

Evidence for motivated control? Climate change related distress is positively associated with domain-specific efficacy beliefs and climate action

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ABSTRACT

Recent cross-sectional and experimental research has found measures of climate change related distress to be positively associated with measures of efficacy beliefs. Authors of some of these studies have interpreted this finding in terms of motivated control, that is, people who experience climate change related distress are

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motivated to believe that they can help mitigate climate change. We extend this notion of motivated control by assuming that efficacy beliefs flowing from climate change related distress play a role in encouraging climate action. In two cross-sectional studies, we investigate this assumption: Study 1 used data from a multi-country study and found that negative emotions regarding climate change were positively associated with climate action and both individual and collective efficacy. Furthermore, we found evidence for an indirect effect of negative emotions on climate action via efficacy beliefs (individual and collective). Study 2 conceptually replicated this mediation effect, using data from a sample of citizens in Germany and a different measure of distress, focusing on climate change worry. Additional exploratory analyses revealed that the association with individual efficacy was stronger for more adaptive forms of climate change worry, compared to less adaptive forms. We conclude that our findings provide correlational support for motivated control being one of the psychological processes – and efficacy beliefs being one of the person-level factors – that account for adaptive behavioral reactions to climate change related distress. Experimental and longitudinal studies are needed to further substantiate this conclusion.

1. Introduction

Climate change related risks for humans and ecosystems may affect people on various cognitive and affective dimensions. A representative survey among EU citizens found that about three-quarters of the respondents regarded climate change as a very serious problem and more than half of the respondents ranked climate change as one of the most important environmental issues of our time (European Commission, 2020). While these findings suggest that a large share of the EU population is strongly concerned about climate change, there was also substantial variation between countries. Similarly, a worldwide survey among Facebook users found that a majority of people were very or somewhat worried about climate change and thought that climate change will harm them personally, again with large variation between countries (Leiserowitz et al., 2021).

Worry and other emotional reactions to environmental risks, including climate change, have long been studied in environmental psychology. For example, Böhm and Pfister (2005) proposed and empirically tested a framework that distinguishes qualitatively different emotional reactions to environmental risks, such as worry (i.e., a consequence-based emotion) or anger (i.e., an ethics-based emotion), as a function of their cognitive-evaluative underpinnings. Moreover, numerous studies evidence a key role of emotions in motivating climate action (Brosch, 2021). However, only recently, research has shifted attention to climate change related psychological distress that may negatively affect human functioning and wellbeing.

This psychological distress has been termed, conceptualized, and operationalized differently, depending on the specific focus and aims of the research. Clayton and Karazsia (2020) developed a scale that captures cognitive-emotional and functional impairments to shed light on possible mental health issues associated with *climate change anxiety*. Stewart (2021) developed a scale to measure personal worry with regard to possible proximal risks of climate change. The items of this scale capture both more adaptive (e.g., seeking information about climate change) and less adaptive forms (e.g., worrying so much that one feels paralyzed to do anything about climate change) of *climate change worry*. Another line of research (Ogunbode et al., 2023) focused on the emotional component of climate anxiety (cf. Ojala et al., 2021) and applied a measure that captures a variety of negative emotions, which people may experience in relation to climate change. Empirical evidence from these lines of research shows that climate change related distress is positively associated with indicators and symptoms of mental health issues (e.g., general anxiety and depressiveness, Wullenkord et al., 2021; depressiveness but not general anxiety, Mouguiama-Daouda, Blanchard, Coussement, & Heeren, 2022; insomnia symptoms, Ogunbode et al., 2023), hinting at a possible clinical significance of the phenomenon.

Clayton (2020) stresses, however, that while anxiety can become clinically relevant, for instance, when people find it difficult to control their anxiety, it can also serve an important adaptive function by motivating people to approach the underlying threat. Research by Böhm and Pfister (2000) supports the notion that emotions play an important

role in motivating individual action to mitigate environmental risks. Their findings suggest that qualitatively different emotional reactions to environmental risks increase the likelihood of different risk-mitigating action tendencies. Indications for associations between emotions and actions also emerge in studies focusing on climate change. The above-mentioned worldwide survey among Facebook users (Leiserowitz et al., 2021) not only found that most people are worried about climate change but also that, in most countries, the majority is willing to participate in a citizens' campaign to convince political leaders to step up climate protection efforts. As with worry about climate change, the population share that stated to be ready and willing to take action also varied markedly between countries. Correlational studies revealed that climate anxiety (Whitmarsh et al., 2022; Wullenkord et al., 2021) and the conceptually similar construct climate change worry (Bouman et al., 2020; Gregersen et al., 2021; Wullenkord & Ojala, 2023) are both positively associated with pro-environmental intentions and behaviors, such as energy saving actions at home and climate policy support. Moreover, two recent multi-country studies found that negative emotional reactions to climate change were positively associated with pro-environmental behaviors, such as cycling or walking instead of driving a car (Kovács et al., 2023; Ogunbode et al., 2022). A meta-analysis of more than 100 studies looking into various factors motivating climate change adaptation behavior even found that negative affect was among the strongest predictors, together with efficacy beliefs and descriptive social norms (van Valkengoed & Steg, 2019).

In the present study, we use data from two cross-sectional studies to further investigate the association between climate change related distress and action. Building on previous findings, we hypothesized that people who experience stronger distress are more likely to engage in climate protective actions.

H1. Climate change distress is positively associated with climate action

We, furthermore, shed light on a possible psychological mechanism that may explain why climate change related distress and action are positively related. We assume that when people experience such distress, they develop strengthened convictions of being efficacious in the domain of climate protection. These convictions, in turn, motivate people to engage in actions to help mitigate climate change. Our assumptions build upon research on the role of efficacy beliefs for pro-environmental behavior as well as theorizing and empirical work by Hornsey and colleagues (Hornsey et al., 2015; Hornsey et al., 2021) on associations between efficacy beliefs and climate threat and anxiety.

A large body of research documents that efficacy beliefs are positively associated with pro-environmental behaviors, indicating that feeling capable of making a difference plays an important role in deliberate action for the environment. Hamann and Reese (2020) provide an overview of and structure this literature by sorting existing studies according to whether they investigate links between actors, behaviors, and goals. With regard to actors, a common distinction is between individuals' (i.e., individual efficacy) and groups' (i.e., collective

efficacy) beliefs in being capable of attaining desired goals through their behaviors. The relative explanatory strength of these two facets of efficacy beliefs seems to depend on the specific behaviors and goals (e.g., mitigating climate change, protecting wildlife, encouraging other people to join in) under scrutiny. This becomes apparent when comparing findings from domains as diverse as choice of travel options (Doran et al., 2017), recycling, signing petitions, and organizing rallies for environmental causes (Hamann & Reese, 2020). Against this backdrop, we included both individual and collective efficacy in our study and hypothesized:

H2a. Individual efficacy is positively associated with climate action

H2b. Collective efficacy is positively associated with climate action

Perceptions of control, such as efficacy beliefs, are ascribed an important role in theories on how people cope with environmental threats. Transactional theory (Lazarus & Folkman, 1987) postulates that when people perceive an environmental condition to pose a threat to their wellbeing, they react to it emotionally, with anxiety being one possible outcome. In an effort to deal with the threat and accompanying emotions, people may engage in different coping strategies, where having stronger control beliefs is assumed to facilitate effective coping. Perceptions of control, however, may also prevent strong reactions to potential threats, if people feel that they can prevent potential negative outcomes. What follows from transactional theory is that threat and control beliefs should be negatively associated. Homburg and Stolberg (2006) applied this reasoning in a series of studies that investigated people's reactions to environmental issues, but found mixed evidence: While control beliefs in the form of individual efficacy were negatively associated with threat appraisal (Studies 1 and 2), this association turned out to be positive (Study 3) and non-significant (Study 4) when control beliefs were measured in the form of collective efficacy. The authors interpret these inconsistent findings partly in light of skewness of their efficacy beliefs variables.

