Leveraging Field-Campaign Networks to Identify Sexual Harassment in Atmospheric Science and Pilot Promising Interventions

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Abstract

Sexual harassment in field settings brings unique challenges for prevention and response, as field research occurs outside "typical" workplaces, often in remote locations that create additional safety concerns and new team dynamics. We report on a project that has 1) trained field project participants to recognize, report, and confront sexual harassment, and 2) investigated the perceptions, attitudes, and experiences of field researchers regarding sexual harassment. Pre-campaign surveys from four major, multi-institutional, domestic and international field projects indicate that the majority of sexual harassment reported prior to the field campaigns was hostile work environment harassment, and women were more likely to be the recipients, on average reporting 2-3 incidents each. The majority of those disclosing harassment indicated that they coped with past experiences by avoiding their harasser or downplaying incidents. Of the incidences reported (47) in post-campaign surveys of the four field teams, all fell under the category of hostile work environment and included incidents of verbal, visual, and physical harassment. Women's harassment experiences were perpetrated by men 100% of the time, and the majority of the perpetrators were in more senior positions than the victims. Men's harassment experiences were perpetrated by a mix of women and men, and the majority came from those at the same position of seniority. Post-project surveys indicate that the training programs (taking place before the field projects) helped participants come away with more positive than negative emotions and perceptions of the training, the leadership, and their overall experiences on the field campaign.

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Capsule

This article raises awareness of sexual harassment within the AMS community, and it provides critical research findings previously absent on this important topic in our community.

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Body Text

Introduction

There are national efforts to identify, research, and address sexual harassment in STEM (National Academies of Sciences, Engineering and Medicine 2018). In addition to being unethical and causing mental and physical harm, harassment jeopardizes the existence of diverse, diligent, and creative teams needed to collaboratively solve challenging problems (Bear et al. 2011; Campbell et al. 2013). Although sexual harassment can be perpetrated by anyone and toward anyone, it is overwhelmingly perpetrated by men toward women, especially women of color, and toward people who identify as LGBTQIA, particularly in traditionally male-dominated domains (Antecol et al. 2001; Willness et al. 2007). Along with discrimination and bias, sexual harassment has been identified as driver contributing to the failture to retain women in STEM (National Academies of Sciences, Engineering and Medicine, 2020) and a barrier to diverse representation in the geosciences (Marín-Spiotta et al. 2020). This issue is particularly germane to the atmospheric science community as it is one of the least diverse scientific fields within STEM (Bernard and Cooperdock, 2018).

Field-based research, education, and outreach are central to scholarship in atmospheric science, and these activities encompass aircraft, ship, and mobile deployments, as well as observations at fixed locations, among others. While sexual harassment has been studied fairly extensively in workplaces (e.g., Chan et al. (2008); Pew Research Center (2018)) including in academia (Bondestam et al. 2020), less research has focused on sexual harassment in field settings (for exceptions see Clancy et al. (2014); Hanson et al. (2019); Nelson et al. (2017)). These settings are unique because they occur outside of "normal" work (e.g., offices or 9:5 hours), and they are often stressful due to the short time and resource windows in which

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important project goals can be achieved. Field work can involve extended working hours, reduced privacy and ability to retreat from social/work interactions, and can feel less formal than a typical workspace, which may create the perception that behaviors that would otherwise be deemed inappropriate are permissible. The remoteness of many field sites (e.g., Wadman (2017)) can bring an additional level of safety concerns with unknown risks and inaccessibility to support networks and familiar resources. Finally, interactions with other people in the field can also create unsafe environments through manifestations of sexism, racism, transphobia, homophobia, and xenophobia (Pickrell 2020). The emerging literature on experiences of sexual harassment in field settings indicates that sexual harassment policies are not typically communicated or enforced, that harassment is common, particularly toward junior women by senior men, and that targets of harassment are often unaware of reporting mechanisms (Clancy et al. 2014; Nelson et al. 2017).

Major field research campaigns are often carried out by large and collaborative multi-institutional teams; such networks can take years to establish, and they can lead to enduring and productive science collaborations. Field research often results in high-impact scholarship and networking that launches careers (Evans et al. 2012; Rauber et al. 2007). Hence, the stakes for early-career atmospheric scientists to be successful when participating in field campaigns, including high-impact scholarship and publications, networking, and leadership training, are particularly high (Evans et al. 2012). Individuals from marginalized groups are particularly vulnerable in field settings (Jenkins et al. 2010; Morris et al. 2012) and the intersection of early career scientists from marginalized groups is especially important in our discussion on this topic. In addition, when students are given the opportunity to participate in hands-on research, many students rapidly expand their interest in research (Dahlberg et al. 2008), and field experiences

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can increase participation of underrepresented and underserved students (Beltran et al. 2020). Reflecting the career benefits of participating in field work in atmospheric science (Evans et al. 2012; Rauber et al. 2007), new programs intentionally include underrepresented students in field campaigns (Rasmussen et al. in review). Thus, to support and encourage students and early-career scientists to continue to participate and become future leaders in atmospheric science, including leading field campaigns, our community needs to intentionally examine how experiences in the field affect retention and career advancement.

It is important to ensure the safety of all participants in field campaigns, particularly for those at greater risk of harassment. At the same time, large connected networks have unique potential to facilitate cultural change (Mohrman et al. 2003), and hence field campaign teams are promising foci for intervention within the atmospheric science community.

