will be disaggregated, by:

- a. Gender
- b. Region currently living in

These disaggregated data will be checked for significant difference (using Pearson Chi Square or ANOVA) for key experiences (e.g. highest degree) and needs of climate science training.

Timeline for analysis

Preliminary survey findings will be presented at WCRP Academy meetings and any further requests for deeper analysis of the data incorporated into the data analysis plan.

A final report of the analysis with publication-ready figures will be circulated to the WCRP Academy by May. In addition, the analysis will consider the needs of upcoming workshops / conferences where survey data will be presented (see workshop lost below).

List of survey questions

1. First Name
2. Last Name
3. Email address
4. Gender
5. What country do you live in currently?
6. What nationality or nationalities do you hold?
7. Please describe your ethnic/ancestral background (e.g., European, African-American, ...). If you prefer not to say, then you can skip this question. We ask this question because we want to ensure that the Academy is inclusive and that we hear what is needed from many different voices.
8. What is your highest level of formal education (Select only one)
9. In what country did you undertake your highest level of formal education
10. What was the main language that your highest level of formal education was taught in?
11. In what year did you gain your highest level of formal education?
12. Have you had any formal or informal climate science training (e.g. short courses, workshops, graduate diploma etc.) since your highest level of formal education?
13. Please briefly describe the training. If you received training in multiple countries, please list those countries.
14. What was the main language that this training was taught in?
15. In what country did most of this training occur?
16. Are you currently... (Select all that apply)
17. Are you affiliated with a... (Select all that apply)
18. Does the institution/company/organization that you are affiliated with provide any climate science training or education?
19. What level of climate science training or education does the institution /company/ organization that you are affiliated with provide (Select all that apply)?
20. Enter up to five key climate science topics that the institution/company/organization that you are affiliated with covers in their training or education? (eg. Geophysical fluid dynamics, climate modelling, urban climatology). (Enter at least one science topic)
21. If possible, please provide a weblink (or weblinks) or information on how to access this training or education.
22. If possible, please provide the email address of a contact person whom we could talk to about including this training or education in the WCRP Academy Portal.
23. What specific climate process-based training (in any field associated with climate) is, to your knowledge, available to climate scientists and key users of technical and scientific climate information in the city/country that you live in (Select all that apply)?
24. What general training is, to your knowledge, available to climate scientists and key users of technical and scientific climate information in the city/country that you live in (Select all that apply)?
25. What training in contemporary topics is, to your knowledge, available to climate scientists and key users of technical and scientific climate information in the city/country that you live in (Select all that apply)?
26. In your opinion, is the climate science training and education available in your country adequate to allow researchers to work effectively on climate change science and associated fields?

27. Please select up to 5 important obstacles to the provision of adequate climate science training and education in your country.
28. Are you aware of other countries (not where you currently live, study or work) where access to climate science training and education is limited?
29. Would you like to access additional climate science training or education?
30. What additional climate science training or education would you like to undertake now or in the future?
31. What are the main benefits of undertaking this training or education (Select all that apply)?
32. What are the most important obstacles to you accessing this training or education? Select up to 5 training choices that you think are most important.
33. Would you like to comment on what you think are the main priorities for climate science training and education?
34. What are the most important climate process-based training areas (in any field associated with climate) that climate scientists need to address current climate science challenges and emerging challenges (Select up to 5 training choices that you think are most important)?
35. What are the most important general training areas that climate scientists need to address current climate science challenges and emerging challenges (Select up to 5 training choices that you think are most important)?
36. What are the most important contemporary training topics that climate scientists need to address current climate science challenges and emerging challenges (Select up to 5 training choices that you think are most important)?
37. What communication channels do you use in order to inform yourself about climate science training and education (Select all that apply)?
38. For your current career level and time commitments, do you prefer face-to-face training or online training for short courses, workshops, and professional development?
39. Do you have one or more favorite websites or web portals for online training and education?
40. Can you please provide the URL(s) of your favourite training and education websites or portals?
41. Do you have suggestions as to what training you would like to see WCRP Academy provide (Select all that apply)?
42. What resources would you find useful to have in the WCRP Academy web portal (Select all that apply)?
43. Are you familiar with the World Climate Research Programme (WCRP)?
44. How do you know the World Climate Research Programme (Select all that apply)?
45. Given that the goal of the WCRP Academy is to inform on climate science training, what name would you suggest for the branding and marketing of the Academy to an international audience (Select only one)?
46. Would you be interested in being contacted by the WCRP Academy as we develop this activity? This may include adding training that you are aware of to the portal, helping to address training gaps, co-designing educational resources for diversity, web portal functionality, marketing and branding, funding and sponsorship, or working with us to make this all happen.
47. Please leave your comments here on how you would like to be involved (If you did not enter your name and email address at the beginning of this survey you can enter it here or email us on wcrp-academy@wcrp-climate.org)
48. Is there anything else you wish to comment on regarding the education and training of climate scientists?

49. Thank you so much for completing this survey. Please rate this survey (1 star means 'bad' and 5 stars means 'excellent').

List of all countries in which respondents currently live

	Frequenc y	Percen t
Brazil	50	12.1
United Kingdom	35	8.5
United States	35	8.5
Australia	24	5.8
Germany	22	5.3
India	21	5.1
Nigeria	20	4.8
Argentina	14	3.4
Peru	14	3.4
Norway	11	2.7
France	10	2.4
Bangladesh	9	2.2
Italy	8	1.9
South Africa	7	1.7
Canada	6	1.4
Colombia	6	1.4
Japan	6	1.4
Austria	5	1.2
Chile	5	1.2
Kenya	5	1.2
Senegal	5	1.2
Cameroon	4	1.0
Ecuador	4	1.0
Switzerland	4	1.0
Ethiopia	3	.7
Ghana	3	.7
Hungary	3	.7
Indonesia	3	.7
Iran	3	.7
Korea, South	3	.7
Philippines	3	.7
Zimbabwe	3	.7
Belarus	2	.5
Denmark	2	.5
France, Metropolitan	2	.5
Greece	2	.5
Netherlands	2	.5
New Zealand	2	.5
Russia	2	.5

Rwanda	2	.5
Spain	2	.5
Tanzania	2	.5
Thailand	2	.5
Turkey	2	.5
Uganda	2	.5
Afghanistan	1	.2
Albania	1	.2
Algeria	1	.2
American Samoa	1	.2
Angola	1	.2
Bahrain	1	.2
Belgium	1	.2
Burma	1	.2
China	1	.2
Costa Rica	1	.2
Cyprus	1	.2
Dominican Republic	1	.2
Guinea-Bissau	1	.2
Guyana	1	.2
Hong Kong (SAR China)	1	.2
Israel	1	.2
Jordan	1	.2
Madagascar	1	.2
Malaysia	1	.2
Mozambique	1	.2
Nepal	1	.2
Niger	1	.2
Paraguay	1	.2
Portugal	1	.2
Serbia	1	.2
Suriname	1	.2
Svalbard	1	.2
Swaziland	1	.2
Sweden	1	.2
Tajikistan	1	.2
Tunisia	1	.2
United Arab Emirates	1	.2
Uruguay	1	.2
Zambia	1	.2
Total	414	100.0