More recent empirical evidence regarding peoples' responses to climate change suggests that efficacy beliefs are, in fact, *positively* associated with perceived threat (Hornsey et al., 2015), worry (Gregersen et al., 2021), and anxiety (Maran & Begotti, 2021). Hornsey and colleagues (2015) suggest different possible reasons for these positive associations: First, perceptions of high control over the course of climate change evoke climate change related distress, such as perceived threat. Second, a third variable elicits both climate change related distress and perceptions of high control. Third, experiences of climate change related distress cause perceptions of high control. Their empirical findings (particularly Study 2; Hornsey et al., 2015) most strongly aligned with the latter reason: Participants in an experiment reported stronger collective control beliefs after having read a high-threat message about climate change compared to participants who had read a low-threat message. Furthermore, the level of *perceived* threat after reading the messages fully mediated the relationship between *communicated* threat level and reported collective control. Hornsey and colleagues interpret the existing evidence for positive distress-efficacy beliefs associations in light of *motivated control*, hypothesizing that "feelings of efficacy can be motivated responses designed to manage the anxiety that arises from the existential threat associated with climate change" (Hornsey et al., 2021, p. 5). Building on previous findings, and following the notion of motivated control, we assumed that climate change related distress is positively associated with individual and collective efficacy.

H3a. Climate change related distress is positively associated with individual efficacy

H3b. Climate change related distress is positively associated with collective efficacy

Taken together, the above hypotheses imply that efficacy beliefs may act as a mediator of the association between climate change related

distress and action. Our assumption extends the motivated control notion to account for people's propensity to engage in climate action. More specifically, we theorize that efficacy beliefs flowing from climate change related distress encourage individuals to engage in climate action. To our knowledge, this study is the first attempt to address this extension of the motivated control assumption in connection with climate change and within a broad geographical context, taking into account cross-country differences. The latter is important, considering evidence that willingness to contribute to combating climate change by individual action varies across countries, with factors such as a country's vulnerability to climate impacts playing an important role (Andre et al., 2024).

H4a. Individual efficacy mediates the association between climate change related distress and climate action

H4b. Collective efficacy mediates the association between climate change related distress and climate action

Fig. 1 summarizes the assumed associations between the focal variables. We tested our hypotheses using data from two cross-sectional surveys, applying two different operationalizations of climate change related distress and controlling for participants' age and gender. Study 1 used data from a multi-country survey among university students in which we operationalized distress by measuring negative emotional responses to climate change (Ogunbode et al., 2022, 2023). Study 2 used survey data collected among people living in Germany, applying a measure of climate change worry (Stewart, 2021) to operationalize distress. This measure captures adaptive and maladaptive forms of worry, which allowed exploring whether the assumed associations with efficacy beliefs and climate action differed for these two facets of climate change related distress.

2. Study 1

Given the nested structure of the data (i.e., students nested within countries) in Study 1 and between country variations in climate change worry and willingness to act found in previous studies (see above), we analyzed these data using a multilevel modeling approach.

2.1. Methods

We used data from a large climate change-related survey, conducted in 28 countries (see Table 1) between the autumn of 2019 and the summer of 2020. The survey questionnaire was administered in digital or paper-and-pencil format, depending on what was more feasible and efficient in the respective contexts. Where necessary, the questionnaire was translated from English into local language, using a back-translation procedure, locally applied by at least one bilingual speaker.

2.1.1. Participants

Participants were university students of different academic fields and programs, recruited through opportunity sampling or from research participant pools. The sample consisted of $N = 10,963$ people, with a mean age of 23.3 years ($SD = 7.1$), of which $n = 6924$ identified as female (63.16 %), $n = 3636$ as male (33.17 %), and $n = 403$ did not provide an answer to the gender identification item (3.68 %). A more detailed and country-specific description of the sample characteristics is available via (Ogunbode et al., 2022, supplementary data Table 1). Ethics approval was sought and given through the De Montfort University Health and Life Sciences Faculty Research Ethics Committee (Ref: 3434) and supplemented with local approvals where required. Participation in the study was voluntary, and all participants gave their informed consent prior to taking the survey. In some countries, we offered a compensation (e.g., course credit) or an incentive (e.g., raffle ticket) for participation, depending on local conventions.

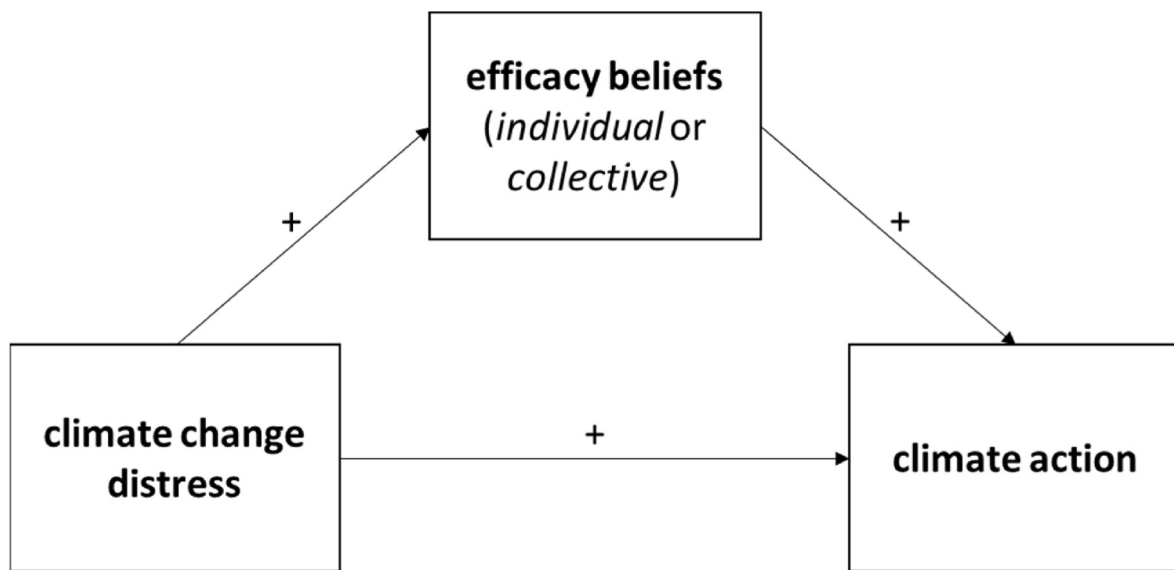


Fig. 1. Summary of assumed associations between climate change distress, efficacy beliefs and climate action.