For these reasons, we implemented an NSF-sponsored project to understand and address issues of sexual harassment in field campaign settings. With the overarching goal of motivating atmospheric science field campaign teams to address sexual harassment, the specific aims of our project were to:

1. Train participants in major field campaign networks to recognize, report, and confront present and future situations of sexual harassment;
2. Investigate the perceptions, attitudes, behaviors, and experiences of atmospheric science field researchers regarding sexual harassment;
3. Build multi-institutional networks of proactive scientists and campaign leaders, including men, that are invested in combating gender inequality.

Methods

Participating Field Campaigns

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Our project targeted the large inter-agency and inter-community networks supporting four major field campaigns. These were the 2018 Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption, and Nitrogen (WE-CAN) (NCAR/UCAR 2020c), the 2018-2019 Remote sensing of Electrification, Lightning, And Mesoscale/microscale Processes with Adaptive Ground Observations (RELAMPAGO) (NCAR/UCAR 2020b), the 2019 Chequamegon Heterogeneous Ecosystem Energy-balance Study Enabled by a High-density Extensive Array of Detectors (CHEESEHEAD) (NCAR/UCAR 2020a), and the 2019 Fire Influence on Regional to Global Environments and Air Quality (FIREX-AQ) (NOAA/NASA 2020) campaigns. The WE-CAN (22 July - 14 September 2018) and FIREX-AQ (22 July - 19 August 2019) field campaigns were both headquartered at the Boise, ID airport, but some team members occasionally spent nights in other western U.S. locations as flight operations required. FIREX-AQ (19 August – 5 September) also headquartered at the Salina, KS airport. As is standard for aircraft campaigns, there were extensive instrument integration and test transit flight periods ahead of the main field campaign periods. Integration and test flights for these campaigns either occurred in Broomfield, CO or Palmdale, CA. RELAMPAGO (1 June 2018 - 30 April 2019) took place in west central Argentina; most field campaign participants stayed in Villa Carlos Paz near Córdoba, Argentina, and the intensive observing period ran 1 November - 17 December 2018. CHEESEHEAD was centered just east of the small city of Park Falls, WI, and this field intensive extended from late June through early October 2019. In all cases, field campaign participants stayed in towns/cities in hotels or short-term rentals.

Program Implementation: Training and Survey

Our procedure for engaging, training, and surveying field researchers and staff was similar across the four campaigns. Approximately one month before the start of each field campaign, all

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158 personnel in each field campaign network were asked to participate in a confidential survey. All
159 methodological details can be found in Part A of the Supplemental Materials. Briefly, participants
160 were asked about their perceptions and attitudes about sexual harassment, past engagement with
161 and/or experience of harassment behaviors, knowledge about reporting mechanisms, and
162 expectations for safety and equity at field sites. Everyone from the four field projects (N = 517) was
163 emailed the pre- and post-training survey. After dropping duplicant participants in multiple field
164 campaigns, those integral to the current project, and those who did not seriously participate[1], we
165 analyzed the data from 451 participants. The average completion rate for both surveys was 54.5%,
166 and we estimate that the proportion of women to men participants was similar to that among the
167 field teams. Thus, we report survey response data from 265 participants who completed the pre-
168 campaign survey (92 women, 166 men, 7 who identified another gender identity or did not specify[2])
169 and 246 participants in the post-campaign survey (89 women, 140 men, 17 who identified another
170 gender identity or did not answer), 186 of whom also completed the pre-survey.[3] Multiple steps
171 were taken to protect participants' data privacy, including de-identifying all data, screening
172 responses for potential identifying information (e.g., reports of harassment, being a member of a
173 very small minority group), and not allowing access to any individual data beyond the second
174 author, who is not a member of the Atmospheric Science community. In addition, the participants
175 had the option of reporting experiences of or engagement in sexual harassment in a separate,
176 completely anonymous survey, although this option was not used by any participants.

[1] See Supplemental Materials Part A for more information

[2] Although we believe it is very important for the geoscience community to recognize and examine the experiences of transgender and gender-nonconforming members, we do not have enough participants in this study to report the perceptions and experiences of those who identified outside of "woman" or "man" to form a statistically large enough or unidentifiable group and thus risk loss of anonymity. Thus, we only report aggregate responses for participants who identified as "woman" or "man" here.

[3] Race/ethnicity was not included as a variable as the low number of non-white participants would risk anonymity.

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177 At the start of each of the field programs we implemented a bystander intervention training
178 to teach each team to recognize, report, and respond to situations of sexual harassment. Bystander
179 intervention is an emerging area of prevention that may build a sense of collective responsibility
180 (see Quick et al. (2017) and references within). The training was implemented by different
181 instructors for each campaign, and included leadership (PIs and/or Co-PIs) for each campaign.
182 While participation in the training was not strictly mandatory, it was strongly encouraged, and
183 campaign leadership noted that most field campaign participants did participate. More details on
184 participation can be found in Part A of the Supplemental Materials.
185 The training materials were developed by the ADVANCEGeo Partnership, an NSF-
186 funded project dedicated to improving diversity in the geoscience workforce by improving
187 workplace climate, including in field settings (ADVANCEGeo 2020; Marín-Spiotta et al. 2020;
188 Marín-Spiotta et al. in review). ADVANCEGeo is a large project with goals that include collecting
189 data on workplace experiences across the earth and space sciences, developing and testing a
190 bystander intervention training, and creating partnerships with scientific societies. Our project
191 represents a collaboration with ADVANCEGeo; our four field teams were some of the first groups
192 used to pilot the ADVANCEGeo interactive workshops.
193 The training was framed around personal knowledge and skills development, rather than
194 litigation risk mitigation. The core of the material used in each training was the same, but some
195 aspects of the training did evolve over the time period of these campaigns based on responses to the
196 training by prior audiences (including, but not limited to, the four field campaign teams). For each
197 ~2-hour training session a lecture portion defined harassment, provided examples of types of sexual
198 harassment, included information on the prevalence of sexual harassment in different STEM
199 settings, discussed challenges of fieldwork settings, and introduced bystander intervention skills.