Table 1

Overall and country-specific overview of index variable distributions.

	climate change related distress			individual efficacy			collective efficacy			climate action		
	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>M</i>	<i>SE</i>	<i>SD</i>
overall	3.2	0.01	0.8	3.6	0.01	0.8	3.9	0.01	0.8	2.0	0.02	1.7
country (<i>n</i> ^a)	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>M</i>	<i>SE</i>	<i>SD</i>	<i>M</i>	<i>SE</i>	<i>SD</i>
AU (312)	3.2	0.05	0.9	3.2	0.05	0.9	3.6	0.05	0.9	1.7	0.08	1.4
BR (280)	3.8	0.05	0.9	3.6	0.05	0.8	4.0	0.05	0.8	2.1	0.09	1.4
CA (305)	3.1	0.04	0.8	3.3	0.04	0.8	3.8	0.04	0.8	1.4	0.07	1.3
CL (391)	3.3	0.04	0.7	3.7	0.04	0.7	3.9	0.04	0.8	2.0	0.07	1.4
CN (266)	2.9	0.05	0.8	3.5	0.04	0.6	3.8	0.04	0.6	0.6	0.04	0.7
FI (612)	3.3	0.04	1.0	3.3	0.03	0.8	3.5	0.03	0.8	2.4	0.06	1.5
DE (240)	3.4	0.05	0.8	3.4	0.05	0.7	3.8	0.05	0.7	2.3	0.10	1.6
IN (224)	3.1	0.05	0.8	3.8	0.05	0.8	4.0	0.06	0.8	2.1	0.11	1.6
ID (345)	3.3	0.04	0.7	3.7	0.03	0.5	4.0	0.02	0.5	1.6	0.07	1.3
IR (317)	3.3	0.05	0.8	3.4	0.05	0.8	3.6	0.05	0.9	1.0	0.06	1.1
IT (292)	3.4	0.04	0.7	3.5	0.03	0.6	3.8	0.03	0.6	1.5	0.07	1.2
JP (302)	3.1	0.04	0.6	2.9	0.04	0.8	3.1	0.04	0.8	0.2	0.03	0.5
MY (264)	3.1	0.04	0.7	3.5	0.04	0.7	3.9	0.04	0.7	1.4	0.08	1.2
NL (412)	3.2	0.04	0.8	3.5	0.04	0.8	3.9	0.03	0.7	3.0	0.08	1.6
NG (570)	2.8	0.03	0.7	3.5	0.03	0.8	3.7	0.03	0.8	1.6	0.07	1.6
NO (261)	3.1	0.05	0.8	3.5	0.05	0.8	3.9	0.04	0.7	2.1	0.09	1.5
PK (245)	3.0	0.05	0.8	3.6	0.04	0.7	3.8	0.04	0.7	1.9	0.10	1.6
PS (330)	3.0	0.04	0.8	3.4	0.04	0.7	3.7	0.04	0.8	5.0	0.06	1.1
PH (1407)	3.5	0.02	0.7	4.1	0.02	0.7	4.4	0.02	0.7	2.0	0.04	1.4
PL (258)	3.4	0.05	0.8	3.4	0.04	0.7	3.8	0.04	0.7	4.1	0.09	1.4
RO (391)	2.9	0.04	0.8	3.1	0.04	0.8	3.6	0.04	0.8	0.8	0.06	1.1
RU (477)	2.7	0.03	0.6	3.4	0.03	0.7	3.7	0.03	0.7	1.1	0.06	1.3
SK (255)	3.0	0.05	0.8	3.6	0.05	0.8	3.6	0.05	0.8	0.8	0.07	1.1
ES (590)	3.7	0.03	0.7	3.9	0.03	0.7	4.1	0.03	0.6	2.5	0.06	1.5
TZ (248)	2.9	0.05	0.7	4.4	0.05	0.8	4.4	0.05	0.7	2.4	0.10	1.6
UG (653)	3.2	0.03	0.9	4.3	0.03	0.7	4.5	0.03	0.7	2.1	0.06	1.5
AE (187)	3.3	0.06	0.9	3.5	0.06	0.8	4.0	0.05	0.7	4.6	0.09	1.3
GB (369)	3.3	0.04	0.8	3.3	0.04	0.8	3.7	0.04	0.8	1.6	0.06	1.2

Note. ^a valid *n*, listwise deletion.

Climate change related distress and efficacy beliefs: measured on 5-point scale from 1 to 5; higher mean values indicate a stronger expression of the respective construct. Climate action index: higher mean values represent a larger number (0–6) of climate actions taken.

AU = Australia, BR = Brazil, CA = Canada, CL = Chile, CN = China, FI = Finland, DE = Germany, IN = India, ID = Indonesia, IR = Iran, IT = Italy, JP = Japan, MY = Malaysia, NL = Netherlands, NG = Nigeria, NO = Norway, PK = Pakistan, PS = Palestine, PH = Philippines, PL = Portugal, RO = Romania, RU = Russia, SK = Slovakia, ES = Spain, TZ = Tanzania, UG = Uganda, AE = United Arab Emirates, GB = United Kingdom.

2.1.2. Measures

The questionnaire contained measures that are outside the scope of the present study. Here, we will only present those measures that we used to test the hypotheses of this study. These measures were presented in the following sequence: climate action - climate change related

distress - efficacy beliefs. The complete questionnaire in English language is available at <https://osf.io/xwg2b>.

Climate change related distress: In Study 1, we focused on the emotional component of climate change related distress. We administered seven items, based on the state anxiety component of the State-

Trait Anxiety Inventory (STAI; [Spielberger, 1983](#)), that captured various negative emotions that people may experience in relation to climate change threats. Each item asked participants to indicate how strongly they experienced a specific emotion at the present moment (i.e., feeling tense, anxious, worried, terrified = anxiety-present items; calm, relaxed, peaceful = anxiety-absent items) with regard to climate change. Answers were given on a 5-point scale, ranging from “not at all” (coded 1) to “extremely” (coded 5), after participants had been instructed to take a moment to collect their thoughts and focus on how they feel about climate change. The English language wording of all items is available via <https://osf.io/xwg2b> (items P4_1a to P4_1g). Internal consistency was good, with a Cronbach’s alpha value of $\alpha = .856$ for all countries combined and country-specific values ranging from $\alpha = .708$ (Nigeria) to $\alpha = .924$ (Finland). Answers on three anxiety-absent items were reverse coded before we calculated Cronbach’s alpha and computed an index variable by averaging the responses of each participant ($n = 10,947$). Higher values on the index variable are indicative of more pronounced state anxiety. A country-specific overview of the index variable distribution is provided in [Table 1](#).

Efficacy beliefs: Building upon previous research (e.g., [Hamann & Reese, 2020](#); [Hanss & Böhm, 2010](#); [Hanss et al., 2016](#)), five items were generated to measure individual efficacy and collective efficacy, each. The items consisted of statements to which participants responded on a 5-point scale, ranging from “strongly disagree” (coded 1) to “strongly agree” (coded 5). “Young people” served as the reference social unit in the items that measured collective efficacy. Example statements are: “Through my own everyday behaviors (e.g., purchasing, consumption and energy use practices), I can make an important contribution to mitigating climate change.” (individual efficacy) and “Through our efforts to influence climate legislation (e.g., send petitions to local politicians, participation in demonstrations), we as young people can help protect the climate.” (collective efficacy). All English language items are available via <https://osf.io/xwg2b> (items P5_4a to P5_4e for individual and P5_4f to P5_4j for collective efficacy). Cronbach’s alpha values indicated good internal consistencies for both scales: individual efficacy $\alpha = .846$ (countries combined; range from $\alpha = .731$ Germany to $\alpha = .912$ Tanzania, across countries) and collective efficacy $\alpha = .885$ (countries combined; range from $\alpha = .781$ Italy to $\alpha = .911$ Philippines and Tanzania, across countries). Index variables for individual and collective efficacy were calculated by averaging individual responses on the respective items ($n = 10,888$, individual; $n = 10,861$ collective efficacy). The two index variables were correlated across countries at $r = 0.78$, $p < .001$. [Table 1](#) provides an overview of the country-specific index variable distributions.