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Workshop facilitators also discussed misconceptions about harassment, provided an overview of the harm caused by this type of behavior, discussed the role of intersectionality in affecting experiences of people with different identities, and shared strategies for intervention. Small groups were presented with real-world scenarios based in field campaign settings, and then identified and debated problematic behavior and options for interventions. Finally, the large group reconvened and responses to the scenarios were shared.

As mentioned above, the training was modified over the course of the project. After the first training session (carried out for the WE-CAN team), an external expert (Yarbrough Group 2020) was engaged to add additional materials on building high-performance teams - a group of people who share a common vision, goals, metrics and who collaborate, challenge and hold each other accountable to achieve outstanding results (Center for Organizational Design, 2020). These materials were delivered to the RELAMPAGO team alongside the ADVANCEGeo training materials. This addition framed preventing harassment as one part of building a safe and inclusive team environment. The last training session (FIREX-AQ) included an additional self-reflection exercise to encourage participants to think about how their identity shapes their experiences in the workplace and field environments.

In addition to the training, three of the four field programs created and posted clear, unified codes of conduct on their respective websites. These documents were easily accessible, but not necessarily accessed by participants. Setting and sharing standards of behavior and sanctions for disrespect has been identified as a promising practice for preventing harassment (National Academies of Sciences, Engineering, and Medicine, 2020), including in field settings, where availability of a code of conduct with clearly defined procedures has been associated with positive field experiences (Nelson et al. 2017).

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Following the completion of each field program, research personnel were invited to participate in an anonymous post-campaign survey. Some questions from the pre-campaign survey were repeated in the post-campaign survey, in addition this survey included questions about experiences of sexual harassment during the field campaign and participants' impressions of the training.

Results and Discussion: Sexual Harassment In Our Community

The following results were derived from applying standard social science statistical analyses to the data (e.g., correlations, ANOVAs, multiple regressions), and the descriptions of the findings below are all based on meeting the threshold of standard statistical significance testing in the social sciences at $\alpha < .05$. A detailed description of the statistical analyses and values for each conclusion can be found in Supplemental Materials Part B.

Pre-Campaign Findings Related to Harassment

Our pre-campaign survey asked members of the field teams whether they had "ever been sexually harassed at work." In response, almost half (42%) of the women reported that it had happened at least once, while 92% of men reported never having been sexually harassed at work. A follow-up question asked whether participants "ever (at any time) experienced any of the following situations at work? (Including during any time or activities related to your work)" and listed 26 specific behaviors that have been identified as forms of sexual harassment, which we categorized based on two tiers. Tier 1 indicates whether the behavior is hostile work environment versus quid-pro-quo harassment, and Tier 2 indicates a specific type of harassment (verbal, visual, or physical harassment, or physical assault). See Table S2 for all specific items and their categorical coding. The average number of specific types of experiences reported by women and men are summarized in Figure 1. When asked about these specific behaviors, the percentage of women and men that

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reported sexual harassment increased, which may be due in part to their reluctance to label specific events as harrassment (Magley et al. 1999). The overwhelming majority (432 incidences out of 463 total reported incidences) of sexual harassment reported prior to the field campaigns was hostile work environment harassment, and women were more likely to be the recipients, on average reporting 2-3 incidents each. In response to the second, more specific question about types of experiences, the majority (52%) of all women surveyed reported experiencing some type of physical harassment at work in the past. Almost one third (30%) of women had experienced quid-pro-quo sexual harassment in the past (compared to only 5% of men), and approximately 15% of women and 11% of men had experienced a form of physical assault. The vast majority (> 80%) of past harassment disclosed in the survey went unreported (for statistical analyses, see Part B of the Supplemental Materials). Of those disclosing harassment, participants indicated that on average about 59% of the time they coped with past experiences by avoiding their harasser or downplaying incidents. Only 35% of women and 17% of men who disclosed harassment indicated that at least one instance was confronted (e.g., reported to someone in a supervisory position or asked the harasser to stop).

Post-Campaign Findings Related to Harassment

The post-campaign surveys revealed a range of inappropriate behaviors that occurred during the field projects studied here (Figure 2). There were 47 incidences of harassment behavior reported in the post-campaign surveys by 30 members of the four field teams (approximately 12% of survey respondents), and all of them fell into the "hostile work environment" category. The most commonly reported behaviors in this category included another person intentionally putting their hands on the participant's body, using obscene or abusive language, and making sexual jokes or comments. A small number of women reported experiencing behaviors such as unwanted sexual

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looks and gestures, such as kissing sounds, howling or whistling being directed at them and/or being called names like "honey" multiple times. The total number of participants who reported these behaviors is listed in Table S2. Open-ended comments indicated that all of the experiences involving kissing sounds/howling/whistling were perpetrated by men unaffiliated with the research teams. Men were more likely than women (6% versus 2%) to report obscene or abusive language (although it was not specified toward whom the language was directed) and were equally as likely as women (about 1 % each) to report hearing sexual comments about their clothing, anatomy, or looks, and to be asked personal questions about their sexual life. In exploring the interaction effects of the participants' gender and seniority, we found that women in trainee positions (e.g., graduate or undergraduate students or post-docs) specifically experienced significantly more hostile work environment, verbal, and visual harassment than any other group (i.e., more than senior women, trainee men, or senior men). Open-ended comments indicated that the majority of these instances occurred in a general setting or toward a group, rather than directed at an individual. For instance, one participant wrote "[A] senior participant made several (mild) but somewhat uncomfortable sexual references/jokes to our small group. I don't believe [the senior participant] had any intent to offend anyone or make anyone feel uncomfortable, but it was still awkward for the rest of us." This comment is an important reminder that impact, not intent, is what matters.

In general, when asked about the gender of the perpetrator(s) of the harassment and whether those individuals were in a more senior or junior position to the target, women and men had very different experiences. Similar to Clancy et al. (2014), women's experiences were perpetrated by men 100% of the time (Figure 3), with the majority of perpetrators (58%) being in a more senior position (Figure 3). Men's experiences were perpetrated by a mix of 15% women and 60% men (men did not identify the gender of the perpetrator in 25% of cases), with the majority (61%)

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perpetrated by individuals at the same level/position as the participant (Figure 3). Interestingly, we found that both women and men trainees' experiences of harassment showed similar patterns to women's experiences based on the seniority of the perpetrator. The majority of trainee participants' harassment came from someone more senior (57%), while the majority of senior participants' harassment came from someone at the same level (60%). However, when it came to the gender of the perpetrator, the seniority of the participant was not a differentiating factor (i.e., trainee men and senior men had similar experiences regarding the gender of the perpetrator, and trainee women and senior women had similar experiences regarding the gender of the perpetrator).

We also asked participants whether they observed any instances of sexual harassment by or toward others because research has shown that people may not label or recognize harassment when it is happening to them (Magley et al. 1999). We received fewer reports of observations of harassment compared to the number of experiences of harassment, and do not know the degree to which reported and observed incidents overlap. However, one egregious instance of inappropriate physical contact was disclosed by an observer and was not reported directly by someone as experiencing the incident. The survey respondent indicated that while they intervened in the situation, offered help to the victim, and sought advice from colleagues, no official report was filed.

This survey data show that sexual harassment continues to be a serious problem for students and early-career researchers in atmospheric science. We found that on the pre-campaign survey, 63% of trainee participants communicated that they had already experienced some form of harassment during their career. During our field campaigns, 24% of junior-level participants disclosed experiencing some form of sexual harassment, while only 9% of more senior-level participants disclosed such experiences during the field campaigns.

Post-Campaign Findings Related to Preventing Harassment

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Research on sexual harassment training applied to field campaign settings is very limited, and our study design allows us to make a unique contribution to this sparse body of knowledge. We found that those who attended the training agreed, on average, that it provided them with helpful resources to address harassment, helped them know what to do if harassment happened to them or others, made them more comfortable working on the team, and gave them more trust in leadership (Table S3). For instance, one male participant reported that he felt enabled to "call out" the use of sexist jokes being shared among team members in an online platform due to the training. A female participant reported that two of her male colleagues helped her leave a situation in which she was being harassed by a person unaffiliated with the field team, named it as harassment, and checked whether she was okay. Participants who attended the training also indicated that it helped them recognize the possible impact or harm that off-handed comments have on others (Table S3). This is promising because behavioral change in connected teams is how we can inspire cultural change.

Past research has shown gender differences in response to sexual harassment training (e.g., Bingham et al. (2001)). We also found gender differences in the emotional responses participants had to the training (Figure 4). Women were significantly more likely than men to feel supported, while men were significantly more likely to feel bored or annoyed. These differences are statistically significant, but it's important to note that only a small subset of men (approximately 8-9% of all men) reported these negative/apathetic emotions. In addition, there was a significant difference in the response to the training by trainees vs. senior-level participants. As shown by the shading in Figure 4, trainees were more likely to report stronger positive and negative feelings toward the training compared to senior-level colleagues. This may be a result of junior-level participants feeling more passionate in general about the topic, or a difference in the way trainee

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versus senior-level participants responded to the survey. Acknowledging differential experiences should increase each individual's sense of their position within the larger community.

Like any study, our results may have been impacted by a number of methodological limitations. First, we could not force team members to participate in the surveys or the training/workshop, and thus, our results may oversample individuals who tend to care or feel concerned about the issue of sexual harassment and may have not fully captured the beliefs and behaviors of those who do not consider sexual harassment to be a serious concern. This could lead some results to be inflated (e.g., positive perceptions of the training), and others depressed (e.g., engagement in harassing behaviors). The lack of a 100% response rate, coupled with an already minimally diverse sample pool, could have underpowered a number of statistical tests. Additionally, it became clear over the course of the study that the wording of some questions did not give us sufficient information about the prevalence of sexual harassment, including whether or not the participant was the target of various behaviors (e.g., sexual jokes or comments), and whether the participant interpreted some behaviors as harassing or benign (e.g., putting hands on your shoulders). We alert the reader that these are potential considerations to the interpretation of the data presented here, and provide further discussion of these limitations in Supplemental Materials Part C.