Climate action: We assessed climate action with six items (P2_1a to P2_1f in <https://osf.io/xwg2b>), each capturing a different type of private or public sphere behavior, for example, making lifestyle changes for reasons related to protecting the climate (private) or attending a climate protest (public). Participants answered whether they had engaged in each of the activities during the past year: either “no” (coded 0) or “yes” (coded 1). For participants who had responded to each behavior ($n = 10,904$), we calculated the sum score across the six items; the remaining participants ($n = 59$) were assigned a value representing missing data for this variable. Individual scores indicate how many climate actions each participant engaged in during the past year, from zero to six. [Table 1](#) provides an overview of the country-specific sum score distributions.

2.1.3. Analyses

For the main analyses in Study 1, we used the Mixed Linear Models package provided in SPSS Statistics 27 (IBM Corp, 2020) and the MLmed macro Beta 2 version ([Hayes & Rockwood, 2020](#)) for multilevel mediation analysis. To test whether there is sufficient clustering in our data to justify a multilevel approach, we first estimated a variance component model (i.e., no predictors; ML estimation) for the dependent variable climate action. The analysis revealed a significant ($p < .001$) estimate of the Level 2 intercept variance (i.e., variation of intercepts between

countries) and an intraclass correlation coefficient (ICC) of 0.390, meaning that roughly 39 % percent of the observed variance in climate action occurs between countries. These findings indicate sufficient clustering in the data to justify a multilevel modeling approach. Although this was not the focus of our study, we also estimated variance component models (ML estimation) for the two assumed mediator variables, individual efficacy and collective efficacy. In both cases, the estimate of the Level 2 intercept variance was significant ($p < .001$), with ICCs of 0.161 (individual) and 0.129 (collective efficacy), indicating that roughly 16 % and 13 % of the observed variance in the variables occurs between countries.

We built the multilevel mediation models sequentially and separately for the two mediators, individual and collective efficacy, using group-mean centering of Level 1 (i.e., individual level) predictors and ML estimation. Missing data are handled case-wise by the MLmed macro ([Rockwood, 2019](#)). We decided against including the two mediators simultaneously in the models to avoid potential multicollinearity issues and because of limited empirical evidence on the interplay between the two efficacy belief facets in the context of pro-environmental behavior. Our first model (Model 1) estimated fixed effects for the Level 1 predictors climate change related distress (i.e., “X” in mediation terminology) and efficacy beliefs (“M”; either individual or collective), the covariates age and gender, and a random effect for the climate action (“Y”) intercept at Level 2 (i.e., country-level). We then successively added four random effects at Level 2: for the efficacy beliefs intercept (either individual or collective; Model 2), the $X \rightarrow Y$ slope (Model 3), the $X \rightarrow M$ slope (Model 4), and the $M \rightarrow Y$ slope (Model 5). In both series of analyses, including either individual or collective efficacy, the most complex model (i.e., Model 5) had the best fit as indicated by AIC. We will only present Model 5 for individual and collective efficacy in the following section.

2.2. Results

In the multilevel mediation model with individual efficacy (left side of [Table 2](#)), all of the hypothesized associations were significant and in the expected direction. Climate change related distress, age, and gender predicted individual efficacy, with people experiencing negative emotions more intensely, being older, and identifying as female (vs. male) holding stronger efficacy beliefs. These results provide support for Hypothesis [H3a](#) stating that climate change related distress is positively associated with individual efficacy. Moreover, climate action was predicted by climate change related distress, individual efficacy, and age (all positive associations), which supports Hypotheses [H1](#) and [H2a](#), stating that climate change related distress and individual efficacy are positively associated with climate action. Finally, the tested indirect effect was significant, providing support for the assumed mediation of the relationship between climate change related distress and climate action via individual efficacy (Hypothesis [H4a](#)).

From the multilevel mediation model with collective efficacy (right side of [Table 2](#)), we obtained very similar results, except age did not predict collective efficacy. All hypothesized associations were significant and in the expected direction, providing support for Hypotheses [H1](#), [H2b](#), and [H3b](#). In addition, the indirect effect via collective efficacy was significant, consistent with our mediation Hypothesis [H4b](#).

In both mediation models, all specified random effects (i.e., intercepts of climate action and efficacy beliefs; slopes $X \rightarrow Y$, $X \rightarrow M$, and $M \rightarrow Y$) were significant.

2.3. Discussion

Study 1 found further evidence for previously documented positive associations of climate change related distress with climate action (e.g., [Gregersen et al., 2021](#); [Wullenkord et al., 2021](#)), pro-environmental behaviors ([Innocenti et al., 2021, 2023](#)), and climate change related efficacy beliefs (e.g., [Maran & Begotti, 2021](#)). Moreover, we found that

Table 2

Multilevel mediation with individual efficacy (left) or collective efficacy (right) as mediator.

AIC	mediator individual efficacy					mediator collective efficacy				
	57169.73					56971.71				
N	10390					10363				
fixed effects										
outcome variable: efficacy beliefs										
Predictor	estimate	SE	p	LL	UL	estimate	SE	p	LL	UL
Constant	3.55	0.06	<0.001	3.43	3.68	3.86	0.05	<0.001	3.75	3.96
cc distress	0.19	0.01	<0.001	0.16	0.22	0.19	0.01	<0.001	0.16	0.22
Age	0.005	0.001	<0.001	0.003	0.007	0.002	0.001	0.20	−0.001	0.004
gender ^a	0.14	0.02	<0.001	0.11	0.17	0.16	0.02	<0.001	0.13	0.19
outcome variable: climate action										
Predictor	estimate	SE	p	LL	UL	estimate	SE	p	LL	UL
Constant	1.99	0.21	<0.001	1.57	2.41	1.99	0.21	<0.001	1.57	2.41
cc distress	0.23	0.05	<0.001	0.13	0.34	0.25	0.05	<0.001	0.13	0.36
efficacy beliefs	0.31	0.06	<0.001	0.18	0.43	0.24	0.04	<0.001	0.15	0.33
age	0.005	0.002	0.03	0.0004	0.009	0.01	0.002	0.006	0.002	0.01
gender ^a	−0.04	0.03	0.18	−0.10	0.02	−0.03	0.03	0.27	−0.09	0.03
random effects										
level-1 residual	estimate	SE	p	LL	UL	estimate	SE	p	LL	UL
efficacy beliefs	0.50	0.01	<0.001	0.49	0.51	0.48	0.01	<0.001	0.47	0.50
climate action	1.64	0.02	<0.001	1.59	1.68	1.69	0.02	<0.001	1.64	1.74
intercepts (I) and slopes (S)	estimate	SE	p	LL	UL	estimate	SE	p	LL	UL
I: efficacy beliefs	0.10	0.03	<0.001	0.06	0.17	0.08	0.02	<0.001	0.05	0.13
I: climate action	1.18	0.32	<0.001	0.70	2.00	1.18	0.32	<0.001	0.70	2.00
S: X → Y	0.06	0.02	0.001	0.03	0.12	0.07	0.02	<0.001	0.04	0.13
S: X → M	0.003	0.002	0.04	0.001	0.01	0.003	0.001	0.03	0.001	0.007
S: M → Y	0.10	0.03	<0.001	0.05	0.18	0.04	0.01	0.01	0.02	0.08
indirect effects										
	estimate	SE	p	MCLL	MCUL	estimate	SE	p	MCLL	MCUL
X → M → Y	0.06	0.01	<0.001	0.03	0.08	0.05	0.01	<0.001	0.03	0.06

Note. cc distress = climate change related distress.

X = cc distress, M = efficacy beliefs (individual, left side; collective, right side), Y = climate action.

LL = lower limit 95 % CI, UL = upper limit 95 % CI.

MCLL = lower limit 95 % Monte Carlo CI, MCUL = upper limit 95 % Monte Carlo CI.

^a 0 = male, 1 = female.

these associations, as well as mean levels of efficacy beliefs and climate action, varied between country samples (random effects for intercepts and slopes). This suggests that country and region-specific context factors play a role (cf. [Demske et al., 2018](#); demonstrated in connection with energy security concerns), such as culture, wealth, availability of behavior options, or prevailing forms of rule. For example, people's willingness and ability to participate in climate activism (e.g., protests) likely varies with the degree of personal freedom granted by the prevailing political system. Levels of collective efficacy – with regard to citizens' joint ability to mitigate climate change – may depend on the degree to which climate friendly technologies have been adopted and behaviors normalized in one's region or country. Furthermore, people with more pronounced climate change related distress and efficacy beliefs can only engage in climate action if their context and financial situation affords them to. Preconditions for people translating their climate change related cognitions into mitigating actions may be more favorable in Northern and Western European countries, because people there often receive more support (e.g., by governments), have better access to climate friendly alternatives (e.g., renewable energy), and are less financially burdened by climate action, due to higher incomes ([Bouman et al., 2020](#)). Such factors should be systematically incorporated into future studies to get a better understanding of the country variation in mean levels and associations found in Study 1.

A novel finding of our study is that efficacy beliefs, both individual and collective, mediate the association between climate change related distress and action. This finding provides support, albeit correlational, for the notion that climate change related distress can serve an adaptive function: experiencing distress may trigger efficacy beliefs, which in

turn encourage climate action. It should be noted, however, that our study focused on the emotional component of climate change related distress. Qualitatively different and more severe forms of distress, such as recurring negative thoughts about climate change that compromise functioning in everyday life, may be less likely to entail adaptive responses. For example, more severe forms of climate change worry may dampen (perceived) problem solving abilities and people's motivation to take adaptive actions ([Stewart, 2021](#)). In correlational studies, this could show weaker associations of more severe (compared to milder) forms of climate change worry with efficacy beliefs and climate action. Research has even found that cognitive and functional impairment linked to climate anxiety were *negatively* associated with individual efficacy – albeit generalized, not domain-specific efficacy ([Innocenti et al., 2021, 2023](#)). In our second study we, therefore, explored how individual and collective efficacy in the domain of climate change relate to milder and more severe forms of climate change related distress and to climate action.

3. Study 2

The main objective of Study 2 was to conceptually replicate the findings of Study 1, using a different operationalization of climate change related distress. This allowed us to explore potential differences between milder and more severe forms of distress with regard to adaptive responses.

3.1. Methods

For Study 2, we used data that one of the authors had collected in November of 2021 as part of another research project, via an open online survey. Respondents were recruited through opportunity sampling via e-mail lists at Darmstadt University of Applied Sciences, used specifically for inviting students to participate in empirical studies on a wide range of topics, and via social media posts targeted at people living in Germany. The topic of the study was announced as “Klimawandel und Umweltbewusstsein” [i.e., “climate change and environmental awareness”], and it was mentioned that individual reactions to climate change were a focus of the study. It was also pointed out that no expert knowledge was required to participate. Some of the participants – students at Darmstadt University of Applied Sciences – were offered course credit for taking part in the survey; no other incentives or compensation were provided.

3.1.1. Participants

In total, $N = 361$ individuals took part in the survey, thereof $n = 80$ cases were excluded due to missing answers on measures of the focal constructs, short answer times, and incorrect answers on attention check items. This resulted in a net sample of $n = 281$ cases. A sensitivity analysis conducted with the software G*Power [$\alpha = .05$, power of 0.95, 4 predictors (the amount of predictors included in the largest model to test for the assumed mediation effect)] revealed that, given our net sample size, the smallest detectable effect (single regression coefficient) was $f^2 = 0.039$, which corresponds to a small effect according to Cohen's (1988) guidelines.

Of the net sample $n = 194$ participants identified as female (69.04 %), $n = 85$ as male (30.25 %), and $n = 1$ as diverse (0.36 %); one person did not answer the gender identification item. The most common age group was 18–24 years ($n = 153$, 54.45 %), followed by 25–34 years ($n = 56$, 19.93 %), 50–64 years ($n = 44$, 15.69 %), 35–49 years ($n = 17$, 16.05 %), and 65 years or older ($n = 10$, 3.56 %); one person did not provide information on their age. With regard to their occupational status, $n = 155$ participants indicated that they were university students (55.16 %), $n = 104$ were employed (37.01 %), $n = 11$ were retired (3.91 %), $n = 3$ were pupils (1.07 %), $n = 1$ participant was unemployed (0.36 %), and $n = 6$ answered “other” (2.14 %); one person did not provide information on their occupational status.

3.1.2. Measures

The measures were almost identical to those used in Study 1. The main difference was that climate change related distress was operationalized using the Climate Change Worry Scale (Stewart, 2021). Below, we describe this scale in more detail and provide descriptive statistics for all measures used for the analyses of Study 2. Another difference to Study 1 was that we presented the measures of the focal variables in random sequence in Study 2.

Climate change related distress: The Climate Change Worry Scale (Stewart, 2021) contains 10 items measuring personal worry with regard to possible proximal risks of climate change. Each item consists of a statement (e.g., “I worry that outbreaks of severe weather may be the result of a changing climate”) to which participants reply on a 5-point scale ranging from “never” (1) to “always” (5). Some of the statements cover more adaptive forms (e.g., “I tend to seek out information about climate change in the media (e.g., TV, newspapers, internet).”), and other statements cover more maladaptive forms of climate change worry (e.g., “I worry about climate change so much that I feel paralyzed in being able to do anything about it.”). Stewart (2021) found that the ten items are well represented by one factor. For the present study, we translated the items into German language using a back-translation procedure, involving one bilingual speaker. The translated items demonstrated high internal consistency with a Cronbach's Alpha value of $\alpha = .894$. We computed an index variable for further analyses by averaging across the 10 items ($n = 281$, $M = 3.2$, $SD = 0.7$); higher

values represent stronger expression of climate change related distress.