Recommendations: Let's Move Forward Together

Based on findings from the surveys of four major atmospheric science field campaign teams, we provide the following set of **recommendations**.

1. **Establish a code of conduct.** Field research teams should acknowledge that sexual harassment is a problem, and they should commit actions to prevent its occurrence, support targets of harassment, and address negative behaviors when they occur. Research teams

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should communicate no-tolerance of sexual and other types of harassment and frequently refer to codes of conduct established before the field campaign. All participants should be familiar with expectations for professional behaviors, and processes outlined in a code of conduct (Nelson et al. 2017). Leadership is one of the predictors of the prevalence of sexual harassment in a work environment (National Academies of Science, Engineering, and Medicine, 2018). Clear codes of conduct need to be developed that also extend to social settings held in the context of field work, including in international locations. Plans should also address how to avoid and respond to situations perpetrated by individuals in the communities hosting the field campaigns. Codes of conduct have been shown to improve field experiences (Nelson et al. 2017; National Academies of Sciences, Engineering, and Medicine, 2020); our examples are available on the homepages associated with the field campaigns (NCAR/UCAR 2020; 2020b; 2020c). The ADVANCEGeo Partnership website includes tips on developing effective codes of conduct and samples (AdvanceGeo 2020).

2. **Implement bystander intervention training.** Our findings revealed that participation in a bystander-intervention training for field campaign teams was a positive experience for most participants, especially in the framework of building a safe and inclusive team. Participants on average agreed that the training made them feel more comfortable working on the team, made them trust those in charge, and allowed their group to become a better team. When all members of the field campaign team feel safe in their environment, high-intensity and often stressful field work may be more successful and productive. Teams should recognize that women and men differentially experience harassment, and they also may perceive aspects of the training differently.

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3. **Collect information on incidents of harassment after each field campaign in a way that protects team members.** On average field campaign participants are more likely to avoid or deny incidents of harassment than to seek help or report them. While our surveys do not allow us to determine whether the lack of formal reporting reflects cultural barriers or problems with reporting mechanisms, there are clearly still barriers to reporting experiences of harassment. Reporting can negatively impact victims (e.g., Bergman et al. 2002), and people are often hesitant to label their experiences as harassment (e.g., Koss 1985; Magley et al. 1999x; Peterson et al. 2004x; Stockdale et al. 1993). We recommend engaging with behavioral scientists with expertise in sexual harassment to ensure that data is collected effectively and that any surveys or discussion are sanctioned by the Institutional Review Board (IRB) and will adequately protect the identities of survey participants. For example, funding can be included in grant proposals to include individuals or organizations with this expertise to seamlessly integrate this component into a field campaign plan from the beginning. Transparency in reporting communicates that sexual harassment is not tolerated, which has been shown to be effective in preventing future incidents of harassment (National Academies of Sciences, Engineering, and Medicine, 2018).
4. **Support junior colleagues.** Junior colleagues are more likely to experience harassment, and they should be supported. Open ended survey comments suggested that some senior participants believe sexual harassment was more frequent in the past but results of the survey suggest that this perception might result from their seniority, rather than changes in the culture.
5. **Continue engagement.** Prevention of sexual harassment requires more than participation in a 2-hour workshop and development of a clear code of conduct. Our surveys revealed

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harassment occurred in the field even after participants received training on how to identify and respond to harassment and on the negative impacts of harassment on people, teams, and research. Addressing these behaviors requires continued engagement and work. It will take a community-led effort to inspire culture change and make progress toward recognizing and preventing harassment in field campaigns and beyond.

Based on informal observations and feedback gathered at in-person events, we provide the following set of **practical lessons**.

6. **Communicate that sexual harassment impacts your team.** When team members heard (via reporting on the surveys) that members of their community had experienced harassment, they expressed surprise and a stronger commitment to supporting best practices. This is consistent with literature demonstrating that individuals may believe issues like sexual harassment happen, but often do not recognize that harassment is happening around them (Crosby 1984).
7. **Integrate sexual harassment training into a broader respectful culture that does not tolerate discrimination, promotes safety, and values teamwork** (Walsh et al. 2019). All members of the team need to feel that they can be part of the solution. In the context of large inter-agency and inter-community teams, training on teamwork and building a safe and inclusive team can make bystander intervention training more directly linked to the fieldwork experience. Engagement of team leadership and expectation of participation of all team members can contribute to strengthening training framed and implemented in a collaborative way.
8. **Optimize training activities with facilitation by well-trained, mixed-gender leaders.** Research on effective workshops on gender-based violence indicates that having other men

facilitate training sessions increases men's comfort and decreases defensiveness (Berkowitz 1994; Tinkler et al. 2015) and may also signal that men are committed to addressing the issue. This requires that men engage in this type of work.

9. **Develop robust safety plans that include harassment in all phases of field campaign planning.** Efforts to build a safe and inclusive team should begin at the proposal phase and continue beyond the completion of the field campaign. Field campaign leadership should communicate that safety is the primary motivation in training all campaign participants on harassment because this is essential for the success of any intervention. PIs of large field campaigns should learn how to lead training sessions (or bring in trained facilitators) so that they have sufficient understanding of the impact of hostile behaviors in STEM, are knowledgeable about strategies for improving workplace climate, and can facilitate bystander intervention training within their communities (ADVANCEGeo 2020; Clancy et al. 2020).

10. **Lead and engage on concerns about sexual harassment beyond the field campaign.** Continued conversations within the broader community are important for greater cultural change within the discipline. We have held multiple "lunch and learn" discussions for the WE-CAN team. We begin these events by presenting survey results to the team members attending about harassment happening to their own team members. We discuss perceived barriers to forward progress and share leadership opportunities. Productive conversations appear to require vulnerability in admitting we aren't always perfect or know everything. We have also consistently presented the results of this project within the science sessions related to WECAN and RELAMPAGO research (e.g., at the AMS annual meeting) associated with these field campaigns, which has increased awareness among the

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atmospheric science community. In fact, this is how we initially recruited the CHEESEHEAD team to this project.

We can all be a part of the cultural change needed to prevent sexual harassment and discrimination in the AMS community. We can change the mentality around sexual harassment by helping everyone understand that it is a real problem that is harming our community, that the effects of our actions, rather than our intentions, are what matters, and that everyone can participate in making forward progress. Many existing strategies (e.g., climate surveys, workshops, online educational programs) to address this problem simply don't work (Clancy et al. 2020). Figure 5 provides a summary of activities and recommendations based on our research and experiences in the context of large field campaign teams. They are organized as a three-step process: identifying harassment problems, initiating training and reporting networks, and finally further disseminating and extending the findings from these efforts. *To create a safe and inclusive community of scientists, we need to move beyond mere legal compliance requirements and promote cultural change.* This will require research to uncover the prevalence and nature of harassment in the atmospheric science community, rigorous testing of new training tools, embracing best practices for mitigation and response that are grounded in social and behavioral science, facilitating difficult conversations, and empowering new leadership. By standing up for our shared values, engaging leadership, and leveraging our connected communities, we can chart a path forward, together.

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(NOAA). The scientific results and conclusions, as well as any views or opinions expressed herein, are those of the author(s) and do not necessarily reflect the views of NOAA or the Department of Commerce. We thank Rebecca Barnes for helpful discussions.

Data Availability Statement

De-identified data used in the final version of this manuscript will be added to the ICPSR (Inter-University Consortium for Political and Social Research; https://www.icpsr.umich.edu). This repository specializes in social science data and has expertise in curating sensitive data. CSU has an institutional membership.

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613 **Figures**

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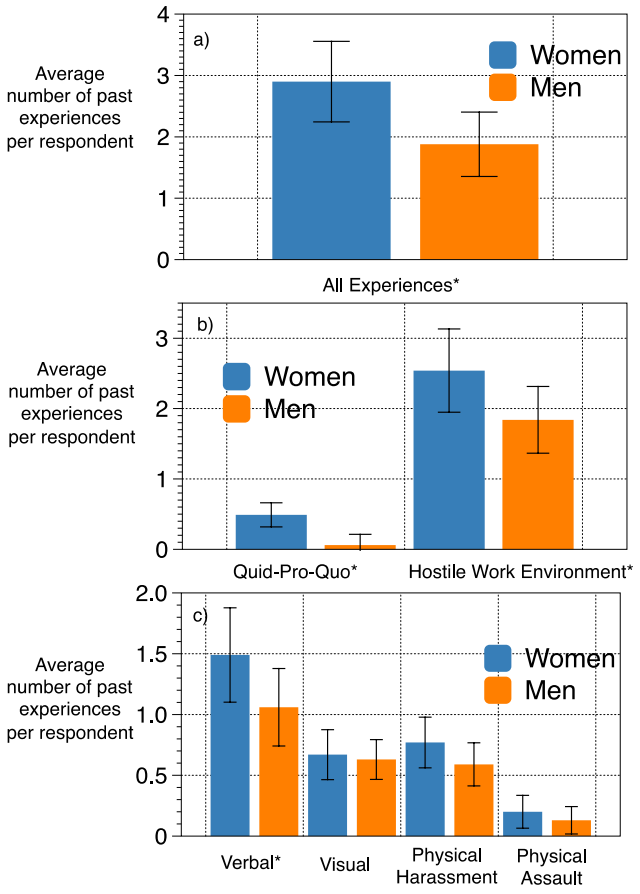

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616 **Figure 1:** Results from the pre-campaign survey presented as the a) average number of past
617 reported experiences of sexual harassment by respondent's gender, b) average number of past
618 reported experiences of sexual harassment by respondent's gender binned as either "hostile work
619 environment" or "quid-pro-quo" situations, and c) average number of past reported experiences
620 of sexual harassment by respondent's gender binned by the specific type of behavior. A small
621 number of participants reported a non-binary gender identity, but their data is not included here
622 for purposes of participant protection.