Efficacy beliefs: Individual and collective efficacy were each measured by four items. We adopted three of these items per efficacy belief facet from the German language version of the questionnaire used in Study 1. “Bürger*innen” (English: citizens) served as the reference social unit in the items to measure collective efficacy. The fourth item combined the wording of two of the German language items used in Study 1, corresponding to P5_4d and P5_4e (individual) and P5_4i and P5_4j (collective) in the English language version of the questionnaire (<https://osf.io/xwg2b>). The wording of the resulting items was “Durch meine eigenen Handlungen zur Eindämmung des Klimawandels kann ich andere Menschen motivieren, sich auch für den Klimaschutz einzusetzen.” (individual efficacy) and “Durch unsere Handlungen zur Eindämmung des Klimawandels können wir gemeinsam als Bürger*innen andere Menschen motivieren, sich auch für den Klimaschutz einzusetzen.” (collective efficacy). Internal consistency was good for both subscales, as indicated by Cronbach's alpha values of $\alpha = .798$ (individual) and $\alpha = .761$ (collective). We computed two index variables to represent individual and collective efficacy by averaging individual responses on the respective four items ($n = 281$, $M = 3.8$, $SD = 0.9$ individual; $n = 281$, $M = 4.0$, $SD = 0.8$ collective); higher values represent stronger expression of efficacy beliefs. The two index variables were correlated at $r = 0.71$, $p < .001$.

Climate action: We adopted six items to assess climate action from the German language version of the questionnaire used in Study 1 (corresponding to P2_1a to P2_1f in the English language version, <https://osf.io/xwg2b>). For participants who responded to all behaviors ($n = 261$), we computed the sum score across the six items, indicating how many climate actions each individual had engaged in during the past year, from zero to six; the remaining $n = 20$ participants were assigned a value representing missing data on this index variable. On average, each participant had engaged in two of the six actions ($M = 2.1$, $SD = 1.3$, $Min = 0$, $Max = 6$).

3.1.3. Analyses

To test our hypotheses, we computed a mediation model for each of the assumed mediators (i.e., individual and collective efficacy) using Model 4 with bootstrap confidence intervals (5000 samples) within the PROCESS macro (Hayes, 2018) for SPSS, Version 4.2. Age (18–24 years, coded 1 vs. 25 years or older, coded 2) and gender (female, coded 1 vs. male, coded 2) entered as covariates. We then explored whether the assumed associations between the focal constructs differed for adaptive versus maladaptive facets of climate change related distress through bivariate correlations. For this purpose, we computed two new index variables, (a) one comprising three items of Stewart's (2021) Climate Change Worry Scale (items no. 6, 7, and 9) that explicitly refer to functional emotional impairments (such as feeling paralyzed in being able to do something about climate change or having recurring thoughts about climate change) and (b) one comprising the remaining seven items of the scale that either explicitly refer to effective coping (such as searching information about climate change) or merely refer to experiences of worry without further specification. Internal consistencies for these subscales were good, as indicated by Cronbach's alpha values of $\alpha = .787$ (maladaptive) and $\alpha = .863$ (adaptive). On average, maladaptive worry ($M = 2.6$, $SD = 0.9$) was somewhat less pronounced in our sample than adaptive worry ($M = 3.4$, $SD = 0.7$), $t(280) = -21.81$, $p < .001$.

3.2. Results

The results of the two mediation models testing our hypotheses (presented in Table 3) replicated the findings of Study 1. In both models, efficacy beliefs were positively associated with both climate change related distress (supporting Hypotheses H3a and H3b) and climate action (supporting Hypotheses H2a and H2b). Climate change related distress was also positively associated with climate action (supporting Hypothesis H1). Moreover, in line with our mediation Hypotheses H4a

Table 3

Mediation with individual efficacy (left) or collective efficacy (right) as mediator.

	mediator individual efficacy					mediator collective efficacy				
<i>n</i>	259					259				
outcome variable: efficacy beliefs										
summary	$R^2 = 0.24$	$F(3, 255) = 27.39, p < .001$				$R^2 = 0.14$	$F(3, 255) = 13.57, p < .001$			
predictor	estimate	<i>SE</i>	<i>p</i>	LL	UL	estimate	<i>SE</i>	<i>p</i>	LL	UL
constant	1.72	0.32	<0.001	1.09	2.35	2.98	0.31	<0.001	2.36	3.60
cc distress	0.59	0.07	<0.001	0.46	0.73	0.40	0.07	<0.001	0.26	0.54
age	0.31	0.10	0.003	0.11	0.52	0.02	0.10	0.84	−0.18	0.22
gender ^a	−0.22	0.11	0.049	−0.43	−0.001	−0.20	0.11	0.06	−0.42	0.01
outcome variable: climate action										
summary	$R^2 = 0.29$	$F(4, 254) = 26.19, p < .001$				$R^2 = 0.29$	$F(4, 254) = 26.42, p < .001$			
predictor	estimate	<i>SE</i>	<i>p</i>	LL	UL	estimate	<i>SE</i>	<i>p</i>	LL	UL
constant	−1.50	0.47	0.002	−2.42	−0.58	−1.77	0.52	<0.001	−2.79	−0.76
cc distress	0.86	0.11	<0.001	0.64	1.08	0.89	0.10	<0.001	0.69	1.09
efficacy beliefs	0.18	0.09	0.04	0.01	0.35	0.20	0.09	0.03	0.02	0.37
age	0.05	0.15	0.73	−0.24	0.34	0.10	0.14	0.47	−0.18	0.38
gender ^a	0.07	0.15	0.67	−0.24	0.37	0.07	0.15	0.66	−0.24	0.37
indirect effects										
	estimate	BSE		BLL	BUL	estimate	BSE		BLL	BUL
X → M → Y	0.11	0.06		0.001	0.22	0.08	0.04		0.01	0.15

Note. cc distress = climate change related distress.

X = cc distress, M = efficacy beliefs (individual, left side; collective, right side), Y = climate action.

LL = lower limit 95 % CI, UL = upper limit 95 % CI.

BSE = bootstrap standard error; BLL = lower limit 95 % bootstrap CI; BUL = upper limit 95 % bootstrap CI.

^a 1 = female, 2 = male.

and H4b, the indirect effects of climate change related distress on climate action via either individual or collective efficacy were positive to a statistically significant degree as indicated by 95 % confidence intervals not encompassing the value “0” (cf. Hayes, 2018).

Only individual efficacy showed significant associations with the covariates: holding stronger efficacy beliefs was associated with falling into the higher age category (i.e., 25 years or older) and identifying as female (vs. male).

Next, we explored whether the assumed associations between distress, efficacy beliefs, and climate action differed for maladaptive and adaptive forms of worry. Bivariate correlations (Table 4) revealed a significant difference only for individual efficacy, indicated by non-overlapping confidence intervals. The association was stronger for adaptive than for maladaptive worry. A similar picture emerged for collective efficacy, however the confidence intervals overlapped slightly.

In a final step of our analysis, we further explored climate action by calculating for each of the six single actions included in our composite score the share of participants who had engaged in the respective action during the past year (Table 5). The most common action was 3. *made lifestyle changes for reasons related to protecting the climate* and the least common was 4. *volunteered in an environmental organization*. Moreover, we explored the associations of individual efficacy and collective efficacy with each of the six climate actions by means of point-biserial

correlations. All significant associations were positive (Table 5), and for none of the climate actions, the strength of associations differed significantly between individual and collective efficacy (indicated by overlapping confidence intervals).

3.3. Discussion

The results of Study 2 largely replicated the key findings of Study 1, providing further support for all our hypotheses, and, thus, the theoretical assumption that efficacy beliefs partly account for adaptive behavioral reactions to climate change related distress. Additional exploratory analyses revealed that individual efficacy was weaker – but still positively – associated with maladaptive compared to adaptive forms of climate change worry. A possible explanation of this finding is that motivated control is less likely to result from more severe forms of climate change related distress, which may be accompanied by tension, depression, frustration of basic psychological needs, and other cognitive-emotional challenges (Stewart, 2021; Wullenkord et al., 2021). Future studies should further explore this assumption, employing operationalizations of climate change related distress, which are dedicated to capturing maladaptive reactions to climate change exposure, including cognitive, emotional, and functional impairments. An example of such an instrument is the Climate Change Anxiety Scale by Clayton and Karazsia (2020).

Table 4

Pearson correlations: Climate change related distress, climate action, and efficacy beliefs.

	climate change related distress			
	maladaptive worry	LL, UL	adaptive worry	LL, UL
climate action	0.42*** (<i>n</i> = 261)	0.31, 0.51	0.53*** (<i>n</i> = 261)	0.43, 0.61
individual efficacy	0.25*** (<i>n</i> = 281)	0.14, 0.35	0.49*** (<i>n</i> = 281)	0.39, 0.57
collective efficacy	0.18** (<i>n</i> = 281)	0.07, 0.29	0.38*** (<i>n</i> = 281)	0.28, 0.48

Note: correlation is statistically significant (two-tailed) ** at $p < .01$ or *** at $p < .001$.

LL = lower limit 95 % CI, UL = upper limit 95 % CI.

Table 5
Exploration of single climate actions and efficacy beliefs.

climate action	carried out by		correlations with efficacy beliefs			
	n	valid %	individual	LL, UL	collective	LL, UL
1. Attended a climate protest	61	22.0	0.15* (n = 277)	0.03, 0.26	0.17** (n = 277)	0.05, 0.28
2. Donated money to an environmental organization tackling climate issues	82	29.6	0.13* (n = 277)	0.02, 0.25	0.10 ns (n = 277)	−0.02, 0.22
3. Made lifestyle changes for reasons related to protecting the climate	244	87.8	0.35*** (n = 278)	0.24, 0.45	0.29*** (n = 278)	0.18, 0.39
4. Volunteered in an environmental organization tackling climate issues	30	10.9	0.12 ns (n = 276)	0.00, 0.23	0.09 ns (n = 277)	−0.03, 0.20
5. Signed a petition or contacted a politician regarding climate change	107	38.9	0.26*** (n = 275)	0.14, 0.36	0.21*** (n = 275)	0.09, 0.32
6. Attended a public lecture, seminar or workshop about climate change	58	20.9	0.08 ns (n = 277)	−0.04, 0.19	0.08 ns (n = 277)	−0.04, 0.19

Note. correlation is statistically significant (two-tailed) * at $p < .05$, ** at $p < .01$ or *** at $p < .001$.

Climate action items were coded as follows: 0 = action *not* performed, 1 = action performed.

LL = lower limit 95 % CI, UL = upper limit 95 % CI.

4. General discussion

The two studies reported here contribute to ongoing scientific and public debates on whether climate change related distress serves an adaptive function. Taken together, the results provide correlational evidence for the theoretical assumptions that climate change related distress can motivate people to engage in climate action (e.g., Bouman et al., 2020), and that efficacy beliefs partly account for such adaptive reactions. We derived the latter assumption from two strands of research investigating associations of climate change related distress with either climate action or efficacy beliefs (including related constructs representing perceptions of personal control). Some studies of the second strand (e.g., Hornsey et al., 2015) built on the notion of motivated control, according to which people are motivated to believe that they are able to help mitigate climate change (as individuals or as part of a social entity), if they feel anxious about the existential threats posed by climate change.

The two studies reported here suggest that efficacy beliefs *may* flow from different forms of climate change related distress: experiences of negative emotions and even more severe forms of distress that involve cognitive-emotional and functional impairments. Yet, exploratory analyses in Study 2, which showed a stronger association between individual efficacy and adaptive than maladaptive worry, suggest that more severe forms of climate change distress may be less likely to entail motivated control. In contrast, a cross-sectional study among adolescents in Canada (Turcotte-Tremblay et al., 2023) found that individuals who reported experiencing more cognitive-emotional and functional impairment related to their deliberation about climate change were *more* likely to believe that they can personally contribute to mitigating climate change. One possible explanation for this finding is that climate anxiety was not very pronounced in this sample, so even individuals with comparatively high levels may not have experienced severe cognitive-emotional and functional impairments. A study from Italy found that climate anxiety, operationalized as experiences of both cognitive-emotional and functional impairments, was negatively associated with people's *general*, i.e., domain-unspecific, sense of efficacy (Innocenti et al., 2023). This finding may seem to contradict the positive associations of distress and efficacy beliefs found in our studies, however, we find it fits well with theorizing on how people cope with environmental stressors. A generalized sense of being in control and able to deal with stressors in life may decrease the likelihood that a potentially threatening event or environmental state is perceived as dangerous (cf. Lazarus & Folkman, 1987) and could, therefore, be a protective factor with regard to experiences of climate change related distress. If efficacy beliefs indeed flow from perceived threat and distress, as has been proposed by Hornsey et al. (2021), it seems plausible that such beliefs pertain to one's domain-specific ability to make a difference, i.e., to help mitigate climate change, rather than one's generalized ability to deal with difficult situations in life.

Another person-level factor that may account for adaptive functions of climate change related distress is perceived personal responsibility. A

multi-country study (Bouman et al., 2020) found that climate change worry was indirectly associated with climate action, via personal responsibility to reduce climate change, the latter showing positive associations with both worry and action. Moreover, worry was positively related to the endorsement of biospheric values. The authors interpret these findings in terms of a causal chain: climate change threatens what people personally value (nature, the environment) and, thus, triggers worry, which in turn leads to a sense of personal responsibility to mitigate climate change. It is important to note that this interpretation was derived from data collected in predominantly Western countries and may not be straightforward in the Global South, because justice perceptions have the potential to hinder responsibility and mitigation efforts, despite a common worry about climate change (Pearson et al., 2021; Çarkoğlu & Kentmen-Çin, 2015).

An interesting avenue for future research is to investigate a potential interplay between perceived responsibility and efficacy beliefs in this context. Possibly, personal responsibility flowing from worry activates feelings of efficacy. This would provide a somewhat different account of positive associations between climate change distress and efficacy beliefs than the one proposed by Hornsey and colleagues (e.g., Hornsey et al., 2021). Rather than being activated in a motivated attempt to deal with negative climate change related emotions, efficacy beliefs may be activated as part of a more problem-focused form of coping (cf. Lazarus & Folkman, 1987), targeted at protecting what one values. Future studies should address different forms of coping, problem and emotion-focused, that could explain associations between climate change distress and efficacy beliefs. The relative importance and possible interactions of these coping forms should be explored, given that people typically combine problem and emotion-focused strategies in most stressful situations (Lazarus & Folkman, 1987).