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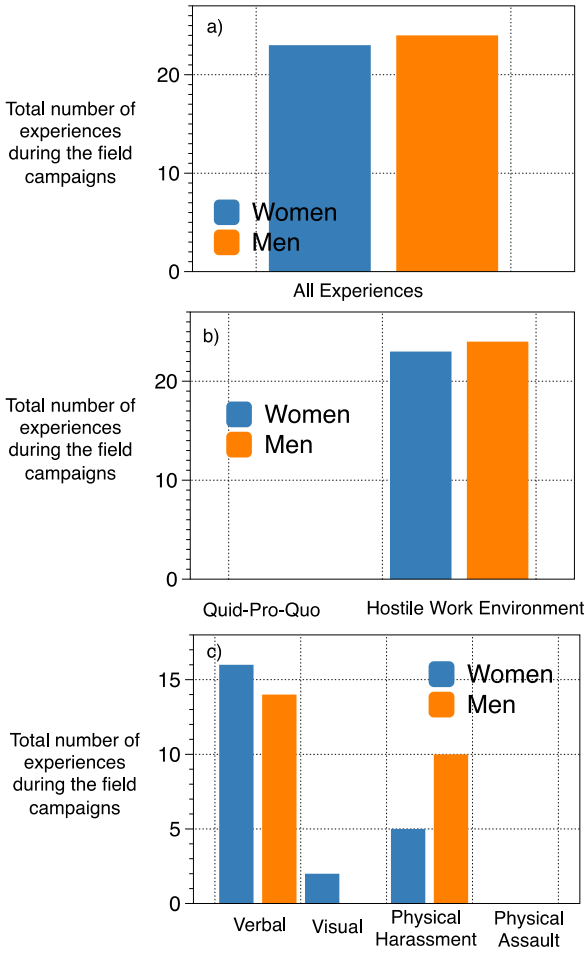

Figure 2: Results from the post-campaign survey presented as the a) total number of reported experiences of sexual harassment during the WE-CAN, RELAMPAGO, FIREX-AQ and CHEESEHEAD campaigns by respondent's gender (N_{Women} = 89, N_{Men} = 140), b) total number of reported experiences of sexual harassment during the field campaigns by respondent's gender categorized by type of impact as either "hostile work environment" or "quid-pro-quo" situations, and c) total number of reported experiences of sexual harassment during the field campaigns by respondent's gender categorized by specific type of behavior. This figure is scaled by total number of experiences, rather than average experiences per participant. We did this for two reasons: the

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majority of participants reported 0 experiences of sexual harassment during the campaign, and the experiences of harassment during the campaign took place over a much shorter time period than "all past experiences" reported in Figure 1. Thus, using the same scale for both figures would result in a deceptively uneven comparison.

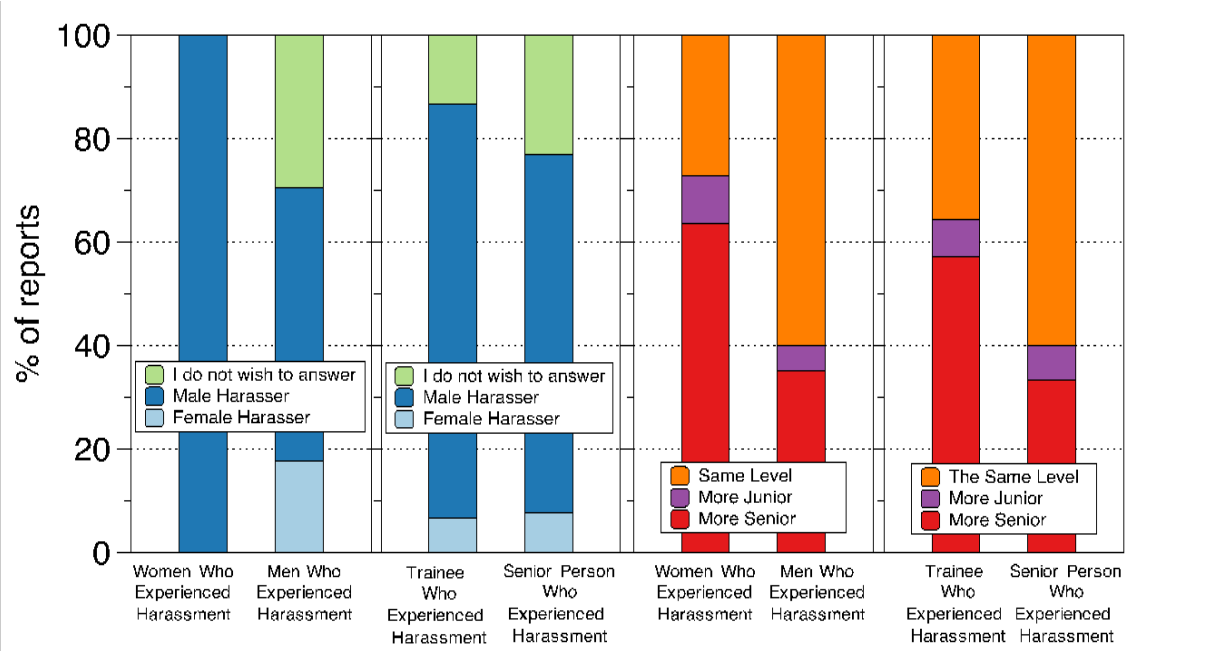

Figure 3. Reported experiences of sexual harassment during the field campaigns, organized by gender and position of the person engaging in harassing behavior relative to the participant. (N_{Women} = 89, N_{Men} = 140).

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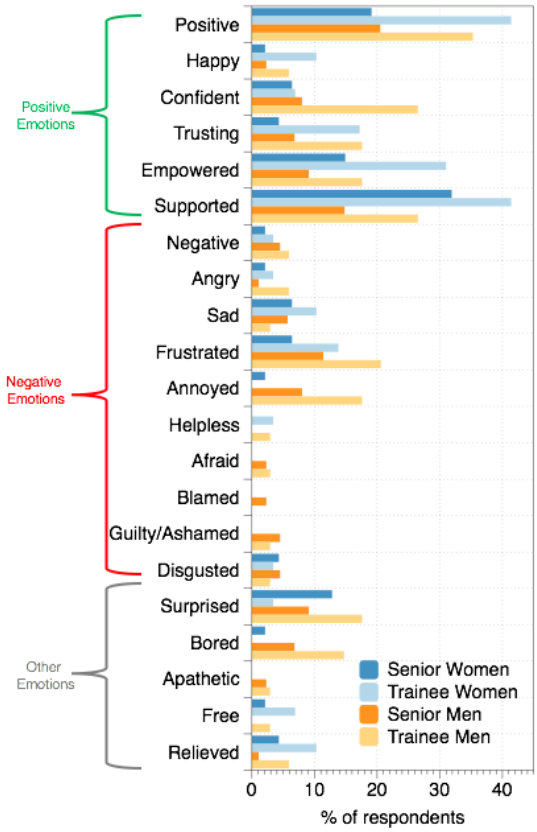

Figure 4: Percent of women and men who report emotional responses to the sexual harassment training in the post-campaign survey, colored by respondent's self-reported gender and their seniority. Participants were given the statement "The [campaign name] safety and sexual harassment training made me feel" and asked to indicate by a check mark whether they had experienced a list of emotions. Participants could check more than one response. All gender differences were not significant except for women felt more supported than men and men felt more bored than women. We did not analyze differences among all the emotions, except for the difference between "positive" and "negative". Both women and men were more likely to say they felt "positive" about the training than "negative".

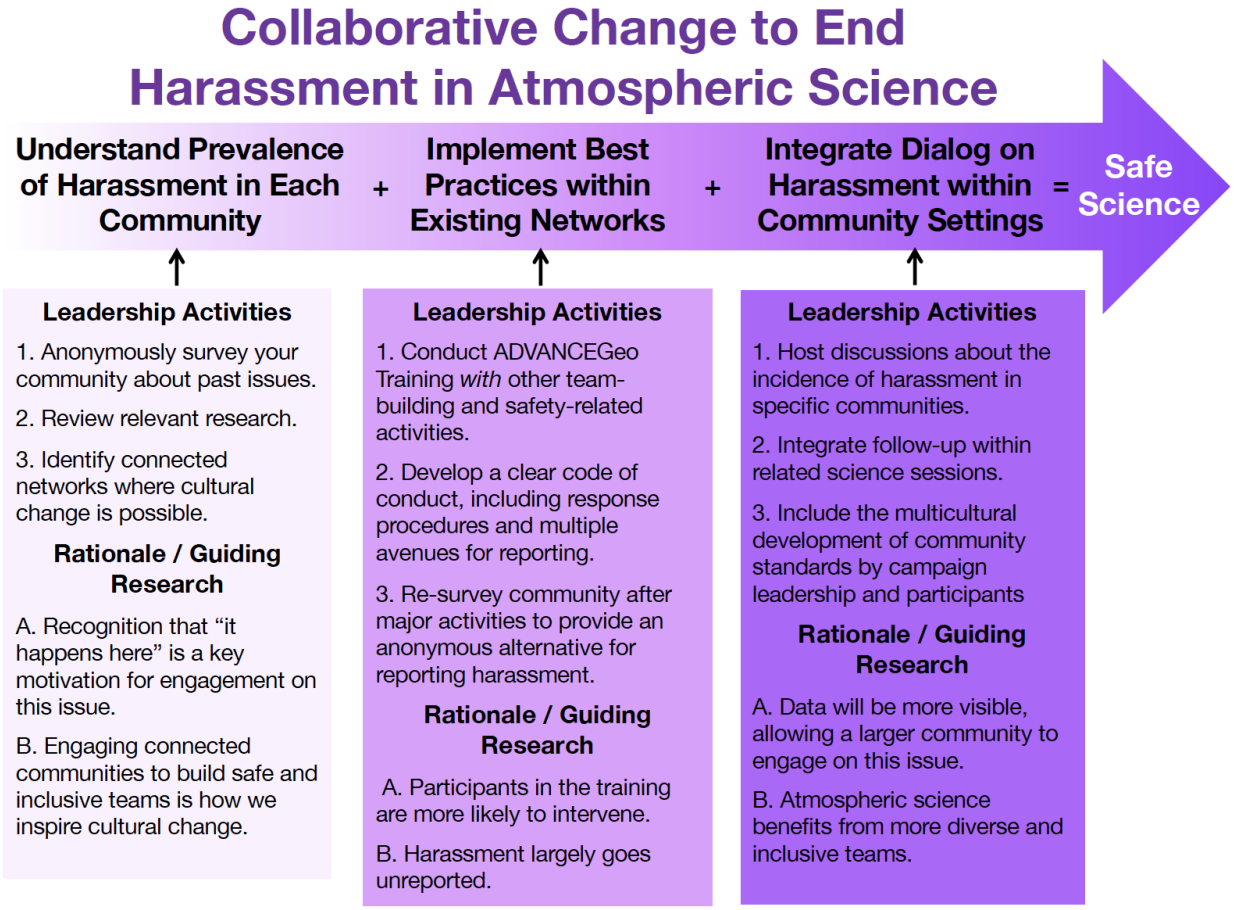

Figure 5: Recommended activities for collaborative change around sexual harassment in field campaigns and connected communities.

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