While we assumed – and found correlational evidence for – a mediating role of efficacy beliefs, other recent studies on the relationship of climate change related distress and action have modeled efficacy beliefs differently, as a *moderator* of that relationship. For example, a study using data from 23 European countries found that climate change worry was more strongly associated with energy saving behaviors among people with stronger versus weaker efficacy beliefs (Gregersen et al., 2021). This approach regards efficacy beliefs as a person-level third variable affecting how people cope with climate change related distress and thus ties in with classic theories in the area of fear appeals and coping. For example, Witte's (1992) Extended Parallel Process Model (EPPM) postulates that fear of a significant threat will more likely prompt behaviors to control the threat (i.e., adaptive reactions) when perceived efficacy is high. When perceived efficacy is low, people are assumed to be motivated to cope with their fear rather than thinking of strategies to avert or mitigate the threat (i.e., maladaptive reactions). Our studies draw on the theoretical notion that efficacy beliefs partly flow from experiences of climate change related distress (i.e., a causal relationship). While the assumed underlying mechanism - motivated control - can be considered a form of fear-oriented coping, we propose that efficacy beliefs evoked and/or strengthened by this process may

also promote adaptive responses in the form of climate-protective actions. To some extent, this reasoning challenges the assumption that emotion-oriented and problem-oriented coping are parallel processes (e.g., EPPM) and ascribes efficacy beliefs a pivotal role in both forms of coping. Further research using longitudinal and experimental designs is needed to investigate whether the correlational associations found in the two studies reported here are indeed a result of a causal chain from climate change related distress to climate action via efficacy beliefs. Experimental studies could build on strategies for activating climate change related emotions that have been shown to be effective in previous research (see Brosch, 2021, for a review). In order to capture and explore the within-person processes underlying a potential causal effect, research designs that gather intensive longitudinal data (cf. Hamaker & Wichers, 2017), such as diary studies, seem particularly suitable. Such initiatives could explore whether effects of climate change related distress on efficacy beliefs occur spontaneously, for example, in situations when negative emotions regarding climate change are particularly salient, or merely after repeated and/or longer-enduring periods of distress. Spontaneous, situational effects would hint at potential non-analytic processes involved in efficacy beliefs, which thus far have received little attention in psychological theory and research. Hornsey et al. (2021) lay out different non-analytic processes that may be at play, including anxiety-management processes, and emphasize that empirical insights in this area are needed to inform initiatives to promote efficacy beliefs in research and application. A stronger research emphasis on non-analytic processes seems particularly warranted, considering that attempts to strengthen sustainable development related efficacy beliefs through evidence-based arguments, efficacy-related information, and persuasion have often failed (e.g., Hamann & Reese, 2020; Hanss & Böhm, 2013).

Another avenue for future research is to further distinguish between different facets of climate change distress. For example, one recent study investigated associations of *micro* and *macro* climate change worry with different coping strategies (Wullenkord & Ojala, 2023); the former worry facet focuses on negative outcomes of climate change for oneself or in-groups (e.g., friends or family), the latter focuses on negative outcomes for other humans (e.g., future generations or people in other countries) and living beings. In connection with macro worry, motivated control processes might more likely entail strengthened feelings of collective (vs. individual) efficacy, because, on a global scale, group efforts are more likely to be effective in mitigating negative consequences of climate change. Vice versa, experiences of micro worry might more likely trigger feelings of individual efficacy. Future studies addressing the emotional component of climate change related distress could benefit from a differentiation of qualitatively different emotions. One survey from Australia separately analyzed experiences of different climate change related emotions and found that while depression and anger were positively associated with collective climate action, such as protesting, people who experienced more anxiety were less likely to have engaged in these actions (Stanley et al., 2021). Maybe some emotions are more likely to cause eco-paralysis (Innocenti et al., 2023) than others are. A recent multi-country study (Kovacs et al., 2023) investigated a range of negative (e.g., sadness, anger) and positive (e.g., hope) climate change related emotions and found in bivariate analyses that their associations with pro-environmental behavior differed. For example, hope was positively but only weakly correlated with pro-environmental behavior, for negative emotions, this positive correlation was of moderate size. An interesting avenue for future studies is to investigate both negative and positive emotional reactions to climate change and how these may interact in shaping climate change action via efficacy beliefs.

4.1. Limitations

Our studies have several limitations that should be considered when interpreting the results. Both studies used non-random opportunity

sampling and may be biased in several ways. For example, young, female, and educated people are over-represented in our samples, and it is possible that people with greater interest in climate change were particularly likely to self-select into the studies. While we assessed different gender identifications in Study 2, people identifying as diverse were not included in our main analyses, due to small numbers ($n = 1$). A study among young people in Canada (Turcotte-Tremblay et al., 2023) found that female participants and individuals who identified other than male or female reported stronger climate anxiety compared to male participants. The same study found that family affluence predicted levels of climate anxiety among young people (negative association); family affluence was not accounted for in our studies, but because the vast majority of our participants were college students, it is possible that people from less affluent backgrounds (by national standards) were underrepresented in our samples. Considering these limitations, generalizations of our findings and inferences to a larger public should be made with caution. Replications of our studies with representative samples are necessary, before conclusions can be drawn with greater confidence.

Moreover, in Study 1, data collection protocols (e.g., online vs. paper-pencil) and conditions (e.g., use of different incentives/compensation) differed slightly between countries. While harmonization of protocols would improve the comparability of results across countries, multi-national studies need to take into account local conditions and customs to be inclusive and achieve sufficiently high response rates.

Another limitation pertains to our measures of the main variables: While we asked participants to recall their participation of climate action *during the past year*, our measures of climate change related distress and efficacy beliefs did not refer to that same time frame but rather captured participants' current experience and beliefs.

Finally, our studies show that climate change related distress correlates with efficacy beliefs and actions consistent with the theorized psychological mechanism of motivated control, however, inferences about direction and causality are possible only through experimental and longitudinal designs. It is, therefore, not evident from our findings, if climate change related distress is an antecedent of efficacy beliefs and individual engagement in climate action. However, previous experimental studies do suggest that inducing or activating climate change related emotions can strengthen perceived control (a construct conceptually similar to efficacy beliefs) and intentions to act (see Brosch, 2021; for an overview).

4.2. Conclusion

Despite these limitations, our findings contribute to different strands of scientific discourse around climate change related distress and efficacy beliefs. They provide empirical support – albeit correlational – for the theoretical assumption that efficacy beliefs play a role in coping with climate change related distress and in encouraging climate action. They complement other recent research in that domain exploring the roles of different facets of climate change related distress and other coping strategies, such as meaning-focused coping (Wullenkord & Ojala, 2023). Practitioners may find our results useful in designing campaigns to inform about climate change related distress and developing strategies to promote climate action. Such initiatives should emphasize that worry and other emotions are reasonable – and potentially adaptive – reactions to an existential threat. Moreover, our studies provide insights for counseling people who seek help in connection with climate change related distress, pointing at efficacy beliefs as a potential catalyzer of emotion and problem-focused coping. Consciously addressing existing fears and concerns related to climate change may help strengthen beliefs in one's ability to make a difference and thereby enable effective coping – especially for individuals with milder forms of climate change related distress.

CRediT authorship contribution statement

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